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SERVICE MANUAL

2004
WRANGLER

To order the special service tools used and illustrated, please refer to the instructions on inside back cover.

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CAUTION

ALL SERVICE AND REBUILDING INSTRUCTIONS CONTAINED HEREIN ARE APPLICABLE TO, AND FOR THE CONVENIENCE OF, THE AUTOMOTIVE TRADE ONLY. All test and repair procedures on components or assemblies in non-automotive applications should be repaired in accordance with instructions supplied by the manufacturer of the total product.

Proper service and repair is important to the safe, reliable, operation of all motor vehicles. The service procedures recommended and described in this publication were developed for professional service personnel and are effective methods for performing vehicle repair. Following these procedures will help assure efficient economical vehicle performance and service reliability. Some of these service procedures require the use of special tools designed for specific procedures. These special tools should be used when recommended throughout this publication.

Special attention should be exercised when working with spring or tension loaded fasteners and devices such as E-Clips, Circlips, Snap rings, etc., as careless removal may cause personal injury. Always wear safety goggles whenever working on vehicles or vehicle components.

It is important to note that this publication contains various **Cautions** and **Warnings.** These should be carefully read in order to minimize the risk of personal injury, or the possibility that improper service methods may damage the vehicle or render it unsafe. It is important to note that these **Cautions** and **Warnings** cover only the situations and procedures DaimlerChrysler Corporation has encountered and recommended. DaimlerChrysler Corporation could not possibly know, evaluate, and advise the service trade of all conceivable ways that service may be performed, or of the possible hazards of each. Consequently, DaimlerChrysler Corporation has not undertaken any such broad service review. Accordingly, anyone who uses a service procedure, or tool, that is not recommended in this publication must assure oneself thoroughly that neither personal safety, nor vehicle safety, be jeopardized by the service methods they select.

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DaimlerChrysler Corporation

UNITED STATES and CANADA

The special service tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

28635 Mound Road, Warren, Michigan 48092, U.S.A.

MILLER SPECIAL TOOLS
SPX Corporation

Telephone 1-800-801-5420 FAX 1-800-578-7375

INTERNATIONAL

The special service tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

28635 Mound Road, Warren, Michigan 48092, U.S.A.

MILLER SPECIAL TOOLS
SPX Corporation

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FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain description, operation, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the systems and components. To assist in locating a group title page, use the Group Tab Locator on the following page. The solid bar after the group title is aligned to a solid tab on the first page of each group. The first page of the group has a contents section that lists major topics within the group. If you are not sure which Group contains the information you need, look up the Component/System in the alphabetical index located in the rear of this manual.

A Service Manual Comment form is included at the rear of this manual. Use the form to provide DaimlerChrysler Corporation with your comments and suggestions.

Tightening torques are provided as a specific value throughout this manual. This value represents the midpoint of the acceptable engineering torque range for a given fastener application. These torque values are intended for use in service assembly and installation procedures using the correct OEM fasteners. When replacing fasteners, always use the same type (part number) fastener as removed.

DaimlerChrysler Corporation reserves the right to change testing procedures, specifications, diagnosis, repair methods, or vehicle wiring at any time without prior notice or incurring obligation.

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GROUP TAB LOCATOR

INTRODUCTION

TABLE OF CONTENTS

VEHICLE IDENTIFICATION NUMBER

DESCRIPTION

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

The Vehicle Identification Number is also imprinted on the:

- Vehicle Safety Certification Label.
- Frame rail.

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

VEHICLE IDENTIFICATION NUMBER DECODING CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = Manufactured By DaimlerChrysler Corporation
2	Make	J = Jeep
3	Vehicle Type	4 = MPV
4	Gross Vehicle Weight Rating	E = 3001-4000 lbs. F = 4001-5000 lbs.
5	Vehicle Line	A = Wrangler 4X4 (LHD) 4 = Wrangler 4X4 (RHD)
6	Series	2 = SE 3 = X 4 = Sport 5 = Sahara 6 = Rubicon
7	Body Style	9 = Open Body
8	Engine	1 = 2.4L 4 cyl DOHC Gasoline S = 4.0L 6 cyl Gasoline

VEHICLE IDENTIFICATION NUMBER (Continued)

POSITION	INTERPRETATION	CODE = DESCRIPTION
9	Check Digit	0 through 9 or X
10	Model Year	4=2004
11	Assembly Plant	P = Toledo #2
12 thru 17	Vehicle Build Sequence	

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

DESCRIPTION

All models have a Vehicle Emission Control Information (VECI) Label. DaimlerChrysler permanently attaches the label in the engine compartment (Fig. 1). It cannot be removed without defacing information and destroying the label.

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

The VECI label contains the following:

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

The label also contains an engine vacuum schematic. These labels are permanently attached and cannot be removed without defacing information and destroying label.

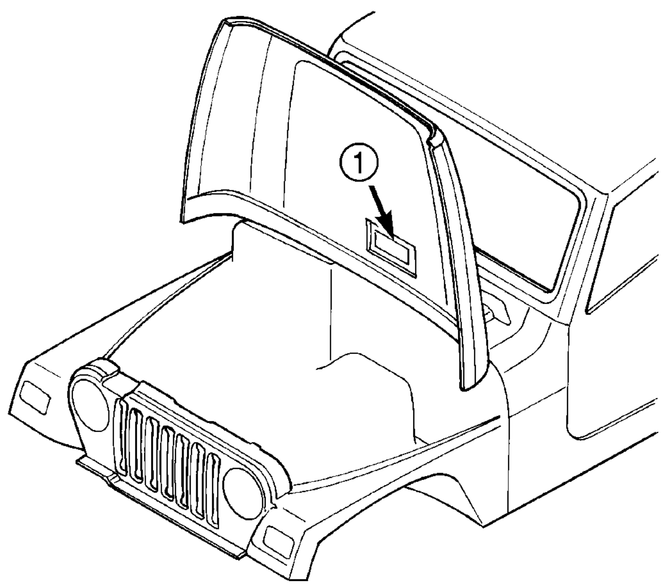


Fig. 1 VECI Label Location

1 - VECI LABEL

VEHICLE CERTIFICATION LABEL

DESCRIPTION

A vehicle certification label (Fig. 2) is attached to every DaimlerChrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Standards. The label also lists:

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

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

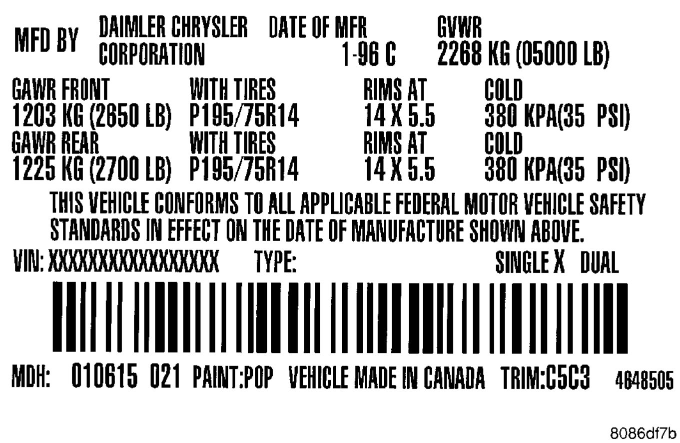


Fig. 2 VEHICLE CERTIFICATION LABEL - TYPICAL

BODY CODE PLATE

DESCRIPTION

BODY CODE PLATE

A metal body code plate is attached to the floor pan under the drivers seat (Fig. 3). Disengage the snaps attaching the carpet to the floor pan to read the information. There are seven lines of information on the body code plate. Lines 4, 5, 6, and 7 are not used to define service information. Information reads from left to right, starting with line 3 in the center of the plate to line 1 at the bottom of the plate (Fig. 4).

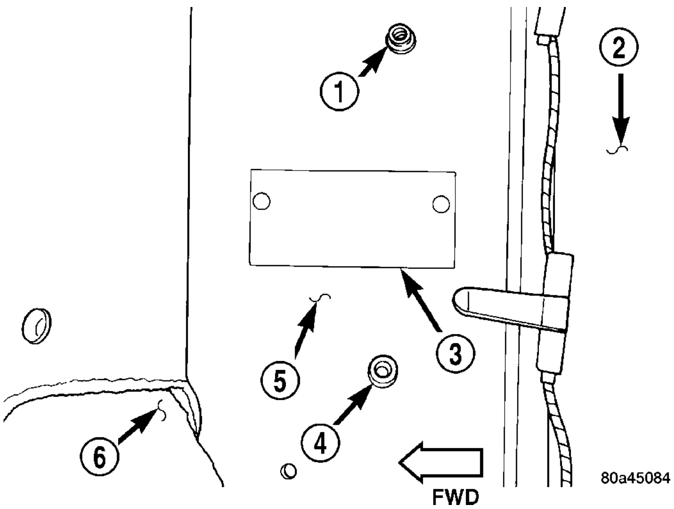


Fig. 3 Body Code Plate Location

1 - SNAP
2 - REAR CARPET
3 - BODY CODE PLATE
4 - SNAP
5 - FLOOR PAN
6 - FRONT CARPET

The last code imprinted on a vehicle code plate will be followed by the imprinted word END. When two vehicle code plates are required, the last available spaces on the first plate will be imprinted with the letters CTD (for continued).

When a second vehicle code plate is necessary, the first four spaces on each row will not be used because of the plate overlap.

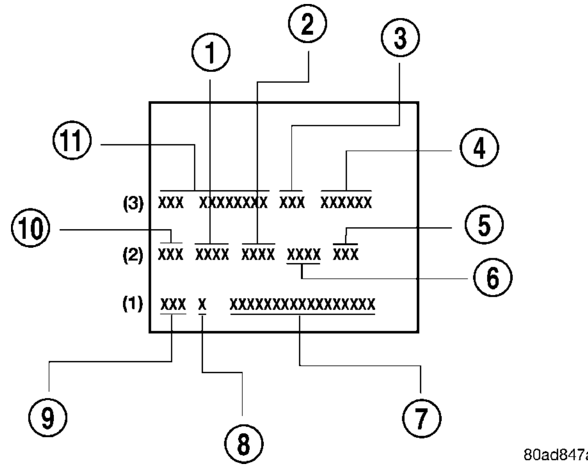


Fig. 4 Body Code Plate Decoding

1 - PRIMARY PAINT
2 - SECONDARY PAINT
3 - ROOF
4 - CAR LINE SHELL
5 - ENGINE
6 - TRIM
7 - VIN
8 - MARKET
9 - TRANSMISSION
10 - PAINT PROCEDURE
11 - VEHICLE ORDER NUMBER

BODY CODE PLATE (Continued)

BODY CODE PLATE—LINE 3

DIGITS 1 THROUGH 12
Vehicle Order Number

DIGITS 13, 14, AND 15
Roof
- VJN = Soft Top White
- VJU = Soft Top Spice
- VJX = Soft Top Black
- VKN = Hard Top White
- VKU = Hard Top Spice
- VKX = Hard Top Black

DIGITS 16, 17, AND 18
Car Line Shell
- TJJ = Wrangler (LHD)
- TJU = Wrangler (RHD)

DIGIT 19
Price Class
- L = Wrangler (All)

DIGITS 20 AND 21
Body Type
- 77 = Wheel Base (93.4 in.)

BODY CODE PLATE—LINE 2

DIGITS 1,2, AND 3
Paint Procedure

DIGIT 4
Open Space

DIGITS 5 THROUGH 8
Primary Paint
(Refer to 23 - BODY/PAINT - SPECIFICATIONS) for color codes.

DIGIT 9
Open Space

DIGITS 10 THROUGH 13
Secondary Paint

DIGIT 14
Open Space

DIGITS 15 THROUGH 18
Interior Trim Code

DIGIT 19
Open Space

DIGITS 20, 21, AND 22
Engine Code
- ED1 = 2.4L 4 cyl. MPI Gasoline
- ERH = 4.0L 6 cyl. MPI Gasoline

BODY CODE PLATE—LINE 1

DIGITS 1, 2, AND 3
Transmission Codes
- DDD = NV3550 5 - speed Manual
- DDK = AX15 5 - speed Manual
- DG6 = 42RLE 4 - speed Automatic

DIGIT 4
Open Space

DIGIT 5
Market Code
- B = International

DIGIT 6
Open Space

DIGITS 7 THROUGH 23
Vehicle Identification Number (VIN)
(Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE IDENTIFICATION NUMBER - DESCRIPTION) for breakdown of VIN code.

INTERNATIONAL SYMBOLS

DESCRIPTION

The graphic symbols illustrated in the following International Control and Display Symbols Chart (Fig. 5) are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

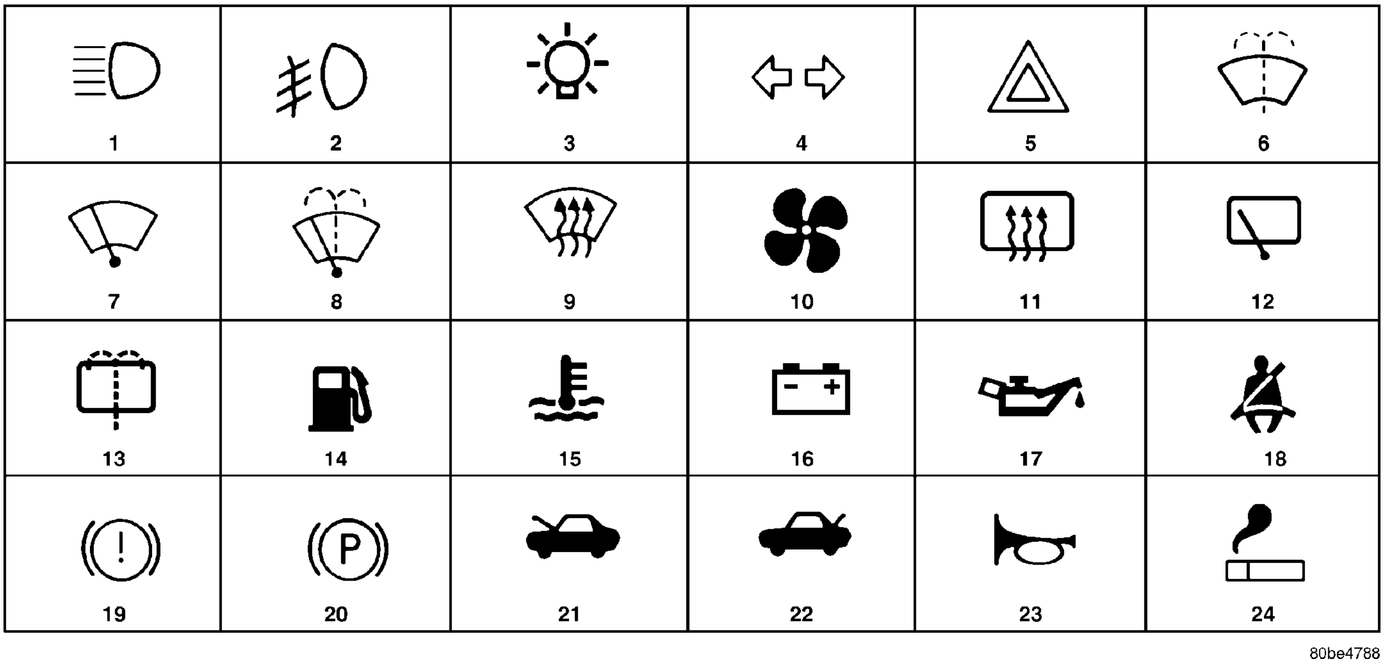


Fig. 5 INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

1	High Beam	13	Rear Window Washer
2	Fog Lamps	14	Fuel
3	Headlamp, Parking Lamps, Panel Lamps	15	Engine Coolant Temperature
4	Turn Warning	16	Battery Charging Condition
5	Hazard Warning	17	Engine Oil
6	Windshield Washer	18	Seat Belt
7	Windshield Wiper	19	Brake Failure
8	Windshield Wiper and Washer	20	Parking Brake
9	Windscreen Demisting and Defrosting	21	Front Hood
10	Ventilating Fan	22	Rear hood (Decklid)
11	Rear Window Defogger	23	Horn
12	Rear Window Wiper	24	Lighter

FASTENER IDENTIFICATION

DESCRIPTION

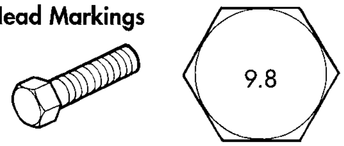
The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts (Fig. 6) and (Fig. 7).

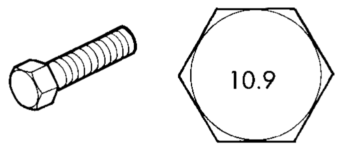
FASTENER IDENTIFICATION (Continued)

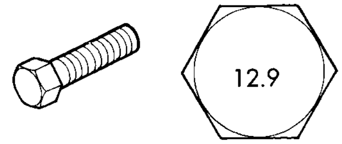
Bolt Markings and Torque - Metric

Commercial Steel Class

Bolt Head Markings





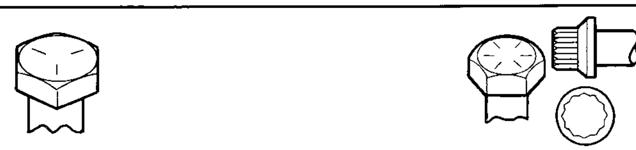


Body Size	9.8 Torque				10.9 Torque				12.9 Torque			
Diam.	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	70	50	55	40
12	70	55	55	40	105	75	80	60	125	95	100	75
14	115	85	90	65	160	120	125	95	195	145	150	110
16	180	130	140	100	240	175	190	135	290	210	220	165
18	230	170	180	135	320	240	250	185	400	290	310	230

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number 5 8

Bolt Head Markings
These are all SAE Grade 5 (3) line



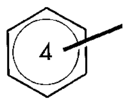
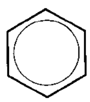
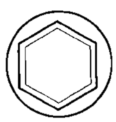
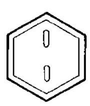
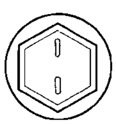
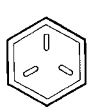
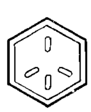
Body Size	Bolt Torque - Grade 5 Bolt				Bolt Torque - Grade 8 Bolt			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40	30
- 24	40	30	35	25	60	45	45	35
7/16 - 14	60	45	45	35	90	65	65	50
- 20	65	50	55	40	95	70	75	55
1/2 - 13	95	70	75	55	130	95	100	75
- 20	100	75	80	60	150	110	120	90
9/16 - 12	135	100	110	80	190	140	150	110
- 18	150	110	115	85	210	155	170	125
5/8 - 11	180	135	150	110	255	190	205	150
- 18	210	155	160	120	290	215	230	170
3/4 - 10	325	240	255	190	460	340	365	270
- 16	365	270	285	210	515	380	410	300
7/8 - 9	490	360	380	280	745	550	600	440
- 14	530	390	420	310	825	610	660	490
1 - 8	720	530	570	420	1100	820	890	660
- 14	800	590	650	480	1200	890	960	710

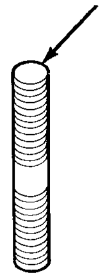
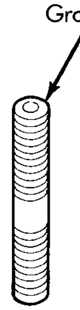
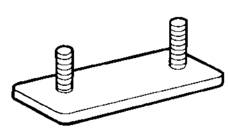
80bdbd8c

Fig. 6 FASTENER IDENTIFICATION

FASTENER IDENTIFICATION (Continued)

HOW TO DETERMINE BOLT STRENGTH

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

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

95IN-4

Fig. 7 FASTENER STRENGTH

FASTENER USAGE

DESCRIPTION

DESCRIPTION - FASTENER USAGE

WARNING: USE OF AN INCORRECT FASTENER MAY RESULT IN COMPONENT DAMAGE OR PERSONAL INJURY.

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

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

DESCRIPTION - THREADED HOLE REPAIR

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

METRIC SYSTEM

DESCRIPTION

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

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

CONVERSION FORMULAS AND EQUIVALENT VALUES

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

COMMON METRIC EQUIVALENTS

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

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.) (Fig. 8).

METRIC SYSTEM (Continued)

in-lbs to N•m

in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966

N•m to in-lbs

N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb
.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270
4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

N•m to ft-lbs

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400

mm to in.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

J901N-10

Fig. 8 METRIC CONVERSION CHART

TORQUE REFERENCES

DESCRIPTION

Individual Torque Charts appear within many or the Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts (Fig. 9).

SPECIFIED TORQUE FOR STANDARD BOLTS

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

Fig. 9 TORQUE SPECIFICATIONS

LUBRICATION & MAINTENANCE

TABLE OF CONTENTS

INTERNATIONAL SYMBOLS

DESCRIPTION

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations (Fig. 1).

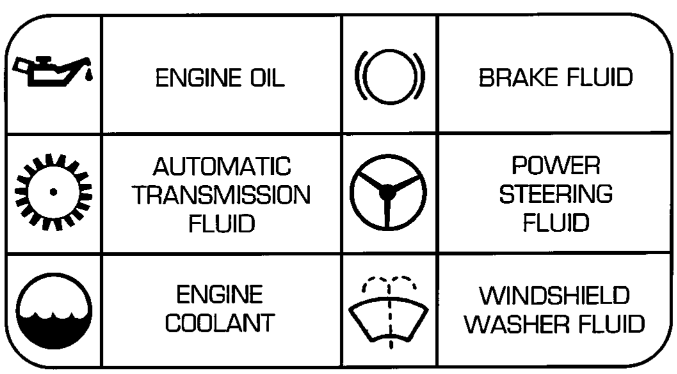


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Fig. 1 INTERNATIONAL SYMBOLS

PARTS & LUBRICANT RECOMMENDATION

DESCRIPTION - LUBRICANT RECOMMENDATIONS

Chassis

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

PARTS & LUBRICANT RECOMMENDATION (Continued)

Body

Component	Fluid, Lubricant, or Genuine Part
Hinges:	
Door And Hood	Mopar® Engine Oil
Liftgate	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Latches:	
Door, Hood/Safety Catch, Liftgate	Mopar® Multi-Purpose Lube NLG Grade 2 EP, GC-LB
Seat Regulator & Track	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Window System Components	Mopar® Spray White Lube
Lock Cylinders	Mopar® Lock Cylinder Lube
Parking Brake Mechanism	Mopar® Wheel Brg. Grease NLGI Grade 1, GC-LBB
Soft Top	Mopar® Soft Top Zipper Cleaner & Lubricant

FLUID TYPES

DESCRIPTION

DESCRIPTION - FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded "regular" gasoline having an octane rating of 87. The routine use of premium gasoline is not recommended. Under normal conditions the use of premium fuel will not provide a benefit over high quality regular gasolines and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

Over 40 auto manufacturers world-wide have issued and endorsed consistent gasoline specifications (the Worldwide Fuel Charter, WWFC) to define fuel properties necessary to deliver enhanced emissions, performance and durability for your vehicle. We recommend the use of gasolines that meet the WWFC specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as "reformulated" gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

We strongly support the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT IN GASOLINE

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. We recommend that gasolines free of MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with Cleaner-Burning California reformulated gasoline with low sulfur. If such fuels are not available in states adopting California emission standards, your vehicles will operate satisfactorily on fuels meeting federal specifications, but

FLUID TYPES (Continued)

emission control system performance may be adversely affected. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light to illuminate. We recommend that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

CAUTION: If the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of DaimlerChrysler Corporation and may not be covered under the new vehicle warranty.

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

DESCRIPTION - ENGINE OIL AND LUBRICANTS

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

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

Only lubricants bearing designations defined by the following organization should be used.

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

API SERVICE GRADE CERTIFIED

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

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 2).

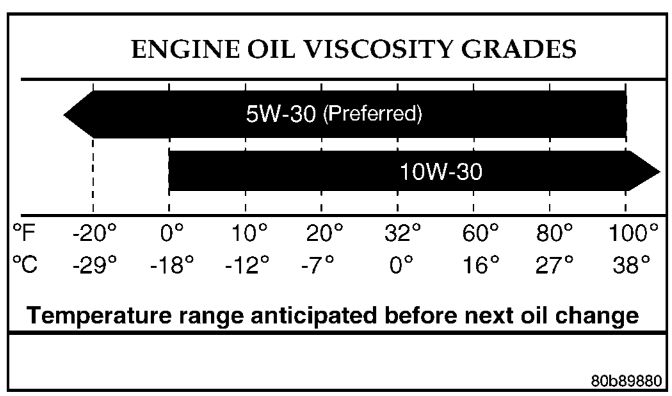

Fig. 2 Temperature/Engine Oil Viscosity

FLUID TYPES (Continued)

ENERGY CONSERVING OIL

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

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the front label of engine oil plastic bottles and the top of engine oil cans (Fig. 3).

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

9400-9

Fig. 3 API Certification Mark

GEAR LUBRICANTS

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

LUBRICANTS AND GREASES

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 4) on the label. At the bottom of the NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter "G". Chassis lubricant is identified by the letter "L". The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

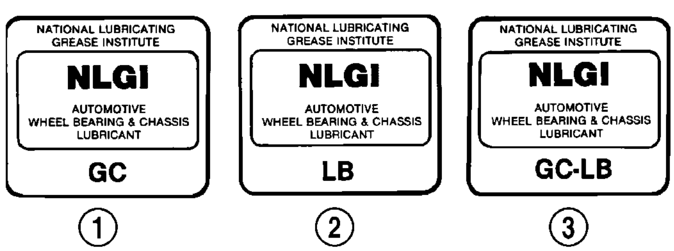

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Fig. 4 NLGI SYMBOL

1 - WHEEL BEARINGS
2 - CHASSIS LUBRICATION
3 - CHASSIS AND WHEEL BEARINGS

SPECIALIZED LUBRICANTS AND OILS

Some maintenance or repair procedures may require the use of specialized lubricants or oils. Consult the appropriate sections in this manual for the correct application of these lubricants.

DESCRIPTION - HOAT COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE-GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE-GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

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

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

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

FLUID TYPES (Continued)

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

COOLANT PERFORMANCE

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

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

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

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

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

COOLANT SELECTION AND ADDITIVES

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

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

DESCRIPTION - TRANSFER CASE - NV231

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

DESCRIPTION - TRANSFER CASE - NV241

Recommended lubricant for the NV241 transfer case is Mopar® ATF +4, Automatic Transmission Fluid.

DESCRIPTION - AXLE LUBRICATION

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

FRONT AXLE

- 181 FBI (Model 30) - Mopar® Gear Lubricant 80W-90 (Trailer Towing Mopar® Synthetic Gear Lubricant 75W-140)
- 216 FBI (Model 44) - Mopar® Gear Lubricant 80W-90 (Trailer Towing Mopar® Synthetic Gear Lubricant 75W-140)
- RUBICON 216 FBI (Model 44) - Mopar® Synthetic Gear Lubricant 75W-140

REAR AXLE

- 194 RBI (Model 35) - Mopar® Gear Lubricant 80W-90 (Trailer Towing Mopar® Synthetic Gear Lubricant 75W-140)
- 194 RBI (Model 35) 4.56 Ratio - 2.4 L Enigne and 42 RLE Automatic Transmission - Mopar® Synthetic Gear Lubricant 75W-140
- 226 RBI (Model 44) - Mopar® Gear Lubricant 80W-90 (Trailer Towing Mopar® Synthetic Gear Lubricant 75W-140)
- RUBICON 226 RBI (Model 44) - Mopar® Synthetic Gear Lubricant 75W-140

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

DESCRIPTION - MANUAL TRANSMISSION

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

- NV1500 - Mopar® Manual Transmission Lubricant
- NV3550 - Mopar® Manual Transmission Lubricant

FLUID TYPES (Continued)

DESCRIPTION - AUTOMATIC TRANSMISSION FLUID

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

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

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

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

FLUID ADDITIVES

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

Various "special" additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission "sealers" should also be avoided, since they may adversely affect the integrity of transmission seals.

DESCRIPTION - POWER STEERING FLUID

The recommended fluid for the power steering system is Mopar® ATF +4.

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

OPERATION - AUTOMATIC TRANSMISSION FLUID

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

FLUID CAPACITIES

SPECIFICATIONS - FLUID CAPACITIES

DESCRIPTION	SPECIFICATION
FUEL TANK	19 U.S. Gallons (71.9 Liters)****
ENGINE OIL	
Engine Oil - with Filter - 2.4L	3.8 L (4.0 qts.)
Engine Oil - with Filter - 4.0L	5.7 L (6.0 qts.)
ENGINE COOLANT	
Cooling System - 2.4 L	8.5 L (9.0 qts.)
Cooling System - 4.0 L	9.9 L (10.5 qts.)
POWER STEERING SYSTEM	
Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to 19, Steering for proper fill and bleed procedures.	
AUTOMATIC TRANSMISSION	
Service Fill - 42RLE	3.8 L (8.0 pts)
O-haul Fill - 42RLE	8.3 L (17.6 pts.)
Dry fill capacity Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)	

FLUID CAPACITIES (Continued)

DESCRIPTION	SPECIFICATION
TRANSFER CASE	
NV231	1.0 L (2.2 pts.)
NV241	2.0 L (4.2 pts.)
MANUAL TRANSMISSION	
NV1500 Approximate dry fill or fill to bottom edge of the fill plug hole.	2.3 L (4.8 pts.)
NV3550 Approximate dry fill or fill to bottom edge of fill plug hole.	1.98 L (4.2 pts.)
FRONT AXLE ± .03 L (1 oz.)	
181 FBI (Model 30)	1.2 L (2.5 pts.)
216 RBI (Model 44)	1.89 L (4.0 pts.)
REAR AXLE ± .03 L (1 oz.)	
194 RBI (Model 35)	1.66 L (3.5 pts.)*
216 RBI (Model 44)	1.89 L (4.0 pts.)*
* With Trac-lok add 118 ml (4.0 oz.) of Limited Slip Additive.	
****Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.	

MAINTENANCE SCHEDULES

DESCRIPTION

DESCRIPTION – DOMESTIC SCHEDULES

Maintenance Schedule Information not included in this section, is located in the appropriate Owner's Manual.

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

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

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

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

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

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

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

At Each Stop for Fuel

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

Once a Month

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

At Each Oil Change

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

MAINTENANCE SCHEDULES (Continued)

Schedule "B"

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

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

Miles (Kilometers)	3,000 (5 000)	6,000 (10 000)	9,000 (14 000)	12,000 (19 000)	15,000 (24 000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.		X		X	
Inspect the brake linings.				X	
Drain and refill the front and rear axle fluid‡				X	

Miles (Kilometers)	18,000 (29 000)	21,000 (34 000)	24,000 (38 000)	27,000 (43 000)	30,000 (48 000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Inspect the PCV Valve, and replace if necessary. ◊					X
Replace the spark plugs.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X		X
Inspect the brake linings.			X		
Drain and refill the front and rear axle fluid‡			X		
Inspect the transfer case fluid, add if necessary.					X

Miles (Kilometers)	33,000 (53 000)	36,000 (58 000)	39,000 (62 000)	42,000 (67 000)	45,000 (72 000)
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.		X		X	
Inspect the brake linings.		X			
Drain and refill the front and rear axle fluid‡		X			

MAINTENANCE SCHEDULES (Continued)

Miles (Kilometers)	**33,000 (53 000)**	**36,000 (58 000)**	**39,000 (62 000)**	**42,000 (67 000)**	**45,000 (72 000)**
Inspect the drive belt and replace as needed.					X

Miles (Kilometers)	**48,000 (77 000)**	**51,000 (82 000)**	**54,000 (86 000)**	**57,000 (91 000)**	**60,000 (96 000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Inspect the PCV Valve, and replace if necessary. ◊					X
Inspect the ignition cables, and replace if necessary (2.4L Only).					X
Replace the spark plugs.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X		X
Inspect the brake linings.	X				X
Drain and refill the front and rear axle fluid‡	X				X
Drain and refill the automatic transmission fluid, and change filter.					X
Inspect the drive belt and replace as needed. Not required if belt was previously.					X
Drain and refill the transfer case fluid.					X

Miles (Kilometers)	**63,000 (101 000)**	**66,000 (106 000)**	**69,000 (110 000)**	**72,000 (115 000)**	**75,000 (120 000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.		X		X	
Inspect the brake linings.				X	
Drain and refill the front and rear axle fluid‡				X	
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X

Miles (Kilometers)	**78,000 (125 000)**	**81,000 (130 000)**	**84,000 (134 000)**	**87,000 (139 000)**	**90,000 (144 000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X

MAINTENANCE SCHEDULES (Continued)

Miles (Kilometers)	**78,000 (125 000)**	**81,000 (130 000)**	**84,000 (134 000)**	**87,000 (139 000)**	**90,000 (144 000)**
Inspect the PCV Valve, and replace if necessary. ♢					X
Replace the spark plugs.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X		X
Replace the timing belt (2.4L Only).					X
Inspect the brake linings.			X		
Drain and refill the front and rear axle fluid‡			X		
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X
Inspect the transfer case fluid, add if necessary.					X

Miles (Kilometers)	**93,000 (149 000)**	**96,000 (154 000)**	**99,000 (158 000)**	**102,000 (163 000)**	**105,000 (168 000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.		X		X	
Inspect the brake linings.		X			
Drain and refill the front and rear axle fluid‡		X			
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X
Flush and replace the engine coolant.				X	

Miles (Kilometers)	**108,000 (173 000)**	**111,000 (178 000)**	**114,000 (182 000)**	**117,000 (187 000)**	**120,000 (192 000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Inspect the PCV Valve, and replace if necessary. ♢					X
Replace the spark plugs.					X
Inspect the ignition cables, and replace if necessary (2.4L Only).					X
Lubricate the steering linkage tie rod ends.	X	X	X	X	X

MAINTENANCE SCHEDULES (Continued)

Miles **(Kilometers)**	**108,000** **(173 000)**	**111,000** **(178 000)**	**114,000** **(182 000)**	**117,000** **(187 000)**	**120,000** **(192 000)**
Lubricate the steering and suspension ball joints.	X		X		X
Inspect the brake linings.	X				X
Drain and refill the front and rear axle fluid‡	X				X
Drain and refill the automatic transmission fluid, and replace main sump filter.					X
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X
Drain and refill the transfer case fluid.					X

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

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

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

Schedule "A"

Miles **(Kilometers)** **[Months]**	**6,000** **(10 000)** **[6]**	**12,000** **(19 000)** **[12]**	**18,000** **(29 000)** **[18]**	**24,000** **(38 000)** **[24]**	**30,000** **(48 000)** **[30]**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, and replace if necessary.					X
Replace the spark plugs.					X
Lubricate the steering linkage joints and outer tie rod ends.	X	X	X	X	X
Lubricate the steering and suspension ball joints.		X		X	
Inspect the brake linings.			X		
Inspect the transfer case fluid.					X

Miles **(Kilometers)** **[Months]**	**36,000** **(58 000)** **[36]**	**42,000** **(67 000)** **[42]**	**48,000** **(77 000)** **[48]**	**54, 000** **(86 000)** **[54]**
Change the engine oil and engine oil filter.	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X	
Lubricate the steering linkage joints and outer tie rod ends.	X	X	X	X
Inspect the brake linings.	X			X

MAINTENANCE SCHEDULES (Continued)

Miles **(Kilometers)** **[Months]**	**60,000** **(96 000)** **[60]**	**66,000** **(106 000)** **[66]**	**72,000** **(115 000)** **[72]**	**78,000** **(125 000)** **[78]**
Change the engine oil and engine oil filter.	X	X	X	X
Inspect the engine air filter element, and replace if necessary.	X			
Inspect the PCV Valve, and replace if necessary. ◊	X			
Replace the ignition cables (2.4L Only).	X			
Replace the spark plugs.	X			
Lubricate the steering linkage joints and outer tie rod ends.	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X	
Inspect the brake linings.			X	
Inspect the drive belt, and replace as needed.	X			
Inspect the drive belt, and replace as needed. Not required if belt was previously replaced.			X	
Flush and replace the engine coolant at 60 months, regardless of mileage.	X			
Inspect transfer case fluid.	X			

Miles **(Kilometers)** **[Months]**	**84,000** **(134 000)** **[84]**	**90,000** **(144 000)** **[90]**	**96,000** **(154 000)** **[96]**	**102, 000** **(163 000)** **[102]**
Change the engine oil and engine oil filter.	X	X	X	X
Inspect the engine air filter element, and replace if necessary.		X		
Inspect the PCV Valve, and replace if necessary. ◊		X		
Replace the spark plugs.		X		
Lubricate the steering linkage joints and outer tie rod ends.	X	X	X	X
Lubricate the steering and suspension ball joints.	X		X	
Inspect the brake linings.		X		
Inspect the drive belt, and replace as needed. Not required if previously replaced.		X		X
Flush and replace the engine coolant if not done at 60 months.				X
Inspect the transfer case fluid.		X		

Miles **(Kilometers)** **[Months]**	**108,000** **(173 000)** **[108]**	**114,000** **(182 000)** **[114]**	**120,000** **(192 000)** **[120]**
Change the engine oil and engine oil filter.	X	X	X
Inspect the engine air filter element, and replace if necessary.			X
Replace the ignition cables (2.4L Only).			X
Inspect the PCV Valve, and replace if necessary. ◊			X

MAINTENANCE SCHEDULES (Continued)

Miles **(Kilometers)** **[Months]**	**108,000** **(173 000)** **[108]**	**114,000** **(182 000)** **[114]**	**120,000** **(192 000)** **[120]**
Replace the spark plugs.			X
Lubricate the steering linkage joints and outer tie rod ends.	X	X	X
Lubricate the steering and suspension ball joints.	X		X
Inspect the brake linings.	X		
Replace the timing belt (2.4L Only).			X
Inspect the drive belt, and replace as needed. Not required if previously replaced.			X
Drain and refill the transfer case fluid.			X

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

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

DESCRIPTION – GASOLINE ENGINES – EXPORT SCHEDULES

Maintenance Schedule Information not included in this section, is located in the appropriate Owner's Manual.

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

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

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

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

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

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

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

At Each Stop for Fuel

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

Once a Month

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

At Each Oil Change

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

MAINTENANCE SCHEDULES (Continued)

Schedule "A"

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

Kilometers **(Miles)** **[Months]**	**72 000** **(45,000)** **[36]**	**84 000** **(52,500)** **[42]**	**96 000** **(60,000)** **[48]**	**108 000** **(67,500)** **[54]**
Change the engine oil and engine oil filter.	X	X	X	X
Inspect the engine air filter element, replace if necessary.			X	
Inspect and replace the PCV valve, if necessary♢.			X	
Inspect the ignition cables, and replace if necessary (2.4L Only).			X	
Replace the spark plugs.			X	
Inspect the brake linings.	X			X
Inspect and replace the Auto Tension Drive Belt, as needed.			X	
Inspect the transfer case fluid.			X	

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

MAINTENANCE SCHEDULES (Continued)

Kilometers **(Miles)** **[Months]**	**160 000** **(100,000)**	**168 000** **(105,000)** **[84]**	**180 000** **(112,500)** **[90]**	**192 000** **(120,000)** **[96]**
Change the engine oil and engine oil filter.		X	X	X
Inspect the brake linings.			X	
Inspect the engine air filter element, replace if necessary.				X
Replace the spark plugs.				X
Inspect the ignition cables, replace if necessary (2.4L Only).				X
Inspect and replace the PCV valve, if necessary. ♢				X
Inspect the drive belt and replace as needed. Not required if previously replaced.		X		X
Flush and replace the engine coolant if not done at 60 months.	X			
Replace the timing belt (2.4L Only).				X
Drain the transfer case, and refill.				X

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

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

Schedule “B”

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

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

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

Kilometers **(Miles)**	**29 000** **(18,000)**	**34 000** **(21,000)**	**38 000** **(24,000)**	**43 000** **(27,000)**	**48 000** **(30,000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Replace the spark plugs.					X
Inspect and replace the PCV valve, if necessary. ♢					X
Inspect the brake linings.			X		

MAINTENANCE SCHEDULES (Continued)

Kilometers **(Miles)**	**29 000** **(18,000)**	**34 000** **(21,000)**	**38 000** **(24,000)**	**43 000** **(27,000)**	**48 000** **(30,000)**
Drain and refill the front and rear axle fluid‡			X		
Inspect the transfer case fluid, add if necessary.					X

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

Kilometers **(Miles)**	**77 000** **(48,000)**	**82 000** **(51,000)**	**86 000** **(54,000)**	**91 000** **(57,000)**	**96 000** **(60,000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Replace the spark plugs.					X
Inspect and replace the PCV valve, if necessary. ◊					X
Replace the ignition cables (2.4L Only).					X
Inspect the brake linings.	X				X
Drain and refill the front and rear axle fluid‡	X				X
Drain and refill the automatic transmission fluid, and replace main sump filter.					X
Inspect the drive belt and replace as needed. Not required if belt was previously					X
Drain and refill the transfer case fluid.					X

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

MAINTENANCE SCHEDULES (Continued)

Kilometers **(Miles)**	**125 000** **(78,000)**	**130 000** **(81,000)**	**134 000** **(84,000)**	**139 000** **(87,000)**	**144 000** **(90,000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Replace the spark plugs.					X
Inspect and replace the PCV valve, if necessary. ♢					X
Inspect the brake linings.			X		
Drain and refill the front and rear axle fluid‡			X		
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X
Replace the timing belt (2.4L Only).					X
Inspect the transfer case fluid, add if necessary.					X

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

Kilometers **(Miles)**	**173 000** **(108,000)**	**178 000** **(111,000)**	**182 000** **(114,000)**	**187 000** **(117,000)**	**192 000** **(120,000)**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element, replace if necessary.					X
Replace the spark plugs.					X
Inspect and replace the PCV valve, if necessary. ♢					X
Replace the ignition cables (2.4L Only).					X
Inspect the brake linings.	X				X
Drain and refill the front and rear axle fluid‡	X				X
Drain and refill the automatic transmission fluid, and replace main sump filter.					X
Inspect the drive belt and replace as needed. Not required if belt was previously replaced.					X
Drain and refill the transfer case fluid.					X

MAINTENANCE SCHEDULES (Continued)

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

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

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

DESCRIPTION – DIESEL ENGINES – EXPORT SCHEDULES

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

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

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

- Extensive engine idling.
- Driving in dusty conditions.
- More than 50% of your driving is at sustained high speeds during hot weather, above 32° C (90° F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).

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

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

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

At Each Stop for Fuel

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

Once a Month

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

At Each Oil Change

- Change the engine oil filter.
- Inspect the exhaust system.
- Inspect the brake hoses.
- Check the manual transmission fluid level — if equipped.
- Check the coolant level, hoses, and clamps.
- Inspect engine accessory drive belts. Replace as necessary.
- Inspect for the presence of water in the fuel filter/water separator unit.
- Rotate the tires.

Schedule "A"

Kilometers	20 000 km	40 000 km	60 000 km	80 000 km	100 000 km
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	
Replace the fuel filter/water separator unit.	X	X	X	X	X
Replace the engine timing belt, and idler pulleys.					X
Inspect timing belt tensioner, and replace if necessary.‡					X
Inspect the engine accessory drive belt.	X	X	X	X	
Replace the engine accessory drive belt.					X

MAINTENANCE SCHEDULES (Continued)

Kilometers	20 000 km	40 000 km	60 000 km	80 000 km	100 000 km
Inspect the ball joints.	X	X	X	X	X
Inspect the brake linings.		X		X	
Inspect the transfer case fluid.			X		

Kilometers	120 000 km	140 000 km	160 000 km	180 000 km
Change the engine oil and engine oil filter.	X	X	X	X
Inspect the engine accessory drive belts, and replace if necessary.	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X
Replace the engine air filter element.	X		X	
Replace the fuel filter/water separator unit.	X	X	X	X
Flush and replace the engine coolant.			X	
Inspect the ball joints.	X	X	X	X
Inspect the brake linings.	X		X	
Drain and refill the automatic transmission fluid, change sump filter, and cooler return filter (if equipped).			X	
Inspect the transfer case fluid.	X			
Drain and refill the transfer case fluid.				X

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

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

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

Schedule "B"

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

- Extensive engine idling.
- Driving in dusty conditions.
- More than 50% of your driving is at sustained high speeds during hot weather, above 32° C (90° F).
- Trailer towing.
- Taxi, police, or delivery service (commercial service).

Kilometers	10 000 km	20 000 km	30 000 km	40 000 km	50 000 km
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X
Replace the engine air filter element.		X		X	
Replace the fuel filter/water separator unit.		X		X	
Inspect the engine accessory drive belt.	X	X	X	X	
Replace the engine accessory drive belt.					X
Replace the engine timing belt and idler pulleys.					X
Inspect the timing belt tensioner.‡					X
Inspect the ball joints.	X	X	X	X	X

MAINTENANCE SCHEDULES (Continued)

Kilometers	**10 000 km**	**20 000 km**	**30 000 km**	**40 000 km**	**50 000 km**
Inspect the brake linings.		X		X	
Drain and refill the front and rear axle fluid.		X		X	
Drain and refill the automatic transmission fluid, and replace sump filter.					X

Kilometers	**60 000 km**	**70 000 km**	**80 000 km**	**90 000 km**	**100 000 km**
Change the engine oil and engine oil filter.	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.		X		X	
Replace the engine air filter element.	X		X		X
Replace the fuel filter/water separator unit.	X		X		X
Inspect the engine accessory drive belt.	X	X	X	X	
Replace the engine accessory drive belt.					X
Replace the engine timing belt, idler pulleys, and tensioner.					X
Inspect the ball joints.	X	X	X	X	X
Inspect the brake linings.	X		X		X
Drain and refill the front and rear axle fluid.	X		X		X
Drain and refill the transfer case fluid.					X
Drain and refill the automatic transmission fluid, and replace sump filter.					X

Kilometers	**110 000 km**	**120 000 km**	**130 000 km**	**140 000 km**	**150 000 km**	**160 000 km**
Change the engine oil and engine oil filter.	X	X	X	X	X	X
Inspect the engine air filter element. Replace as necessary.	X		X		X	
Replace the engine air filter element.		X		X		X
Inspect the engine accessory drive belts, and replace if necessary.	X	X	X	X		X
Replace the engine accessory drive belt.					X	
Inspect the timing belt tensioner.‡					X	
Replace the engine timing belt and idler pulleys.					X	
Replace the fuel filter/water separator unit.		X		X		X
Flush and replace the engine coolant.						X
Inspect the ball joints.	X	X	X	X	X	X

MAINTENANCE SCHEDULES (Continued)

Kilometers	**110 000 km**	**120 000 km**	**130 000 km**	**140 000 km**	**150 000 km**	**160 000 km**
Inspect the brake linings.		X		X		X
Drain and refill the front and rear axle fluid.		X		X		X
Drain and refill the automatic transmission fluid, and replace sump filter.					X	
Replace the transmission cooler return filter (if equipped).					X	

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

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

HOISTING

STANDARD PROCEDURE - HOISTING RECOMMENDATIONS

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

When properly positioned, a floor jack can be used to lift a Jeep vehicle (Fig. 5). Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

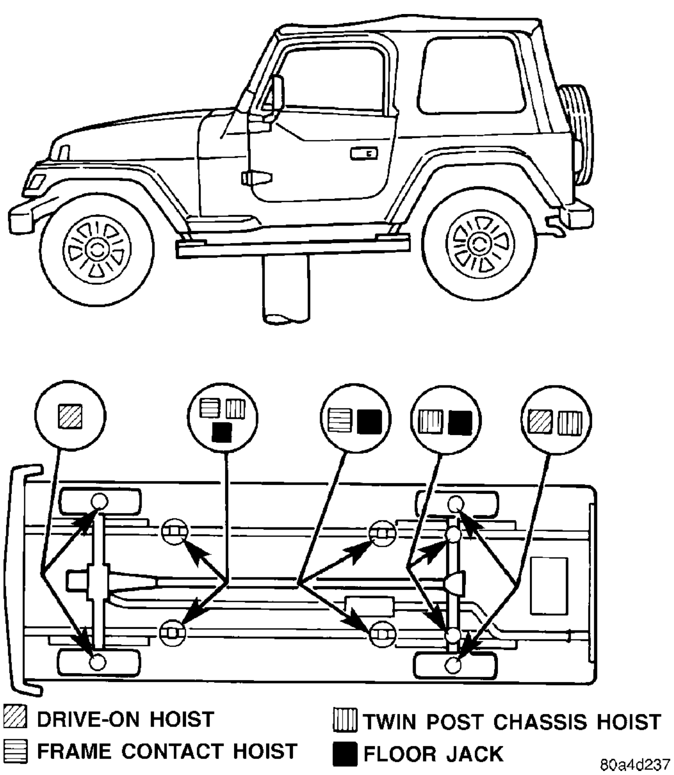

Fig. 5 Vehicle Lifting Locations

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

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

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

HOIST

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

A vehicle can be lifted with:

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

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

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

TOWING

STANDARD PROCEDURE - TOWING RECOMMENDATIONS

DaimlerChrysler Corporation recommends that a 4WD vehicle be transported on a flat-bed device. A Wheel-lift or front end attached Sling-type device can be used provided all the wheels are lifted off the ground using tow dollies (Fig. 6) and (Fig. 7).

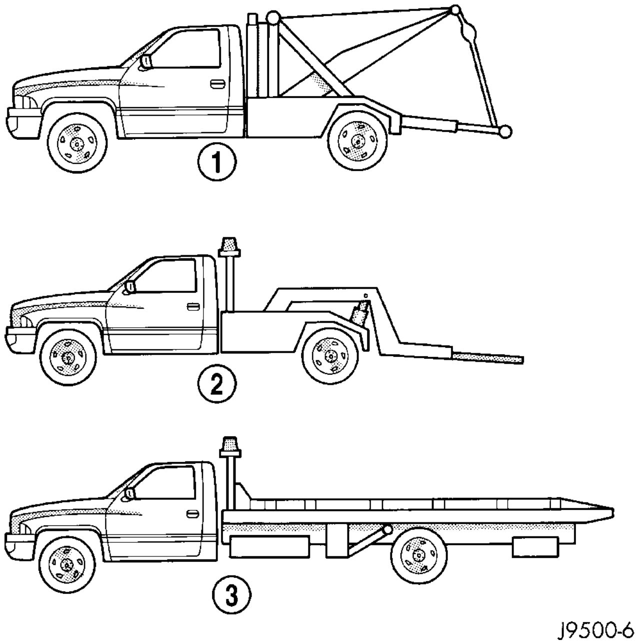

Fig. 6 Tow Vehicles With Approved Equipment

1 - SLING TYPE
2 - WHEEL LIFT
3 - FLAT BED

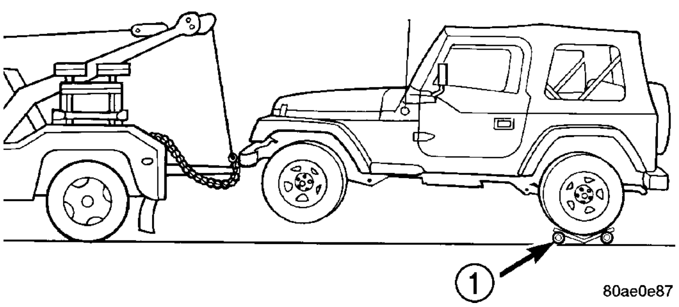

Fig. 7 Towing With Tow Dollies

1 - TOW DOLLY

SAFETY PRECAUTIONS

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

GROUND CLEARANCE

CAUTION: If vehicle is towed with wheels removed, install lug nuts to retain brake drums.

A towed vehicle should be raised until lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the opposite end of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums.

FLAT-BED TOWING RAMP ANGLE

If a vehicle with flat-bed towing equipment is used, the approach ramp angle should not exceed 15 degrees.

VEHICLE TOWING

WARNING: WHEN TOWING A DISABLED VEHICLE AND THE DRIVE WHEELS ARE SECURED IN A WHEEL LIFT OR TOW DOLLIES, ENSURE THE TRANSMISSION IS IN THE PARK POSITION (AUTOMATIC TRANSMISSION) OR A FORWARD DRIVE GEAR (MANUAL TRANSMISSION).DO NOT ATTACH SLING-TYPE TOWING EQUIPMENT TO THE REAR OF A TJ.

TOWING-FRONT END LIFTED (WHEEL LIFT)

(1) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.

(2) Attach the wheel lift to the front wheels.

TOWING-REAR END LIFTED (WHEEL LIFT ONLY)

(1) Raise the front of the vehicle off the ground and install tow dollies under front wheels.

(2) Attach the wheel lift to the rear wheels.

TOWING-FRONT END LIFTED (SLING-TYPE)

(1) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.

TOWING (Continued)

(2) Attach T-hooks to the access holes on the outboard side of the frame rails (Fig. 8).

(3) Before tightening the chain, position a protective pad between the chain and the bumper.

(4) Attach the safety chains to the vehicle (Fig. 9).

(5) Turn the ignition switch to the OFF position to unlock the steering wheel.

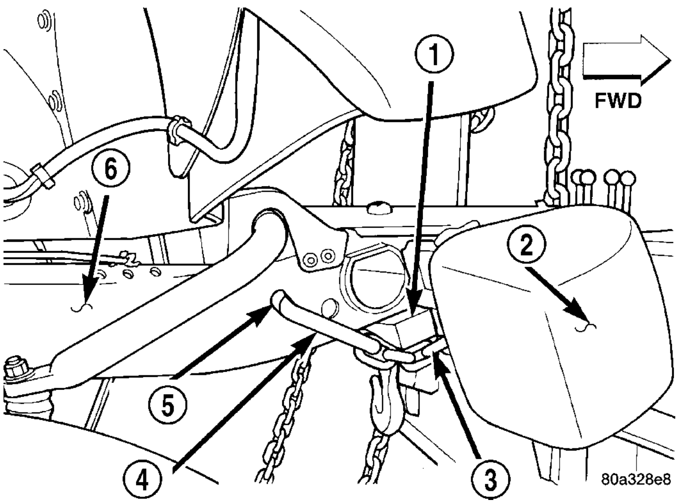

Fig. 8 T-Hook Attachment

1 - PROTECTIVE PAD
2 - BUMPER
3 - CHAIN
4 - T-HOOK
5 - ACCESS HOLE
6 - FRAME

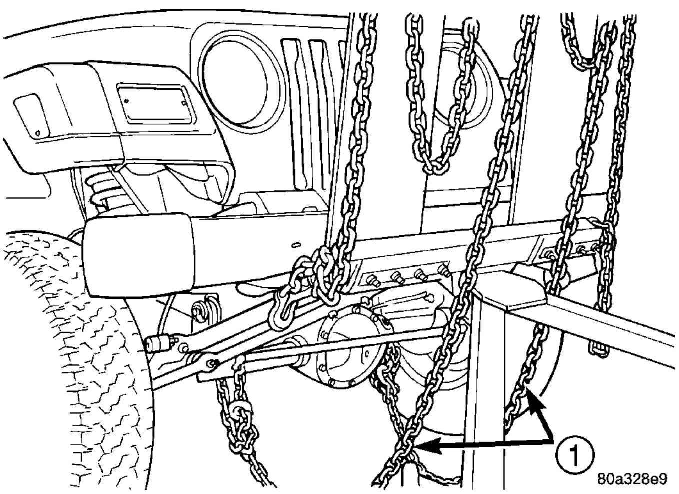

Fig. 9 Safety Chain Attachment

1 - SAFETY CHAIN

RECREATIONAL TOWING

Refer to the Owners Manual for towing procedures.

EMERGENCY TOW HOOKS

WARNING: REMAIN AT A SAFE DISTANCE FROM A VEHICLE THAT IS BEING TOWED VIA ITS TOW HOOKS. THE TOW STRAPS/CHAINS COULD BREAK AND CAUSE SERIOUS INJURY.

Some Jeep vehicles are equipped with front emergency tow hooks. The tow hooks should be used for **EMERGENCY** purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

JUMP STARTING

STANDARD PROCEDURE - JUMP STARTING PROCEDURE

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

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

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

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

JUMP STARTING (Continued)

TO JUMP START A DISABLED VEHICLE:

(1) Raise hood on disabled vehicle and visually inspect engine compartment for:

- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.

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

(2) When using another vehicle as a booster source, turn off all accessories, place gear selector in park or neutral, set park brake or equivalent and operate engine at 1200 rpm.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake or equivalent. Turn OFF all accessories.

(4) Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result (Fig. 10). Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to battery positive (+) terminal. Connect BLACK jumper cable clamp to the engine as close to the ground cable connection as possible (Fig. 10).

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

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

DISCONNECT CABLE CLAMPS AS FOLLOWS:

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

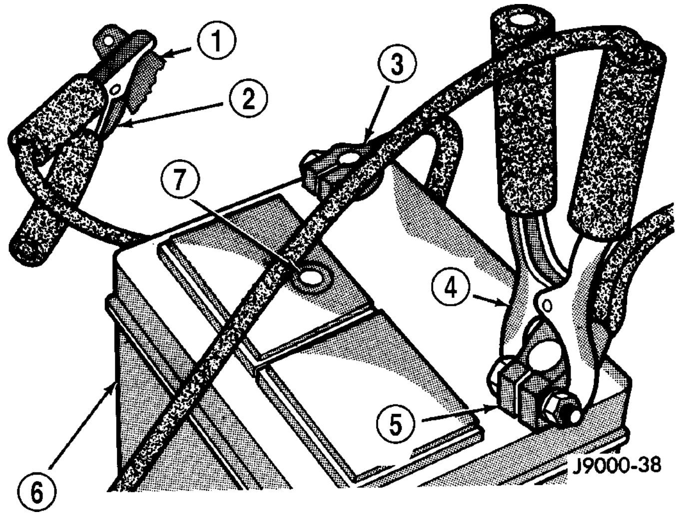

Fig. 10 Jumper Cable Clamp Connections

1 - ENGINE GROUND
2 - NEGATIVE JUMPER CABLE
3 - BATTERY NEGATIVE CABLE
4 - POSITIVE JUMPER CABLE
5 - BATTERY POSITIVE CABLE
6 - BATTERY
7 - TEST INDICATOR (IF EQUIPPED)

- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

EMERGENCY TOW HOOKS

DESCRIPTION — EMERGENCY TOW HOOKS

WARNING: REMAIN AT A SAFE DISTANCE FROM A VEHICLE THAT IS BEING TOWED VIA ITS TOW HOOKS. THE TOW STRAPS/CHAINS COULD BREAK AND CAUSE SERIOUS INJURY.

Some Jeep vehicles are equipped with front emergency tow hooks. The tow hooks should be used for **EMERGENCY** purposes only.

CAUTION: DO NOT use emergency tow hooks for tow truck hook-up or highway towing.

SUSPENSION

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WHEEL ALIGNMENT

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WHEEL ALIGNMENT

DESCRIPTION

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe position (Fig. 1).

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

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

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

OPERATION

- **CASTER** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle rearward provides positive caster. Tilting the top of the knuckle forward provides negative caster. Caster is a directional stability angle. This angle enables the front wheels to return to a straight ahead position after turns (Fig. 1)
- **CAMBER** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire. The angle is not adjustable, damaged component(s) must be replaced to correct the camber angle (Fig. 1)
- **WHEEL TOE POSITION** is the difference between the leading inside edges and trailing inside edges of the front tires. Incorrect wheel toe position is the most common cause of unstable steering and uneven tire wear. The wheel toe position is the **final** front wheel alignment adjustment (Fig. 1)
- **STEERING AXIS INCLINATION ANGLE** is measured in degrees and is the angle that the steering knuckles are tilted. The inclination angle has a fixed relationship with the camber angle. It will not change except when a spindle or ball stud is damaged or bent. The angle is not adjustable, damaged

WHEEL ALIGNMENT (Continued)

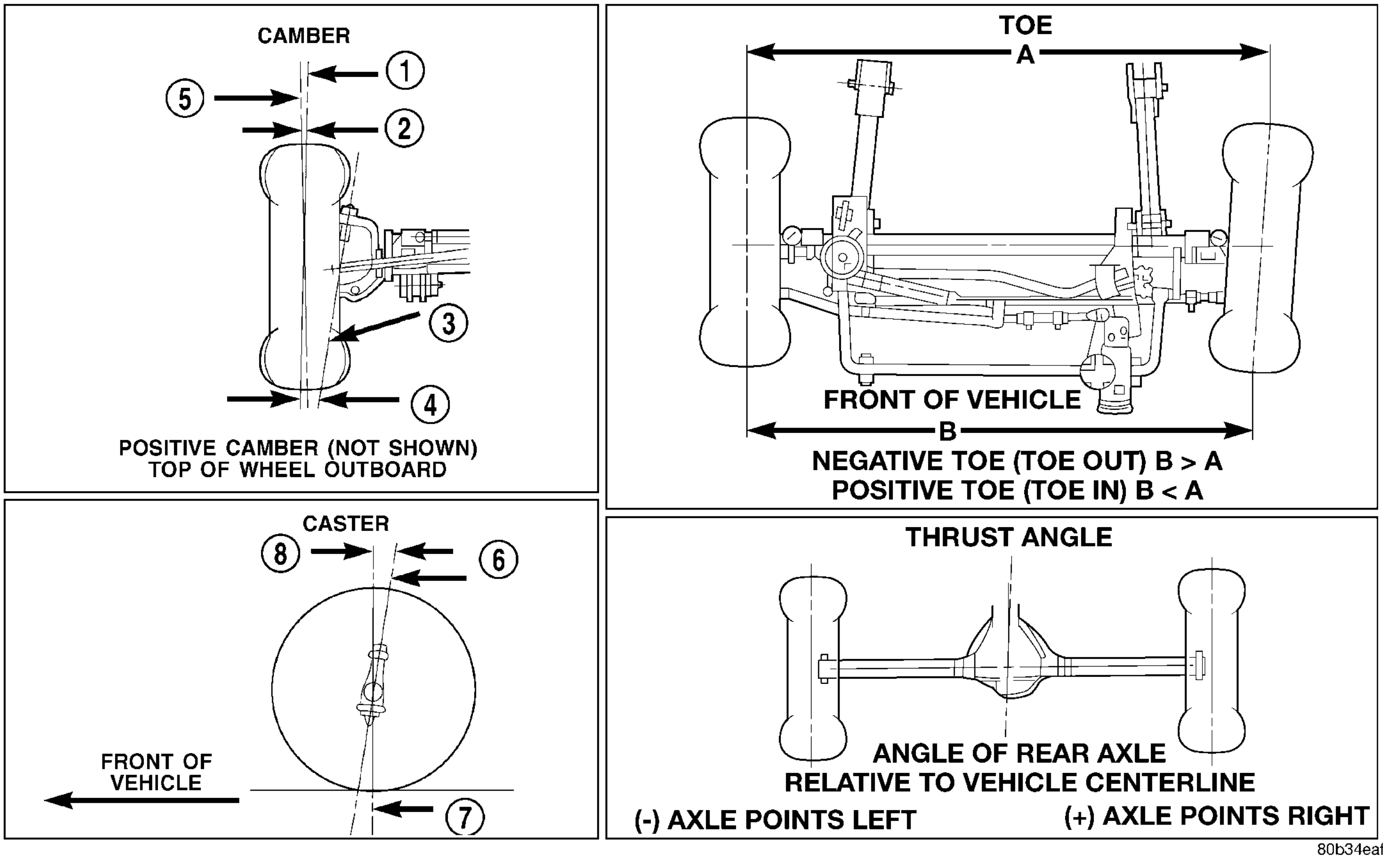


Fig. 1 Wheel Alignment Measurements

1 - WHEEL CENTERLINE
2 - NEGATIVE CAMBER ANGLE
3 - PIVOT CENTERLINE
4 - SCRUB RADIUS
5 - TRUE VERTICAL
6 - KING PIN
7 - VERTICAL
8 - POSITIVE CASTER

component(s) must be replaced to correct the steering axis inclination angle (Fig. 1)

- **THRUST ANGLE** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. This angle is not adjustable, damaged component(s) must be replaced to correct the thrust angle (Fig. 1)

DIAGNOSIS AND TESTING - SUSPENSION AND STEERING SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Adjust or replace steering gear.

WHEEL ALIGNMENT (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
	5. Leaking steering dampener.	5. Replace steering dampener.
VEHICLE INSTABILITY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Adjust or replace steering gear.
	2. Power steering fluid low.	2. Add fluid and repair leak.
	3. Column coupler binding.	3. Replace coupler.
	4. Tire pressure.	4. Adjust tire pressure.
	5. Alignment.	5. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE DURING BRAKING	1. Uneven tire pressure.	1. Adjust tire pressure.
	2. Worn brake components.	2. Repair brakes as necessary.
	3. Air in brake line.	3. Repair as necessary.
VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD	1. Radial tire lead.	1. Cross front tires.
	2. Brakes dragging.	2. Repair brake as necessary.
	3. Weak or broken spring.	3. Replace spring.
	4. Uneven tire pressure.	4. Adjust tire pressure.
	5. Wheel Alignment.	5. Align vehicle.
	6. Loose or worn steering or suspension components.	6. Repair as necessary.
	7. Cross caster out of spec.	7. Align vehicle.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings.	1. Replace shock.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.
	3. Shock valve.	3. Replace shock.
IMPROPER TRACKING	1. Loose, worn or bent track bar.	1. Inspect, tighten or replace component as necessary.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.

WHEEL ALIGNMENT (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - CAMBER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

The wheel camber angle is preset. This angle is not adjustable and cannot be altered.

STANDARD PROCEDURE - CASTER

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

Check the caster of the front axle for correct angle. Be sure the axle is not bent or twisted. Road test the vehicle and observe the steering wheel return-to-center position. Low caster will cause poor steering wheel returnability.

During the road test, turn the vehicle to both the left and right. If the steering wheel returns to the center position unassisted, the caster angle is correct. However, if steering wheel does not return toward the center position unassisted, a low caster angle is probable.

Caster can be adjusted by installing cam bolts and rotating the cams on the lower suspension arm (Fig. 2).

NOTE: Changing caster angle will also change the front propeller shaft angle. The propeller shaft angle has priority over caster. Refer to Group 3, Differential and Driveline for additional information.

STANDARD PROCEDURE - TOE POSITION

Before each alignment reading the vehicle should be jounced (rear first, then front). Grasp each bumper at the center and jounce the vehicle up and down three times. Always release the bumper in the down position.

NOTE: The wheel toe position adjustment is the final adjustment. This adjustment must be performed with the engine running, if the vehicle is equipped with power steering.

(1) Start the engine and turn wheels both ways before straightening the steering wheel. Center and secure the steering wheel.

(2) Loosen the adjustment sleeve clamp bolts (Fig. 3).

(3) Adjust the right wheel toe position with the drag link (Fig. 4). Turn the sleeve until the right wheel is at the correct positive TOE-IN position. Position the clamp bolts as shown (Fig. 3) and tighten to 49 N·m (36 ft. lbs.). **Make sure the toe setting does not change during clamp tightening.**

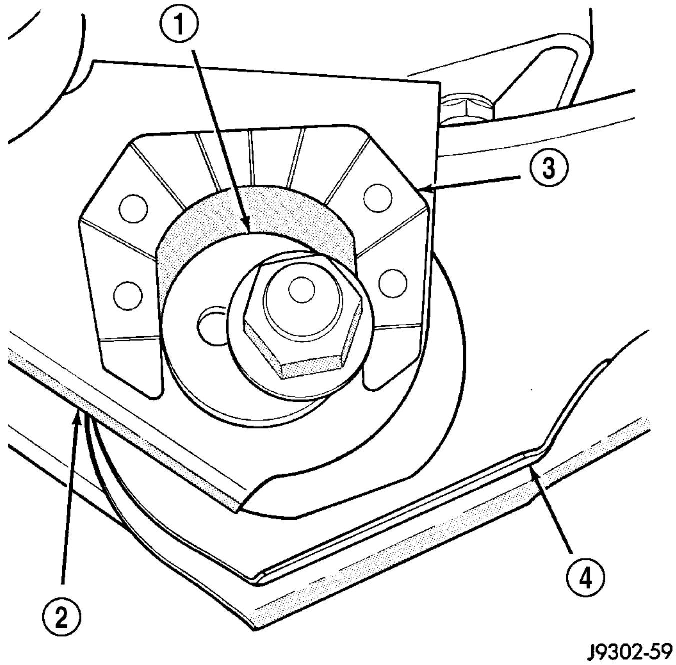


Fig. 2 Cam Adjuster

1 - ADJUSTMENT CAM
2 - AXLE BRACKET
3 - BRACKET REINFORCEMENT
4 - LOWER SUSPENSION ARM

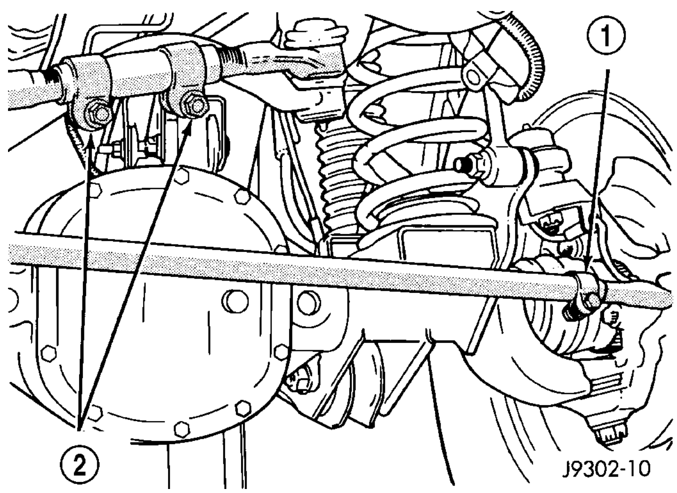


Fig. 3 Drag Link and Tie Rod Clamp

1 - TIE ROD CLAMP
2 - DRAG LINK CLAMPS

(4) Adjust the left wheel toe position with the tie rod. Turn the sleeve until the left wheel is at the same TOE-IN position as the right wheel. Position the clamp bolts as shown (Fig. 3) and tighten to 27

WHEEL ALIGNMENT (Continued)

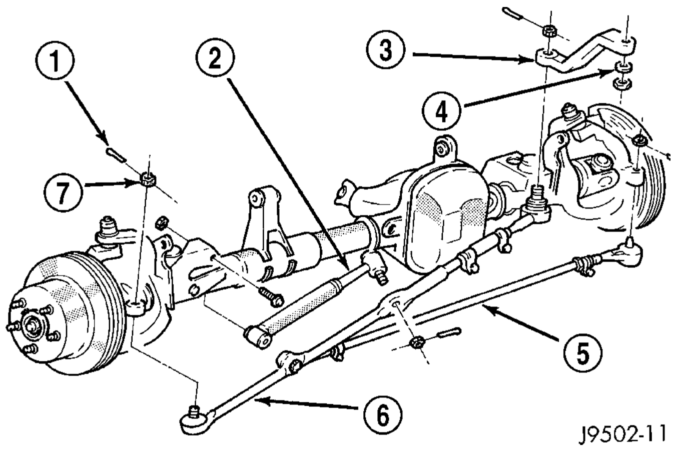


Fig. 4 Steering Linkage

1 - COTTER PIN
2 - DAMPENER
3 - PITMAN ARM
4 - WASHER
5 - TIE ROD
6 - DRAG LINK
7 - NUT

N·m (20 ft. lbs.). **Make sure the toe setting does not change during clamp tightening.**

(5) Verify the right toe specifications and turn off the engine.

SPECIFICATIONS

ALIGNMENT SPECIFICATIONS

NOTE: Alignment specifications are in degrees.

SPECIFICATIONS

DESCRIPTION	SPECIFICATION		
PREFERRED	CASTER + 7.0°	CAMBER (fixed angle) – 0.25°	TOTAL TOE-IN + 0.15° (each front wheel)
RANGE	±1.0°	± 0.63°	±0.06°
MAX RT/LT DIFFERENCE	0.65°	±1.0°	.06°
REAR SPECIFICATION			
PREFERRED	N/A	REAR CAMBER –0.25°	TOTAL TOE-IN +0.25°
RANGE	N/A	0° to –.50°	0° to .5°
THRUST ANGLE 0° ± 0.25°			

FRONT

TABLE OF CONTENTS

FRONT

DESCRIPTION

FRONT SUSPENSION

The front suspension is a link/coil design comprised of:

- Shock absorbers
- Jounce Bumper
- Coil springs
- Upper and lower suspension arms
- Stabilizer bar
- Track bar

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

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

STANDARD PROCEDURE - LUBRICATION

Periodic lubrication of the suspension system is required. Refer to Lubrication And Maintenance for the recommended maintenance schedule.

The following component must be lubricated:

- Track bar

FRONT (Continued)

SPECIFICATIONS

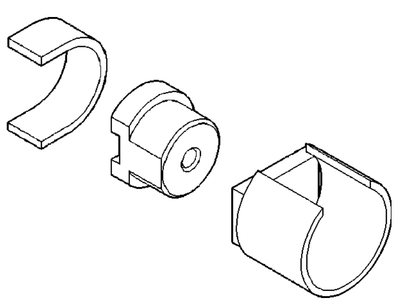
TORQUE CHART

TORQUE SPECIFICATIONS

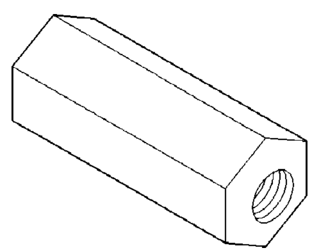
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Nut	23	17	—
Shock Absorber Lower Nut	28	—	250
Suspension Arm Lower Axle Bracket Nut	176	130	—
Suspension Arm Lower Frame Bracket Nut	176	130	—
Suspension Arm Upper Axle Bracket Nut	81	60	—
Suspension Arm Upper Frame Bracket Bolt	81	60	—
Stabilizer Bar Retainer Bolts	61	45	—
Stabilizer Bar Link Upper Nut	61	45	—
Stabilizer Bar Link Lower Bolt	102	75	—
Track Bar Ball Stud Nut	81	60	—
Track Bar Axle Bracket Bolt	47	40	—
Hub/Bearing Bolts	102	75	—
Hub/Bearing Axle Nut	237	175	—

SPECIAL TOOLS

FRONT SUSPENSION

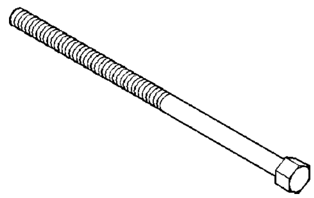


Remover/Installer Suspension Bushing 7932

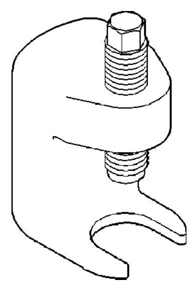


Nut, Long 7603

FRONT (Continued)



Bolt, Special 7604



Remover C-4150A

BUSHINGS

REMOVAL

(1) Remove the upper suspension arm from axle.

(2) Position Spacer 7932-3 over the axle bushing on a 4x2 vehicle and right side on a 4x4 vehicle.

(3) Place Receiver 7932-1 over flanged end of the bushing. (Fig. 1).

(4) Place small end of Remover/Install 7932-2 against other side of the bushing.

(5) Install bolt 7604 through remover, bushing and receiver.

(6) Install Long Nut 7603 and tighten nut too pull bushing out of the axle bracket.

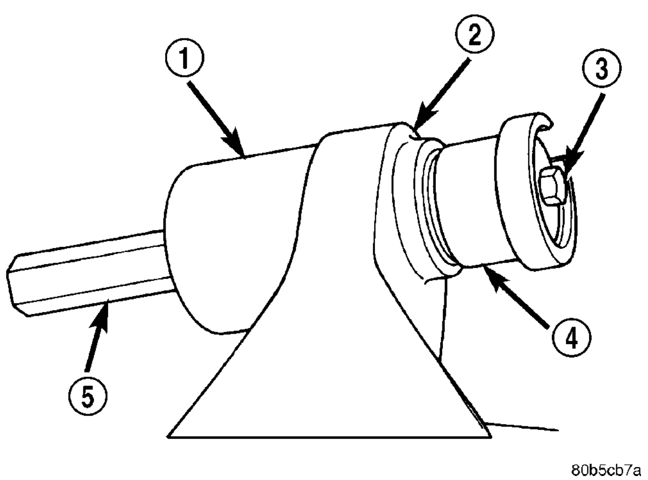


Fig. 1 Bushing Removal

1 - RECEIVER
2 - AXLE BRACKET
3 - BOLT
4 - REMOVER/INSTALLER
5 - LONG NUT

(7) Remove nut, bolt, receiver, remover and bushing.

NOTE: On 4x2 vehicle and right side of 4x4 vehicle, leave Spacer 7932-3 in position for bushing installation.

INSTALLATION

(1) Place Receiver 7932-1 on the other side of the axle bracket.

(2) Position new bushing up to the axle bracket., and large end of Remover/Install 7932-2 against the bushing (Fig. 2).

(3) Install bolt 7604 through receiver, bushing and installer.

(4) Install Long Nut 7603 and tighten nut to draw the bushing into the axle bracket.

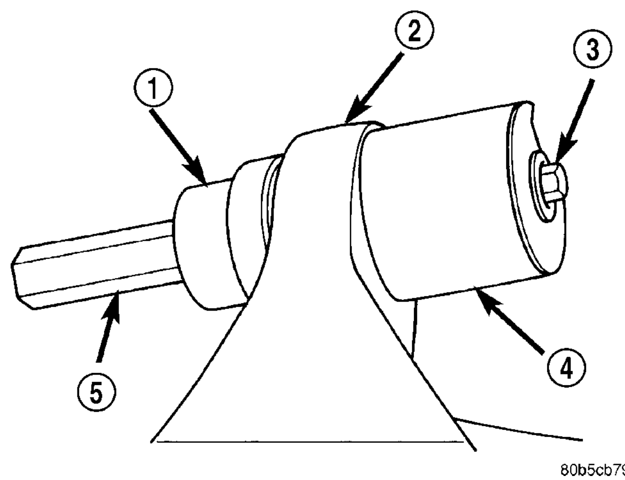


Fig. 2 Bushing Installation

1 - REMOVER/INSTALLER
2 - AXLE BRACKET
3 - BOLT
4 - RECEIVER
5 - LONG NUT

(5) Remove tools and install the upper suspension arm.

HUB / BEARING

DESCRIPTION

The bearing used on the front hub of this vehicle is the combined hub and bearing unit type assembly. This unit assembly combines the front wheel mounting hub (flange) and the front wheel bearing into a one piece unit. The wheel mounting studs are the only replaceable component of the hub/bearing assembly.

HUB / BEARING (Continued)

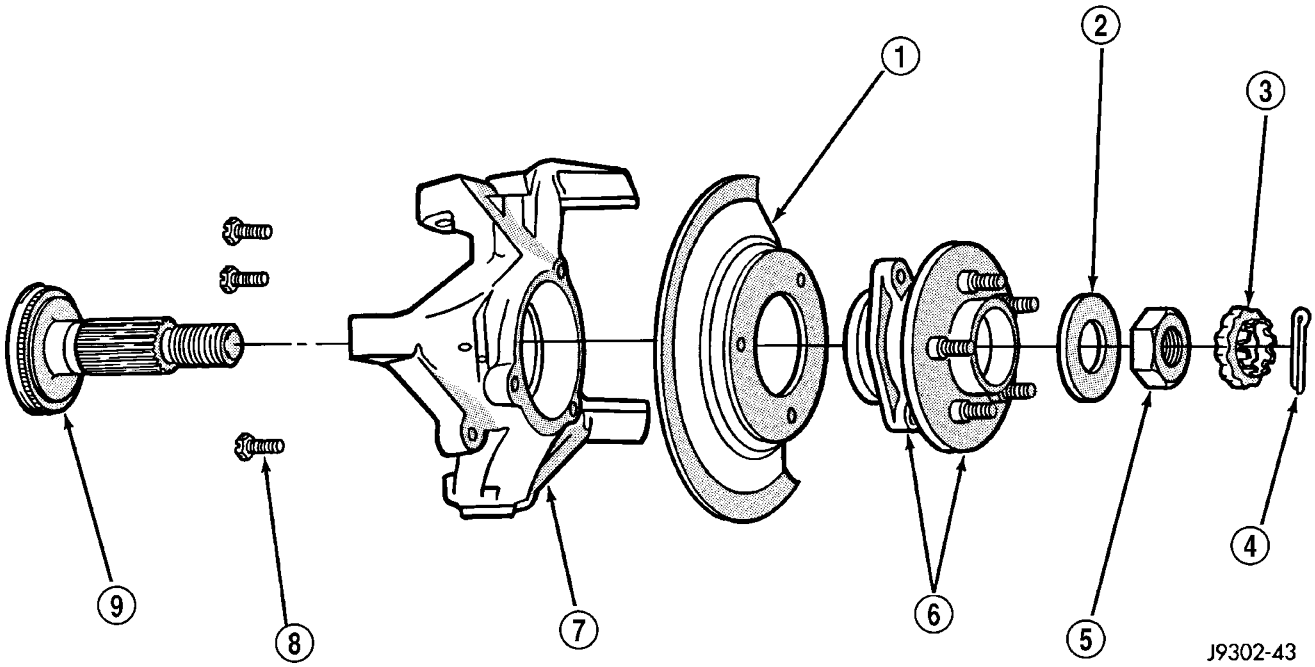


Fig. 3 Hub Bearing & Knuckle

1 - BRAKE SHIELD
2 - WASHER
3 - RETAINER
4 - COTTER PIN
5 - NUT
6 - HUB AND BEARING ASSEMBLY
7 - STEERING KNUCKLE
8 - BOLT
9 - TONE WHEEL (ABS)

OPERATION

The hub/bearing assembly is mounted to the steering knuckle and is retained by three mounting bolts accessible from the back of the steering knuckle. The hub/bearing unit is not serviceable and must be replaced as an assembly if the bearing or the hub is determined to be defective.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove the brake caliper, rotor and ABS wheel speed sensor, (Refer to 5 - BRAKES/HYDRAULIC/ MECHANICAL/ROTORS - REMOVAL).

(4) Remove the cotter pin, nut retainer and axle hub nut (Fig. 3).

(5) Remove the hub bearing mounting bolts from the back of the steering knuckle. Remove hub bearing from the steering knuckle and off the axle shaft.

INSTALLATION

(1) Install the hub bearing and brake dust shield to the knuckle.

(2) Install the hub bearing to knuckle bolts and tighten to 102 N·m (75 ft. lbs.).

(3) Install the hub washer and nut. Tighten the hub nut to 237 N·m (175 ft. lbs.). Install the nut retainer and a new cotter pin.

(4) Install the brake rotor, caliper and ABS wheel speed sensor, (Refer to 5 - BRAKES/HYDRAULIC/ MECHANICAL/ROTORS - INSTALLATION).

(5) Install the wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(6) Remove support and lower the vehicle.

JOUNCE BUMPER

DESCRIPTION

The jounce bumpers are mounted under the frame rails inside of the coil springs.

KNUCKLE

REMOVAL

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Remove hub bearing and axle shaft. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL) (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 181FBI/AXLE SHAFTS - REMOVAL).

(2) Disconnect the tie-rod or drag link from the steering knuckle arm,(Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL) OR (Refer to 19 - STEERING/LINKAGE/DRAG LINK - REMOVAL).

(3) Remove the cotter pins from the upper and lower ball studs.

(4) Remove the upper and lower ball stud nuts.

(5) Using special tool C-4150A seperate the ball joints from the steering knuckle. Remove knuckle from ball studs (Fig. 4).

INSTALLATION

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Position the steering knuckle on the ball studs.

(2) Install and tighten the bottom retaining nut to 109 N·m (80 ft. lbs.) torque. Install new cotter pin.

(3) Install and tighten the top retaining nut to 101 N·m (75 ft. lbs.) torque. Install new cotter pin.

(4) Install the hub bearing and axle shaft. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - INSTALLATION) (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 181FBI/AXLE SHAFTS - INSTALLATION).

(5) Connect the tie-rod or drag link end to the steering knuckle arm,(Refer to 19 - STEERING/LINKAGE/TIE ROD END - INSTALLATION) OR (Refer to 19 - STEERING/LINKAGE/DRAG LINK - INSTALLATION).

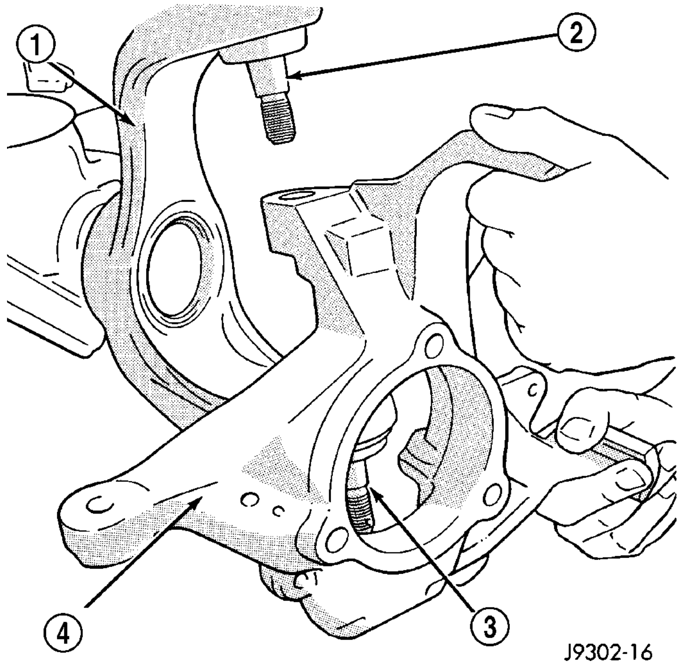


Fig. 4 Steering Knuckle Removal/Installation

1 - AXLE YOKE
2 - UPPER BALL STUD
3 - LOWER BALL STUD
4 - STEERING KNUCKLE

LOWER BALL JOINT

REMOVAL

Ball stud service procedures below require removal of the hub bearing and axle shaft. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL) (Refer to 3 - DIFFERENTIAL & DRIVELINE/FRONT AXLE - 181FBI/AXLE SHAFTS - REMOVAL). Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Position tools as shown to remove and install ball stud (Fig. 5).

LOWER BALL JOINT (Continued)

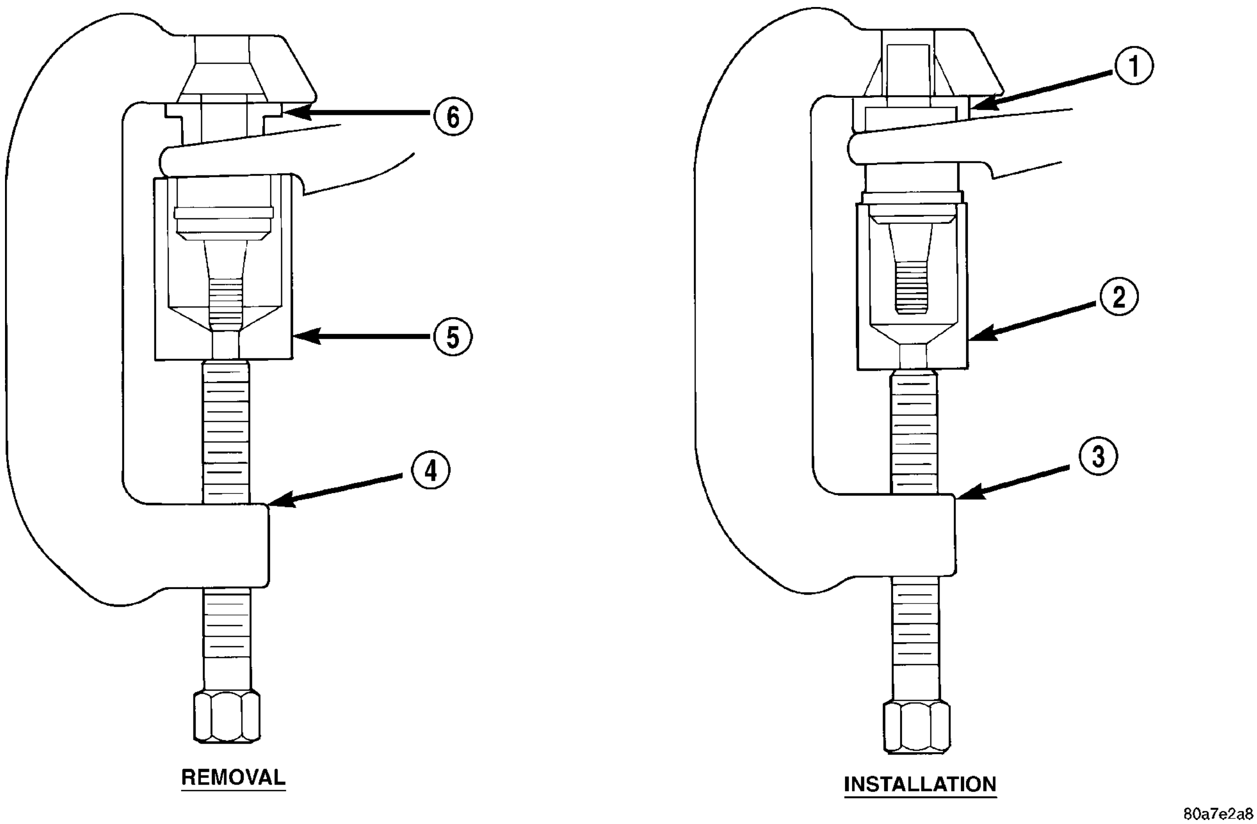


Fig. 5 Lower Ball Stud Remove/Install

1 - SPECIAL TOOL 6289–12
2 - SPECIAL TOOL 6289–4
3 - SPECIAL TOOL 4212F
4 - SPECIAL TOOL 4212F
5 - SPECIAL TOOL 6289–1
6 - SPECIAL TOOL 6289–3

LOWER CONTROL ARM

DESCRIPTION

The lower suspension arms are steel and use bushings at both ends of the arm. The arms mount to the frame rail bracket and the axle brackets.

OPERATION

The lower suspension arm bushings provide isolation from the axle. The arm and bushings provide location and react to loads from the axle. The lower suspension arms can be used to adjust caster and pinion angle by installing a cam bolt service package.

REMOVAL

(1) Raise and support the vehicle.

(2) If equipped with ABS brakes remove sensor wire from the inboard side of the arm.

(3) If the vehicle is equipped with a cam bolt service package paint or scribe alignment marks on the cam adjusters and suspension arm for installation reference (Fig. 6).

(4) Remove the lower suspension arm nut and bolt from the axle (Fig. 7).

(5) Remove the nut and bolt/cam bolt from the frame rail bracket and remove the lower suspension arm (Fig. 7).

INSTALLATION

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

NOTE: Small holes in the side of the arm face inboard.

(2) Install the rear bolt and nut finger tighten.

(3) Install bolt/cam bolt and new nut finger tighten in the axle and align the reference marks.

(4) If equipped with ABS brakes install sensor wire to the inboard side of the arm with new clips.

(5) Lower the vehicle.

(6) Tighten axle bracket nut to 176 N·m (130 ft. lbs.).

(7) Tighten frame bracket nut to 176 N·m (130 ft. lbs.).

LOWER CONTROL ARM (Continued)

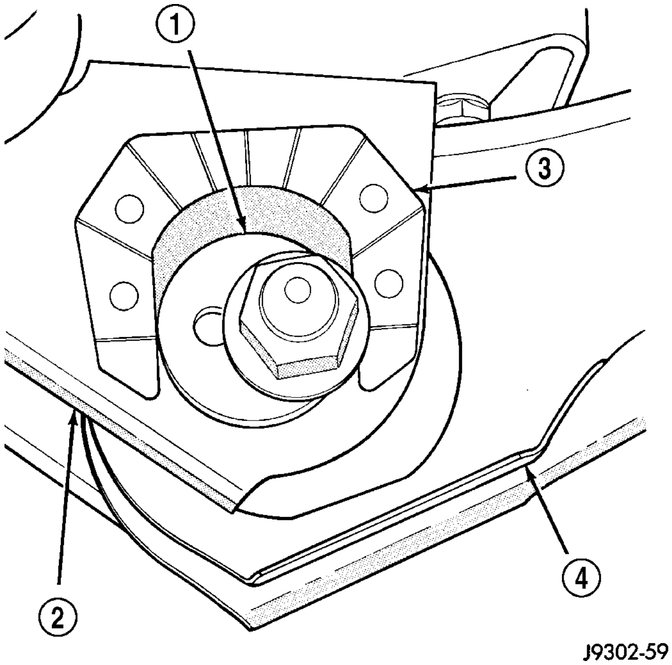


Fig. 6 Cam Bolt Service Package

1 - ADJUSTMENT CAM
2 - AXLE BRACKET
3 - BRACKET REINFORCEMENT
4 - LOWER SUSPENSION ARM

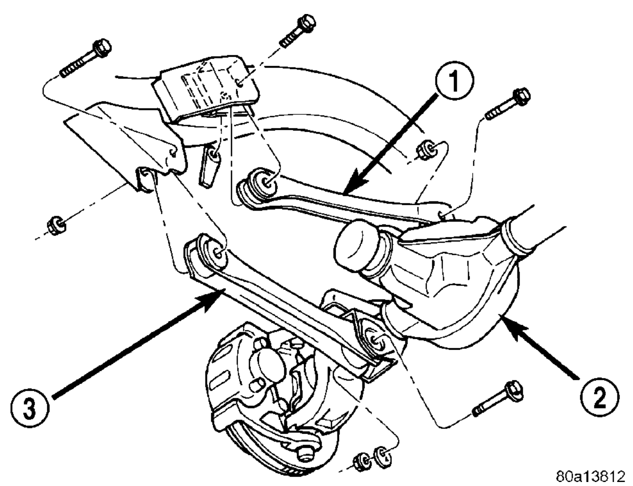


Fig. 7 Upper & Lower Suspension Arms

1 - UPPER SUSPENSION ARM
2 - FRONT AXLE
3 - LOWER SUSPENSION ARM

(8) Align vehicle to specifications. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to a frame bracket. The bottom of the shocks are bolted to the axle brackets.

OPERATION

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.

DIAGNOSIS AND TESTING - SHOCK ABSORBER

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

REMOVAL

(1) Remove the nut, retainer and grommet from the upper stud through engine compartment access hole (Fig. 8).

(2) Remove the lower nuts and bolts from the axle bracket and remove the shock absorber.

INSTALLATION

(1) Position the lower retainer and grommet on the upper stud. Insert the shock absorber through the shock bracket hole.

(2) Install the lower bolts and nuts. Tighten nuts to 28 N·m (250 in. lbs.).

SHOCK (Continued)

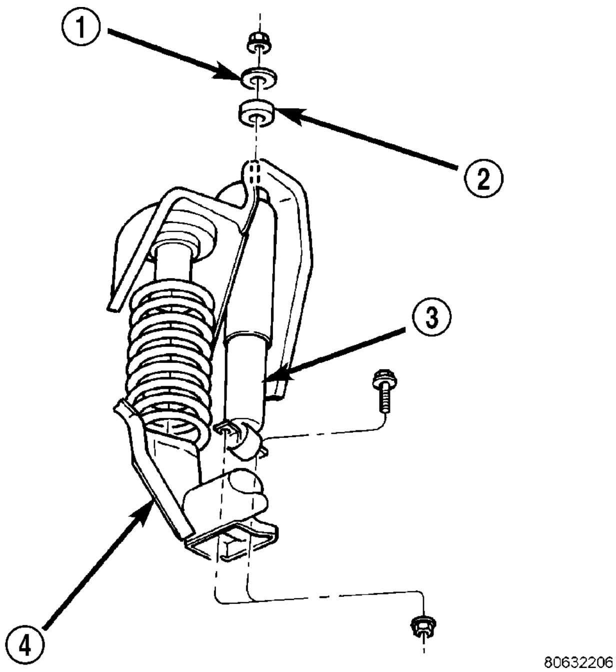


Fig. 8 Coil Spring & Shock Absorber

1 - RETAINER
2 - GROMMET
3 - SHOCK
4 - FRONT AXLE

(3) Install the upper grommet and retainer on the stud and install the nut and tighten to 23 N·m (17 ft. lbs.).

SPRING

DESCRIPTION

The coil springs mount up in the wheelhouse which is part of the unitized body bracket. A rubber doughnut isolator is located between the top of the spring and the bracket. The bottom of the spring seats on a axle pad.

OPERATION

The coil springs control ride quality and maintain proper ride height. The isolators provide road noise isolation.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the wheel and tire assemblies.
(3) Position a hydraulic jack under the axle to support it.
(4) Remove the front shocks at the lower mountings, (Refer to 2 - SUSPENSION/FRONT/SHOCK - REMOVAL).
(5) Remove the ABS wire mounting brackets at the axle. (if equipped)
(6) Remove lower suspension arms mounting nuts and bolts from the frame, (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).
(7) Remove the track bar from the axle bracket, (Refer to 2 - SUSPENSION/FRONT/TRACK BAR - REMOVAL).
(8) Remove the right side of the drag link from the right side knuckle, (Refer to 19 - STEERING/LINKAGE/DRAG LINK - REMOVAL).
(9) Lower the axle until the spring is free from the upper mount.

NOTE: Rotation of the spring and prying down slightly on the axle will aid in removal.

(10) Remove the coil spring retainer clip and remove the spring.
(11) Remove the upper spring isolator. (if needed)
(12) Pull jounce bumper out of mount. (if needed)

INSTALLATION

(1) Install jounce bumper into mount.
(2) Install the spring isolator.

NOTE: Rotation of the spring and prying down slightly on the axle will aid in installation.

(3) Position the coil spring on the axle pad. It may be necessary to rotate the spring while installing.
(4) Install the spring retainer clip and bolt. Tighten bolt to 21 N·m (16 ft. lbs.).
(5) Raise the axle into position until the spring seats in the upper mount.
(6) Install the shock at the axle, (Refer to 2 - SUSPENSION/FRONT/SHOCK - INSTALLATION).
(7) Install the ABS wire mounting brackets at the axle (if equipped).
(8) Install the track bar to the axle bracket, (Refer to 2 - SUSPENSION/FRONT/TRACK BAR - INSTALLATION).
(9) Install the lower suspension arms to the frame. Install mounting bolts and nuts finger tight, (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).
(10) Install the drag link to the right side knuckle, (Refer to 19 - STEERING/LINKAGE/DRAG LINK - INSTALLATION).
(11) Remove the hydraulic jack from under the axle.
(12) Install the wheel and tire assemblies, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
(13) Remove the supports and lower the vehicle.
(14) Tighten the lower suspension arms nuts to 115 N·m (85 ft. lbs.) at normal ride height with the vehicle weight.

STABILIZER BAR

DESCRIPTION

The spring steel bar extends across the top of the chassis frame rails. Links are connected from the bar to the axle brackets. The stabilizer bar and links are isolated by rubber bushings.

OPERATION

The stabilizer bar is used to control vehicle body roll during turns. The bar helps to control the vehicle body in relationship to the suspension.

REMOVAL

(1) Remove upper link nuts (Fig. 9) and separate the links from the stabilizer bar with Remover MB-991113.

(2) Remove front bumper valence.

(3) Remove stabilizer retainer bolts (Fig. 9)and remove retainers.

(4) Remove stabilizer bar.

(5) Remove lower link nuts and bolts and remove links (Fig. 9).

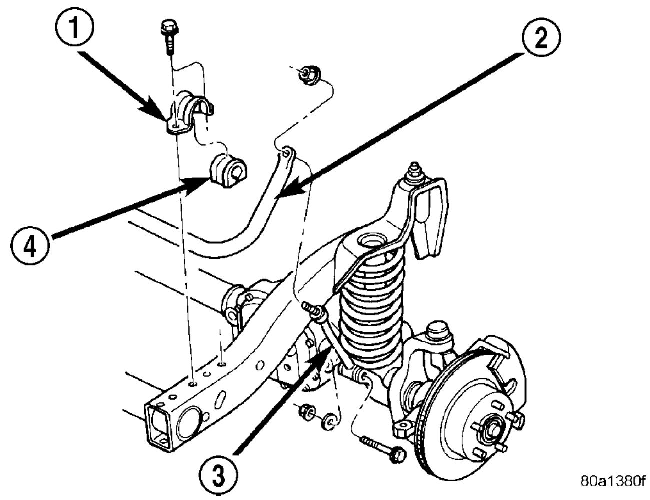


Fig. 9 Stabilizer Bar

1 - RETAINER
2 - STABILIZER BAR
3 - LINK
4 - BUSHING

INSTALLATION

(1) Center stabilizer bar on top of the frame rails and install retainers and bolts. Tighten bolts to 61 N·m (45 ft. lbs.).

(2) Position links on axle brackets and into the stabilizer bar. Install lower link bolts and nuts and tighten to 102 N·m (75 ft. lbs.).

(3) Install upper link nuts and tighten to 61 N·m (45 ft. lbs.).

(4) Install bumper valence.

TRACK BAR

DESCRIPTION

The bar is attached to a frame rail bracket with a ball stud and an axle bracket with a bushing. The bar is forged and has non replaceable isolator bushing and ball stud.

OPERATION

The track bar is used to control front axle lateral movement and provides cross car location of the axle assembly.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the cotter pin and nut from the ball stud end at the frame rail bracket (Fig. 10).

(3) Use a universal puller tool to separate the track bar ball stud from the frame rail bracket.

(4) Remove the bolt and flag nut from the axle bracket (Fig. 10). Remove the track bar.

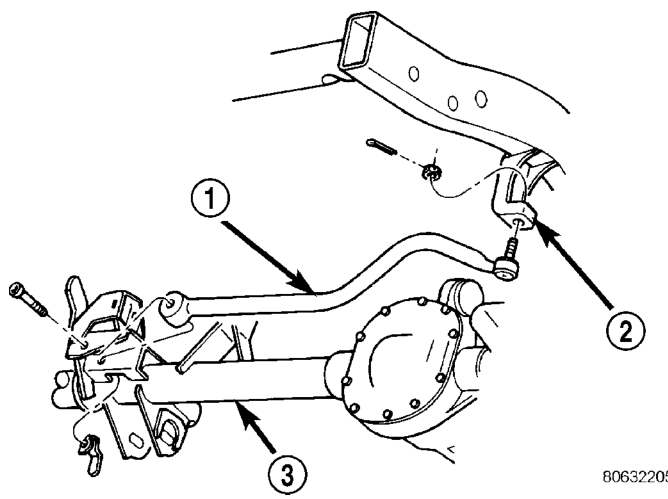


Fig. 10 Track Bar

1 - TRACK BAR
2 - FRAME BRACKET
3 - FRONT AXLE

INSTALLATION

(1) Install the track bar at axle tube bracket. Loosely install the retaining bolt and flag nut.

(2) It may be necessary to pry the axle assembly over to install the track bar at the frame rail. Install track bar at the frame rail bracket. Install the retaining nut on the stud.

(3) Tighten the ball stud nut to 81N·m (60 ft. lbs.) and install a new cotter pin.

(4) Remove the supports and lower the vehicle.

(5) Tighten the bolt at the axle bracket to 47 N·m (40 ft. lbs.).

TRACK BAR (Continued)

(6) Check alignment if a new track bar was installed. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

UPPER BALL JOINT

REMOVAL

Ball stud service procedures below require removal of the hub bearing and axle shaft. (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL) (Refer to 3 - DIFFERENTIAL & DRIVELINE/ FRONT AXLE - 181FBI/AXLE SHAFTS - REMOVAL). Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

(1) Position tools as shown to remove and install ball stud (Fig. 11).

UPPER CONTROL ARM

DESCRIPTION

The upper suspension arms are steel and use rubber bushings at each end of the arm. The arms mount to the frame rail bracket and the axle brackets.

OPERATION

The arm and bushings provide location and react to loads from the axle. The bushings provide isolation from the axle.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the upper suspension arm nut and bolt at the axle bracket (Fig. 7).

(3) Remove the nut and bolt at the frame rail and remove the upper suspension arm.

INSTALLATION

(1) Position the upper suspension arm at the axle and frame rail.

(2) Install the bolts and finger tighten the nuts.

(3) Remove the supports and lower the vehicle.

(4) Tighten the nut at the axle and frame brackets to 81 N·m (60 ft. lbs.).

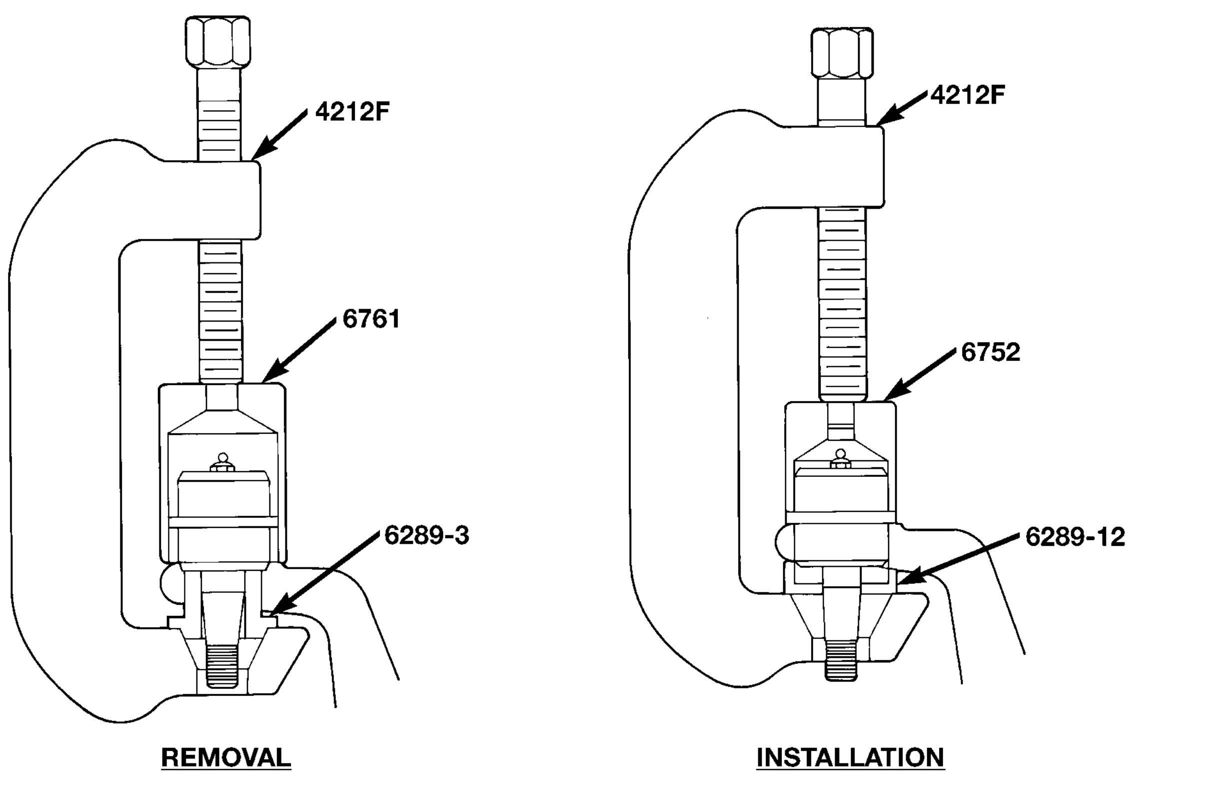


Fig. 11 Upper

REAR

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REAR

DESCRIPTION

REAR SUSPENSION

The rear suspension is link/coil design comprised of:

- Shock absorbers
- Coil springs
- Upper and lower suspension arms
- Stabilizer bar
- Track bar

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

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Shock Absorber Upper Bolts	35	26	—
Shock Absorber Lower Nut	100	74	—
Suspension Arm Lower Axle Bracket Nut	203	150	—

REAR (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Suspension Arm Lower Frame Bracket Nut	203	150	—
Suspension Arm Upper Axle Bracket Nut	75	55	—
Suspension Arm Upper Frame Bracket Bolt	75	55	—
Stabilizer Bar Retainer Bolts	54	40	—
Stabilizer Bar Link Nut/Bolt	54	40	—
Track Bar Frame Bracket Nut	100	74	—
Track Bar Axle Bracket Bolt	100	74	—

JOUNCE BUMPER

DESCRIPTION

The jounce bumpers are mounted inside the coil spring to the frame rail.

OPERATION

The jounce bumpers are used to limit suspension travel in compression.

LOWER CONTROL ARM

DESCRIPTION

The lower suspension arms are steel and use bushings at each end of the arm. The arms are mounted from the frame to the axle brackets.

OPERATION

The bushings isolation axle and road noise. The arm and bushings provide location and react to loads from the axle.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the lower suspension arm nut and bolt at the axle bracket (Fig. 1).

(3) Remove the nut and bolt at the frame rail mount (Fig. 2) and remove the lower suspension arm.

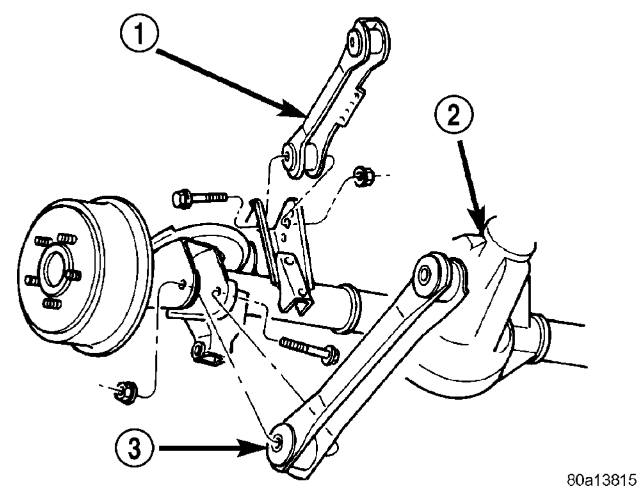

Fig. 1 Upper & Lower Suspension Arms

1 - UPPER SUSPENSION ARM
2 - REAR AXLE
3 - LOWER SUSPENSION ARM

INSTALLATION

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

(2) Install the mounting bolts and finger tighten the nuts.

(3) Remove the supports and lower the vehicle.

(4) Tighten the lower suspension arm nuts to 203 N·m (150 ft. lbs.).

LOWER CONTROL ARM (Continued)

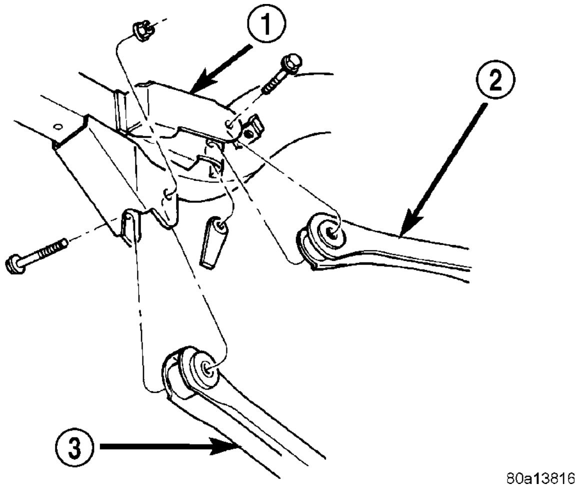

Fig. 2 Upper & Lower Suspension Arms

1 - FRAME MOUNT
2 - UPPER SUSPENSION ARM
3 - LOWER SUSPENSION ARM

SHOCK

DESCRIPTION

The top of the shock absorbers are bolted to the frame. The bottom of the shocks are bolted to the axle brackets.

OPERATION

The shock absorbers dampen jounce and rebound motion of the vehicle over various road conditions and limit suspension rebound travel.

DIAGNOSIS AND TESTING - SHOCK ABSORBER

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

REMOVAL

(1) Raise and support the vehicle and the axle.
(2) Remove the upper mounting bolts (Fig. 3).
(3) Remove the lower nut and bolt from the axle bracket. Remove the shock absorber.

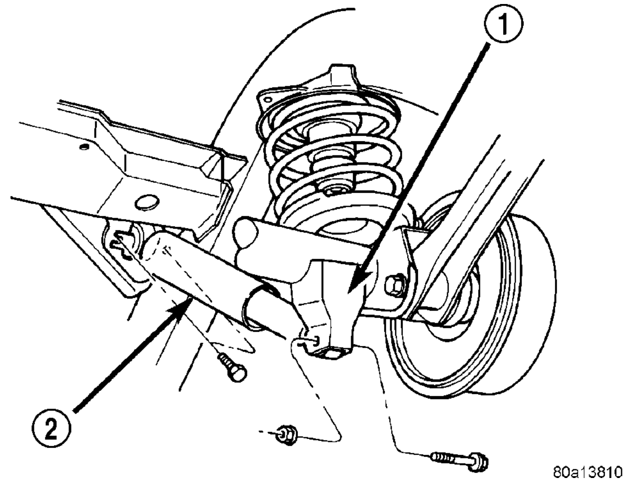

Fig. 3 Shock Absorber

1 - AXLE BRACKET
2 - SHOCK

INSTALLATION

(1) Install the shock absorber on the upper frame rail and install mounting bolts.
(2) Tighten the upper bolts to 31 N·m (23 ft. lbs.).
(3) Install lower bolt and nut finger tight.
(4) Remove the supports and lower the vehicle.
(5) Tighten the lower nut to 100 N·m (74 ft. lbs.).

SPRING

DESCRIPTION

The coil springs mount between the bottom of the frame rail and the top of the axle. A rubber doughnut isolator is located between the top of the spring and the frame rail. A plastic isolator is located between the bottom of the spring and the axle.

OPERATION

The coil springs control ride quality and maintain proper ride height. The isolators are used to isolate road noise.

REMOVAL

(1) Raise and support the vehicle. Position a hydraulic jack under the axle to support it.
(2) Disconnect the stabilizer bar links and shock absorbers from the axle brackets. (Refer to 2 - SUS-

SPRING (Continued)

PENSION/REAR/STABILIZER BAR - REMOVAL) (Refer to 2 - SUSPENSION/REAR/SHOCK - REMOVAL).

(3) Disconnect the track bar from the frame rail bracket. (Refer to 2 - SUSPENSION/REAR/TRACK BAR - REMOVAL).

(4) Lower the axle until the spring is free from the upper mount seat and remove the spring.

INSTALLATION

NOTE: Springs can be install with either end up.

(1) Position the coil spring on the axle pad isolator.

(2) Raise the axle into position until the spring seats on the upper isolator.

(3) Connect the stabilizer bar links and shock absorbers to the axle bracket. Connect the track bar to the frame rail bracket.

(4) Remove the supports and lower the vehicle.

(5) Tighten the stabilizer bar links, shock absorbers and track bar to specified torque.

STABILIZER BAR

DESCRIPTION

The spring steel bar extends across the axle and mounts to bracket on the axle. Links are connected from the bar to the side of the frame rail. The stabilizer bar and links are isolated by rubber bushings.

OPERATION

The stabilizer bar is used to control vehicle body roll during turns. The bar helps to control the vehicle body in relationship to the suspension.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the stabilizer bar link bolts from the frame mounts (Fig. 4).

(3) Remove the link bolts from the stabilizer bar.

(4) Remove the stabilizer bar retainer bolts and retainers from the axle mounts (Fig. 5) and remove the bar.

INSTALLATION

(1) Install the stabilizer bar on the axle mounts and install the retainers and bolts.

NOTE: Ensure the bar is centered with equal spacing on both sides and is positioned above the differential housing (Fig. 5).

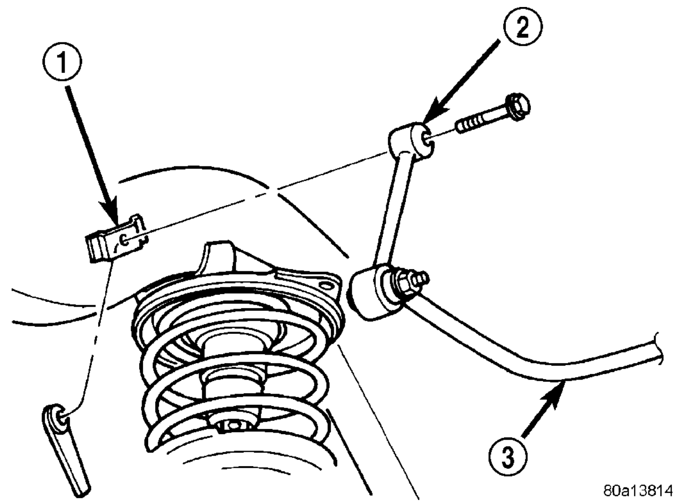

Fig. 4 Stabilizer Bar Link

1 - FRAME MOUNT
2 - LINK
3 - STABILIZER BAR

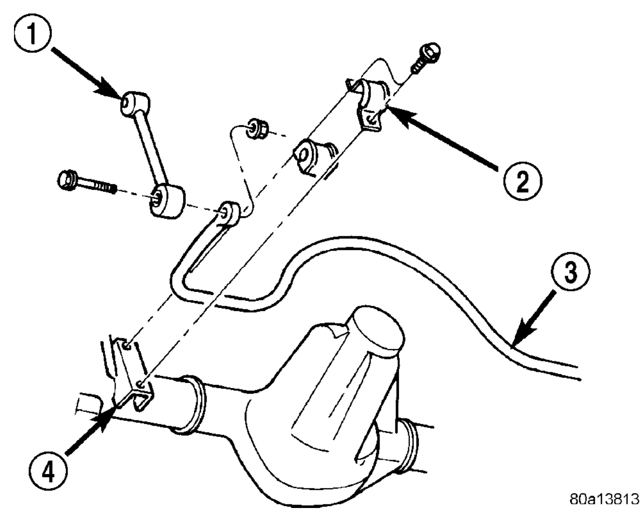

Fig. 5 Stabilizer Bar

1 - LINK
2 - RETAINER
3 - STABILIZER BAR
4 - AXLE MOUNT

(2) Tighten the retainer bolts to 54 N·m (40 ft. lbs.).

(3) Install the links onto the stabilizer bar and frame mounts. Install the bolts and nuts finger tight.

(4) Remove support and lower vehicle.

(5) Tighten the link nuts/bolts to 54 N·m (40 ft. lbs.).

TRACK BAR

DESCRIPTION

The bar is attached to a frame rail bracket and axle bracket. The bar has bushings at both ends.

OPERATION

The track bar is used to control rear axle lateral movement.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the bolt and nut from the frame rail bracket (Fig. 6).

(3) Remove the bolt from the axle bracket (Fig. 6) and remove the track bar.

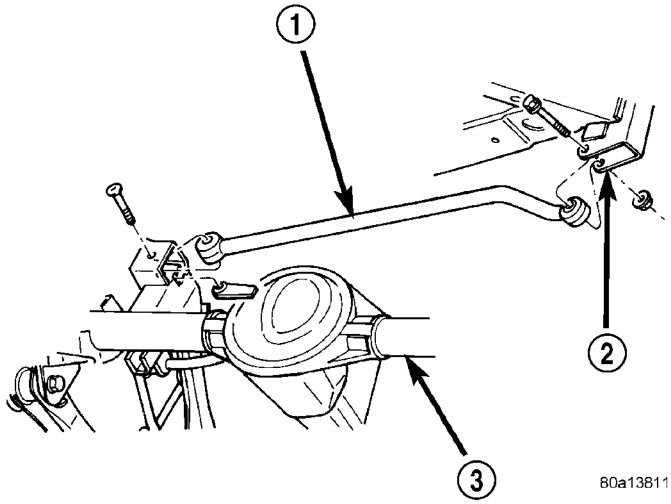

Fig. 6 Rear Track Bar

1 - TRACK BAR
2 - FRAME BRACKET
3 - REAR AXLE

INSTALLATION

(1) Install the track bar in the axle bracket and install the bolt loosely.

(2) Install the track bar in the frame rail bracket and loosely install the bolt and nut.

NOTE: It may be necessary to pry the axle assembly over to install the track bar.

(3) Remove supports and lower the vehicle.

(4) Tighten the track bar nut/bolt at both ends to 100 N·m (74 ft. lbs.).

UPPER CONTROL ARM

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the parking brake cable/bracket and ABS wiring bracket from the arm if equipped (Fig. 7).

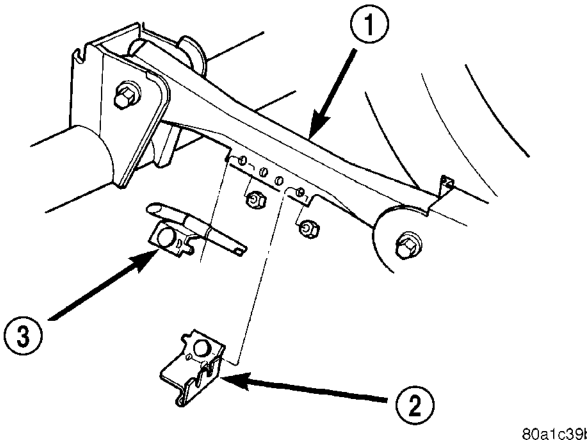

Fig. 7 Parking Brake Cable/Bracket And Wiring Bracket

1 - UPPER SUSPENSION ARM
2 - WIRING BRACKET
3 - PARKING BRAKE CABLE BRACKET

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

(4) Remove the nut and bolt from the frame rail bracket (Fig. 2)and remove the upper suspension arm.

INSTALLATION

(1) Position the upper suspension arm in the axle bracket and frame rail bracket.

(2) Install the bolts and finger tighten the nuts.

(3) Install the parking brake cable/bracket and ABS wiring bracket on the arm if equipped.

(4) Remove the supports and lower the vehicle.

(5) Tighten the upper suspension arm frame rail bracket bolt to 75 N·m (55 ft. lbs.).

(6) Tighten the upper suspension arm axle bracket nut to 75 N·m (55 ft. lbs.).

DIFFERENTIAL & DRIVELINE

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PROPELLER SHAFT

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PROPELLER SHAFT

DIAGNOSIS AND TESTING

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration. Refer to Group 22, Tires and Wheels, for additional information.

Brake drums that are unbalanced will cause a harsh, low frequency vibration. Refer to Group 5, Brakes, for additional information.

Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 9 Engines for additional information.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

PROPELLER SHAFT (Continued)

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose U-joint clamp screws.	2) Install new clamps and screws and tighten to proper torque.
	3) Loose or bent U-joint yoke or excessive runout.	3) Install new yoke.
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Rear spring center bolt not in seat.	5) Loosen spring u-bolts and seat center bolt.
	6) Worn U-joint bearings.	6) Install new U-joint.
	7) Propeller shaft damaged or out of balance.	7) Installl new propeller shaft.
	8) Broken rear spring.	8) Install new rear spring.
	9) Excessive runout or unbalanced condition.	9) Re-index propeller shaft, test, and evaluate.
	10) Excessive drive pinion gear shaft runout.	10) Re-index propeller shaft and evaluate.
	11) Excessive axle yoke deflection.	11) Inspect and replace yoke if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint Noise	1) Loose U-joint clamp screws.	1) Install new clamps and screws and tighten to proper torque.
	2) Lack of lubrication.	2) Replace U-joints as necessary.

PROPELLER SHAFT (Continued)

BALANCE

NOTE: Removing and re-indexing the propeller shaft 180° relative to the yoke may eliminate some vibrations.

If propeller shaft is suspected of being unbalanced, it can be verified with the following procedure:

(1) Raise the vehicle.

(2) Clean all the foreign material from the propeller shaft and the universal joints.

(3) Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**

(4) Inspect the universal joints to ensure that they are not worn, are properly installed, and are correctly aligned with the shaft.

(5) Check the universal joint clamp screws torque.

(6) Remove the wheels and tires. Install the wheel lug nuts to retain the brake drums or rotors.

(7) Mark and number the shaft six inches from the yoke end at four positions 90° apart.

(8) Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.

(9) Install a screw clamp at position 1 (Fig. 1).

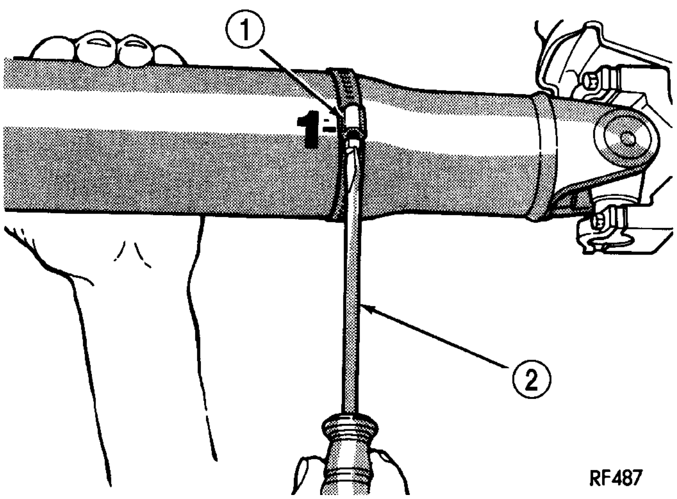


Fig. 1 CLAMP SCREW AT POSITION 1

1 - CLAMP
2 - SCREWDRIVER

(10) Start the engine and re-check for vibration. If there is little or no change in vibration, move the clamp to one of the other three positions. Repeat the vibration test.

(11) If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.

(12) If the vibration decreased, install a second clamp (Fig. 2)and repeat the test.

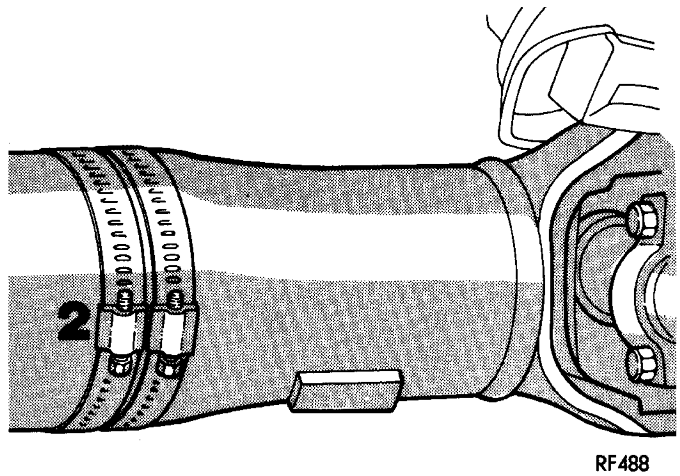


Fig. 2 TWO CLAMP SCREWS

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 3).

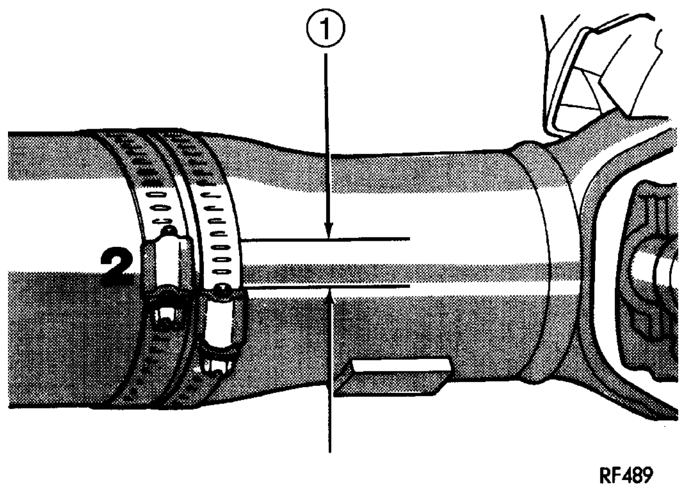


Fig. 3 CLAMP SCREWS SEPARATED

1 - 1/2 INCH

(14) Increase distance between the clamp screws and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.

(15) If the vibration remains unacceptable, apply the same steps to the front end of the propeller shaft.

(16) Install the wheel and tires. Lower the vehicle.

RUNOUT

(1) Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.

(2) The dial indicator must be installed perpendicular to the shaft surface.

(3) Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure

PROPELLER SHAFT (Continued)

that the effects of the weld process will not enter into the measurements.

(4) Refer to Runout Specifications chart.

(5) If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 180°, and re-install the propeller shaft. Measure shaft runout again.

(6) If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.

(7) If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.

(8) Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

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

STANDARD PROCEDURE

PROPELLER SHAFT ANGLE

(1) Place transmission in netural.

(2) Raise and support the vehicle at the axles as level as possible.

(3) Remove any external bearing snap rings from universal joint so protractor base sits flat.

(4) Rotate the shaft until transmission/transfer case output yoke bearing is facing downward.

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

(5) Place Inclinometer 7663 (J-23498A) on yoke bearing (A) parallel to the shaft (Fig. 4). Center bubble in sight glass and record measurement.

NOTE: This measurement will give you the Output Yoke Angle (A).

(6) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing parallel to the shaft (Fig. 5). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.

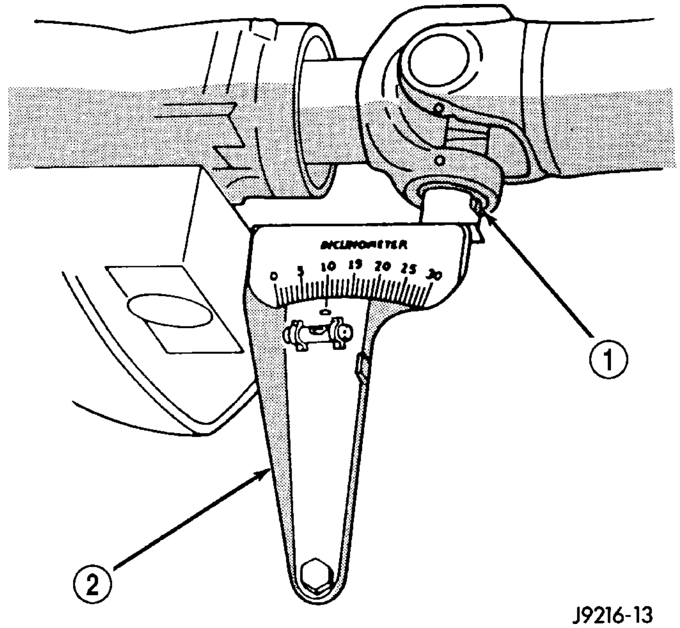


Fig. 4 OUTPUT YOKE ANGLE (A)

1 - SLIP YOKE BEARING CAP
2 - INCLINOMETER

NOTE: This measurement will give you the Propeller Shaft Angle (C).

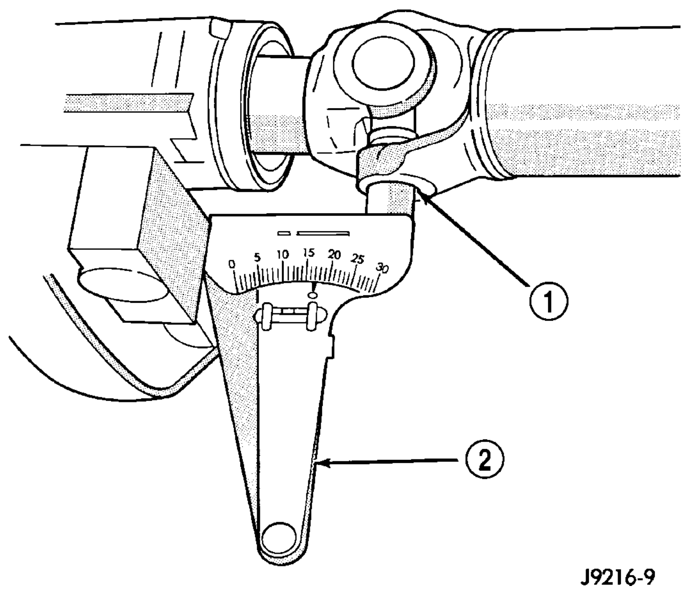


Fig. 5 PROPELLER SHAFT ANGLE (C)

1 - SHAFT YOKE BEARING CAP
2 - INCLINOMETER

(7) Subtract smaller figure from larger (C minus A) to obtain Transmission Output Operating Angle.

(8) Rotate propeller shaft 90 degrees and place Inclinometer on pinion yoke bearing parallel to the shaft (Fig. 6). Center bubble in sight glass and record measurement.

PROPELLER SHAFT (Continued)

NOTE: This measurement will give you the pinion shaft or Input Yoke Angle (B).

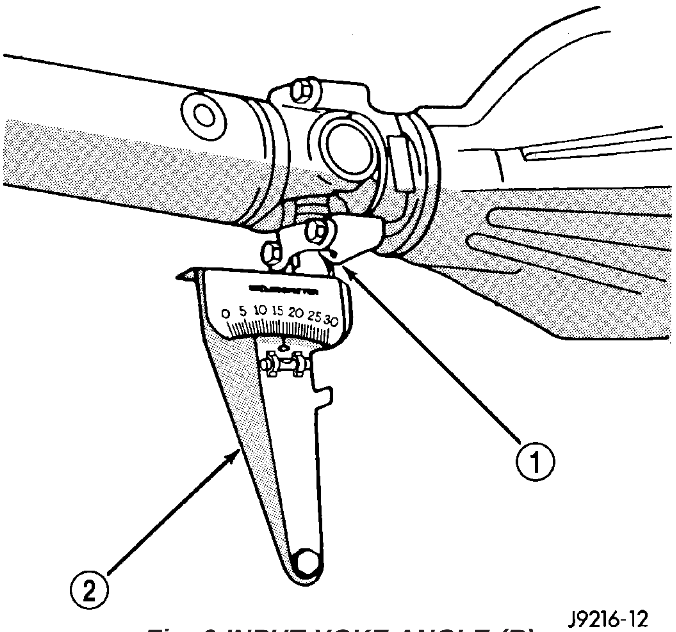


Fig. 6 INPUT YOKE ANGLE (B)

1 - PINION YOKE BEARING CAP
2 - INCLINOMETER

(9) Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.

Refer to rules given below and the example in (Fig. 7) for additional information.

- Good cancellation of U-joint operating angles (within 1°).
- Operating angles less than 3°.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.

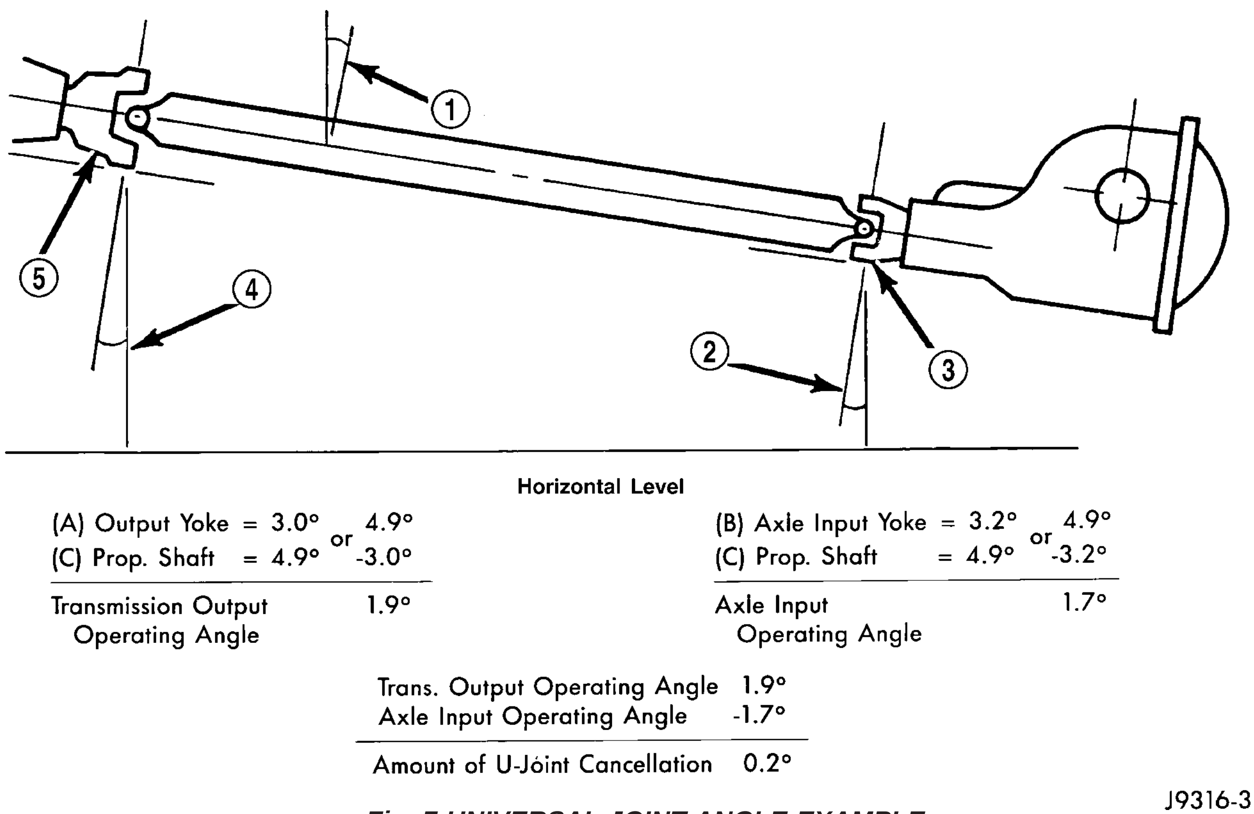


Fig. 7 UNIVERSAL JOINT ANGLE EXAMPLE

1 - 4.9° Angle (C)
2 - 3.2° Angle (B)
3 - Input Yoke
4 - 3.0° Angle (A)
5 - Output Yoke

PROPELLER SHAFT (Continued)

ADJUSTMENTS

The pinion angle of the front axle can be adjusted by the use of adjustment cams in the lower suspension arms (Fig. 8). The primary function of the cams is to adjust caster angle for alignment of the front suspension. When using the cams to adjust pinion angle, make sure that both cams are moved equally. After pinion angle is adjusted, the front suspension alignment should be checked to ensure that side-to-side caster is with in acceptable range. Having the correct pinion angle does have priority over having the preferred caster angle.

A cam kit is available for the rear axle upper suspension arms in order to provide adjustablity of the pinion angle. Follow the procedures supplied with the kit in order to ensure a safe installation.

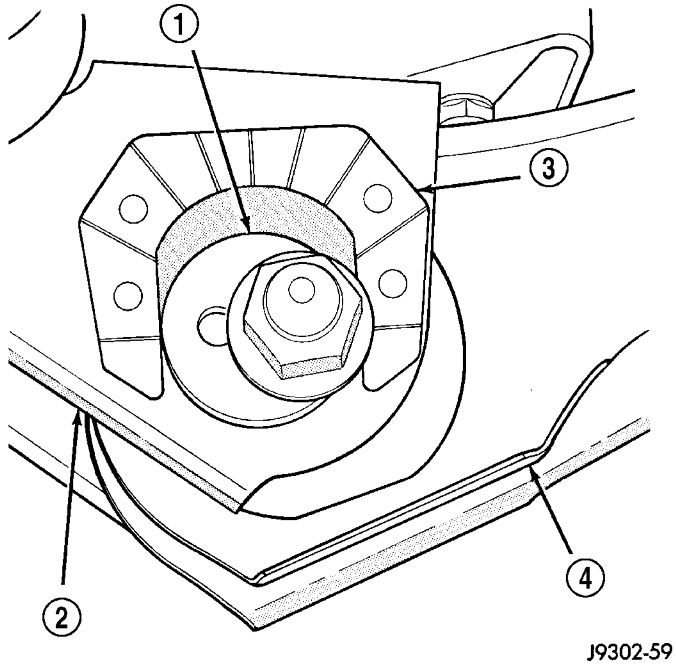


Fig. 8 ADJUSTMENT CAM

1 - ADJUSTMENT CAM
2 - AXLE BRACKET
3 - BRACKET REINFORCEMENT
4 - LOWER SUSPENSION ARM

SPECIFICATIONS

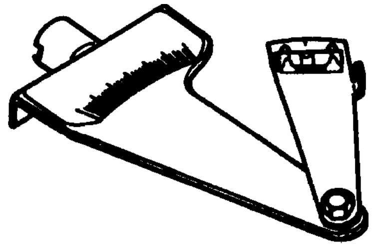
PROPELLER SHAFT

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Front Shaft Front Yoke Bolts	19	14	-
Front Shaft Rear Flange Bolts	27	20	-
Rear Saft Rear Yoke Bolts	19	14	-
Rear Shaft Transfer Case Flange Bolts	115	85	-

PROPELLER SHAFT (Continued)

SPECIAL TOOLS



INCLINOMETER 7663

PROPELLER SHAFT - FRONT

REMOVAL

(1) With vehicle in neutral positon vehicle on hoist.

(2) Remove skid plate if equipped to gain access to the propeller shaft.

(3) Mark a line across the transfer case yoke, link yoke and propeller shaft yoke for installation reference (Fig. 9).

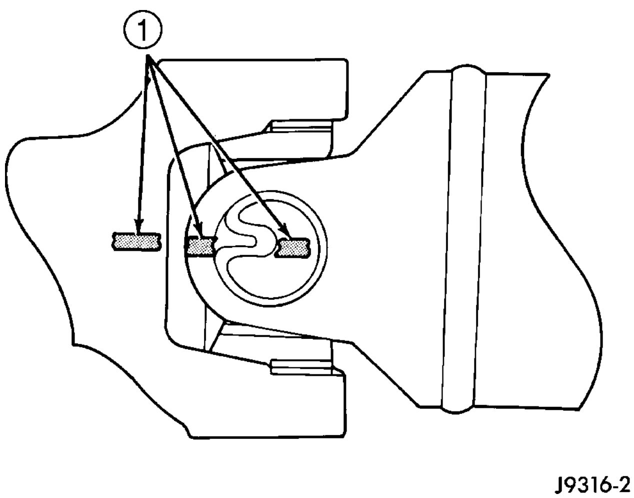


Fig. 9 YOKE REFERENCE MARKS

1 - REFERENCE MARKS

(4) Remove U-joint strap bolts at the pinion shaft yoke (Fig. 10).

(5) Remove transfer case yoke bolts.

(6) Push rear of propeller shaft forward to clear transfer case yoke.

(7) Remove propeller shaft from vehicle.

INSTALLATION

(1) Install propeller shaft with reference marks aligned.

(2) Loosely install bolts to hold universal joint to transfer case yoke.

(3) Install U-joint strap bolts at the axle yoke and tighten to 19 N·m (14 ft. lbs.).

(4) Install universal joint to transfer case bolts and tighten to 27 N·m (20 ft. lbs.).

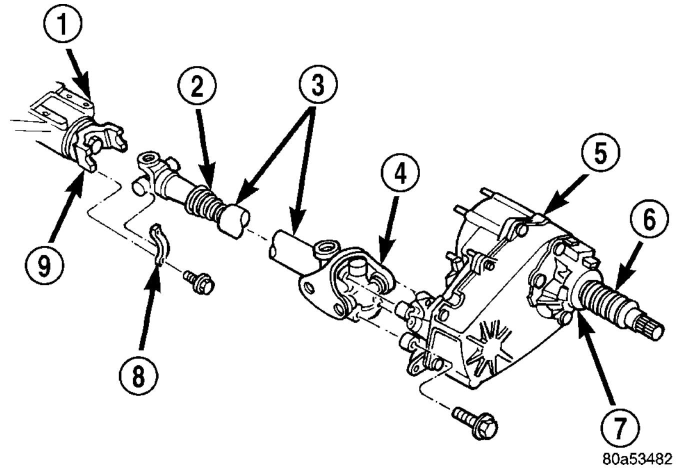


Fig. 10 FRONT PROPELLER SHAFT

1 - FRONT AXLE
2 - BOOT
3 - PROPELLER SHAFT
4 - CV-JOINT
5 - TRANSFER CASE
6 - BOOT
7 - SLINGER
8 - CLAMP
9 - YOKE

PROPELLER SHAFT - REAR

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Mark a line across the shaft and at each end of the propeller shaft for installation reference.

(3) Remove U-joint strap bolts, at pinion shaft yoke.

(4) Pry open clamp, holding dust boot to propeller shaft yoke (Fig. 11).

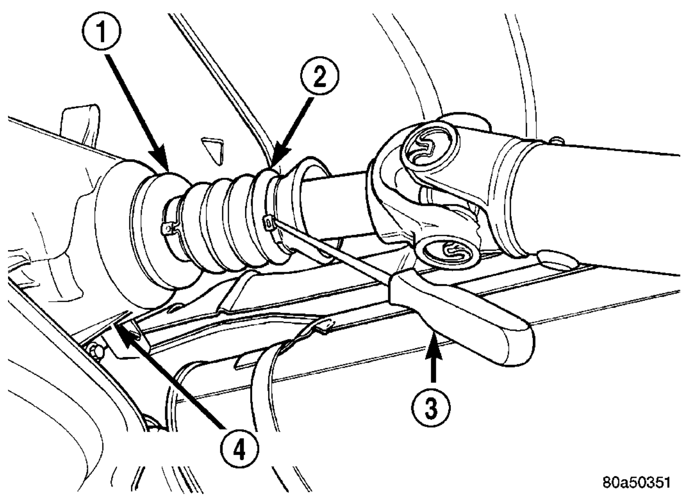


Fig. 11 DUST BOOT CLAMP

1 - SLINGER
2 - BOOT
3 - AWL
4 - TRANSFER CASE

PROPELLER SHAFT - REAR (Continued)

(5) Slide slip yoke off of transmission/transfer case output shaft and remove propeller shaft (Fig. 12).

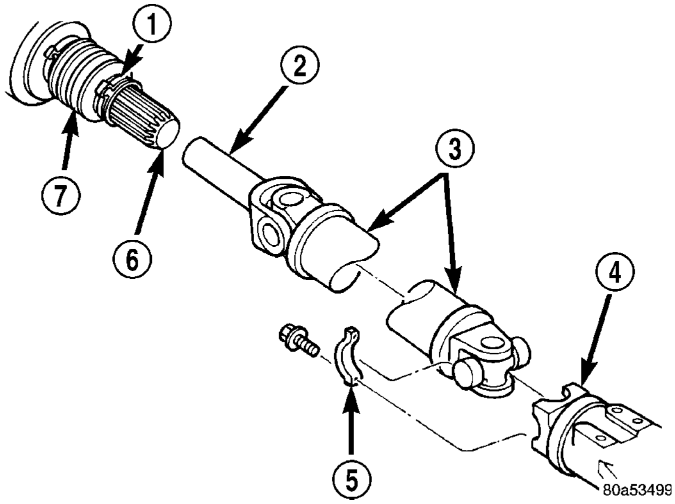


Fig. 12 REAR PROPELLER SHAFT

1 - CLAMP
2 - YOKE
3 - PROPELLER SHAFT
4 - AXLE YOKE
5 - CLAMP
6 - OUTPUT SHAFT
7 - BOOT

INSTALLATION

(1) Slide slip yoke on transmission/transfer case output shaft. Align installation reference marks at axle yoke and install propeller shaft.

(2) Install U-joint strap bolts at axle yoke and tighten to 19 N·m (14 ft. lbs.).

(3) Tighten clamp with Clamp Tool C-4975A to hold dust boot to propeller shaft yoke (Fig. 13).

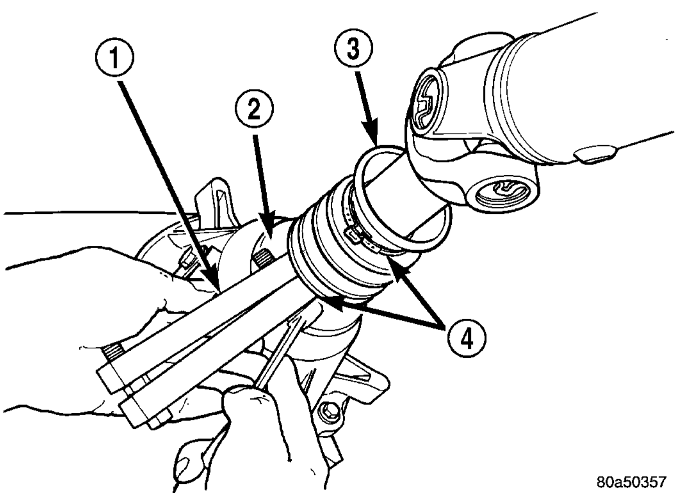


Fig. 13 CRIMPING DUST BOOT CLAMP

1 - CLAMP TOOL
2 - SLINGER
3 - BOOT
4 - CLAMP

PROPELLER SHAFT - REAR RUBICON

REMOVAL

(1) With vihicle in neutral, postion vehicle on hoist.

(2) Mark reference lines across the pinion yoke, transfer case flange and propeller shaft for installation reference.

(3) Remove transfer case flange bolts (Fig. 14) and U-joint strap bolts at the pinion shaft yoke.

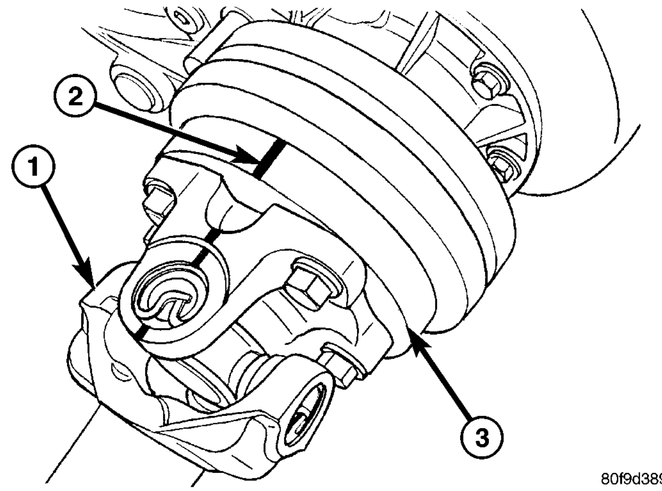


Fig. 14 TRANSFER CASE FLANGE

1 - REAR PROPELLER SHAFT
2 - REFERENCE MARK
3 - TRANSFER CASE FLANGE

(4) Remove propeller shaft from vehicle.

PROPELLER SHAFT - REAR RUBICON (Continued)

INSTALLATION

(1) Align installation reference marks at the pinion yoke, transfer case flange and propeller shaft.

(2) Install U-joint strap and tighten bolts to 19 N·m (14 ft. lbs.).

(3) Install transfer case flange bolts (Fig. 15) and tighten to 115 N·m (85 ft. lbs.).

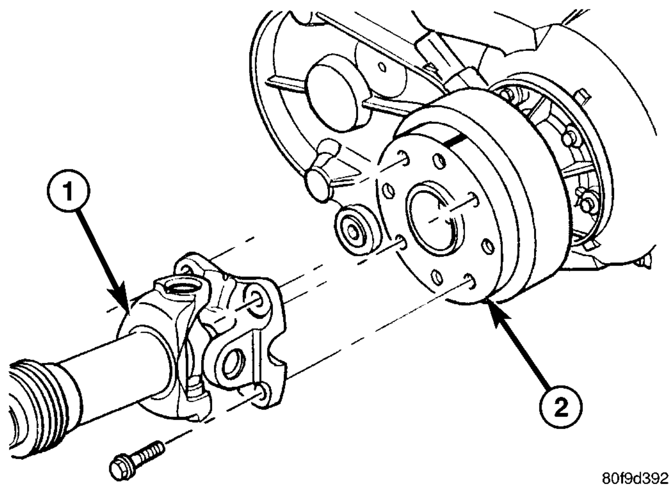


Fig. 15 TRANSFER CASE FLANGE BOLTS

1 - REAR PROPELLER SHAFT
2 - TRANSFER CASE FLANGE

SINGLE CARDAN UNIVERSAL JOINTS

DISASSEMBLY

NOTE: Individual components of cardan universal joints are not serviceable, they must be replaced as an assembly.

(1) Tap the outside of the bearing cap assembly with a drift to loosen the snap rings.

(2) Remove snap rings from both sides of yoke (Fig. 16).

(3) Position a socket with a inside diameter large enough to receive the bearing cap beneath the yoke on the press.

(4) Position yoke with the grease fitting if equipped, pointing up.

(5) Place another socket with an outside diameter smaller than bearing cap on the upper bearing cap and press the lower cap through the yoke (Fig. 17).

(6) Pull bearing cap of the yoke.

NOTE: If bearing cap will not come out, tap the yoke ear near the bearing cap to dislodge the cap.

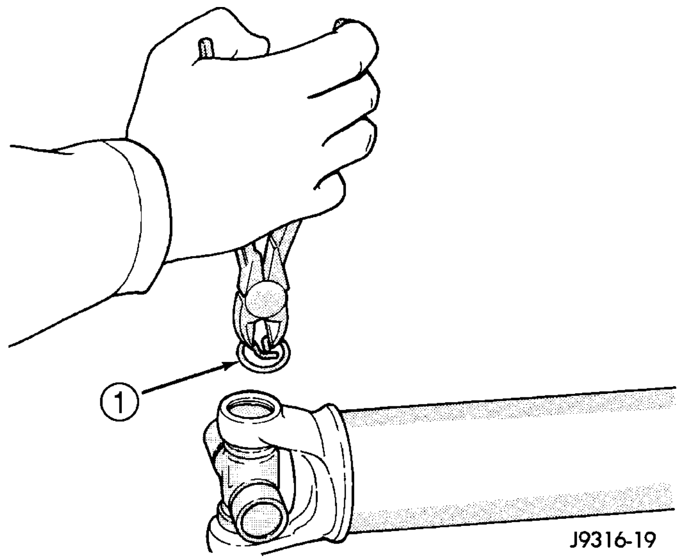


Fig. 16 YOKE SNAP RING

1 - SNAP RING

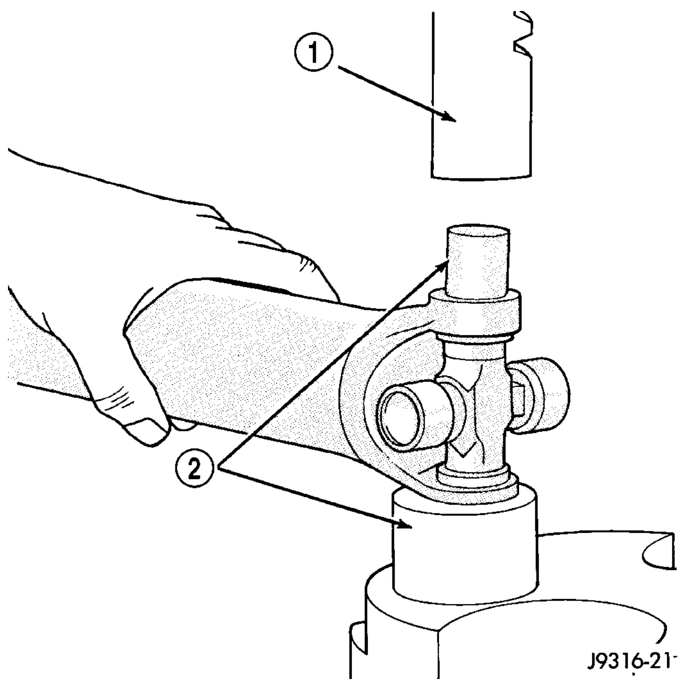


Fig. 17 PRESS OUT BEARING CAP

1 - PRESS
2 - SOCKET

SINGLE CARDAN UNIVERSAL JOINTS (Continued)

(7) Turn yoke over and straighten the cross in the open hole. Then carefully press the end of the cross until the other bearing cap can be removed (Fig. 18).

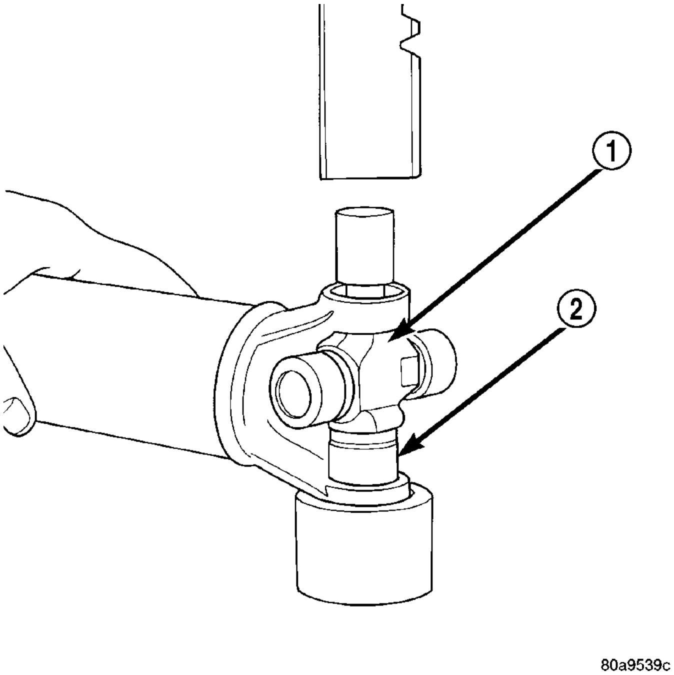


Fig. 18 PRESS OUT BEARING CAP

1 - CROSS
2 - BEARING CAP

ASSEMBLY

CAUTION: Keep cross and bearing cap straight during installation. Failure to heed caution may result in damage.

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.
(2) Position cross in the yoke with lube fitting if equipped, pointing up (Fig. 19).
(3) Place a bearing cap over the trunnion and align cap with yoke bore (Fig. 20).
(4) Press bearing cap into the yoke bore enough to clear snap ring groove.
(5) Install a snap ring.
(6) Repeat Step 3 and Step 4 to install the other bearing cap.

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

(7) Add grease to lube fitting, if equipped.

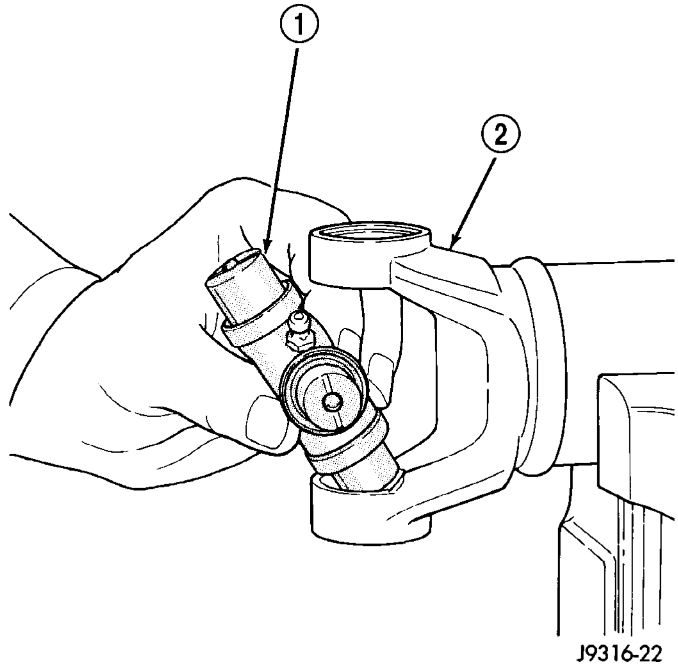


Fig. 19 U-JOINT CROSS

1 - CROSS
2 - YOKE

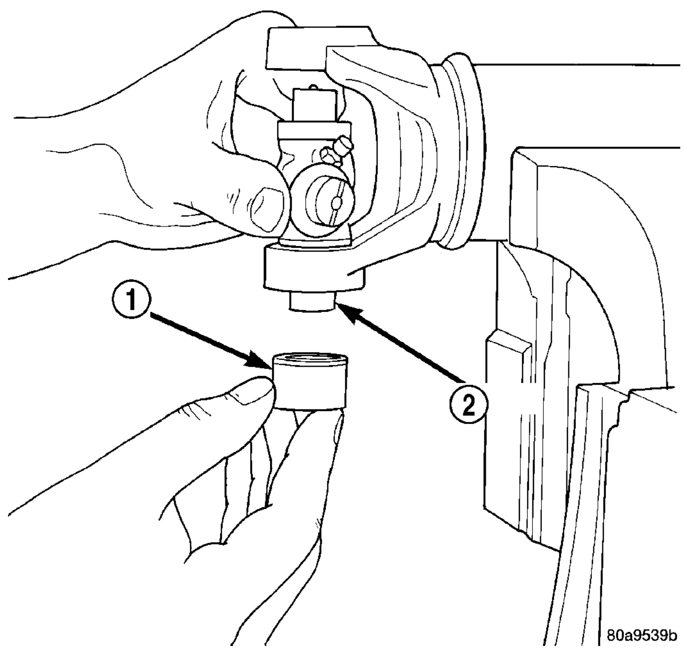


Fig. 20 BEARING AND CROSS

1 - BEARING CAP
2 - TRUNNION

DOUBLE CARDAN UNIVERSAL JOINTS

DISASSEMBLY

NOTE: Individual components of cardan universal joints are not serviceable they must be replaced as an assembly.

(1) Mark propeller shaft yoke and link yoke for assembly reference.

(2) Tap the outside of the bearing cap assembly with drift to loosen snap rings.

(3) Remove all bearing cap snap rings (Fig. 21).

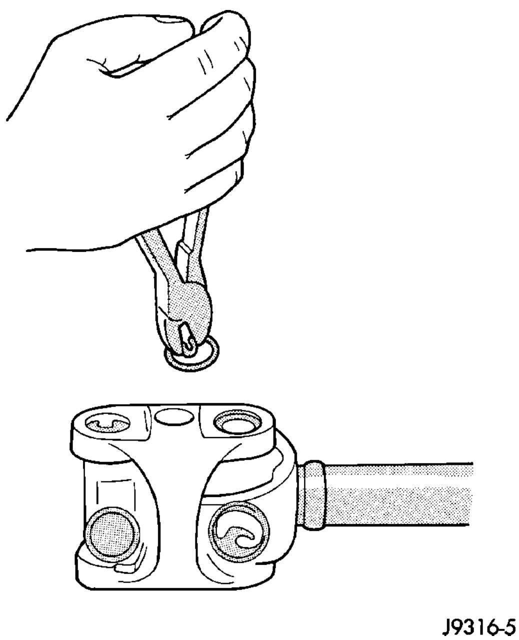


Fig. 21 SNAP RINGS

(4) Remove any grease fittings if equipped.

(5) Position a socket on the press with an inside diameter large enough to receive the bearing cap under the link yoke.

(6) Place another socket with an outside diameter smaller than the bearing cap on the upper bearing cap.

(7) Press one bearing cap from the outboard side of the link yoke enough to grasp the cap with vise jaws (Fig. 22).

(8) Grasp protruding bearing cap with vise jaws and tap link yoke with a mallet and drift to remove bearing cap (Fig. 23).

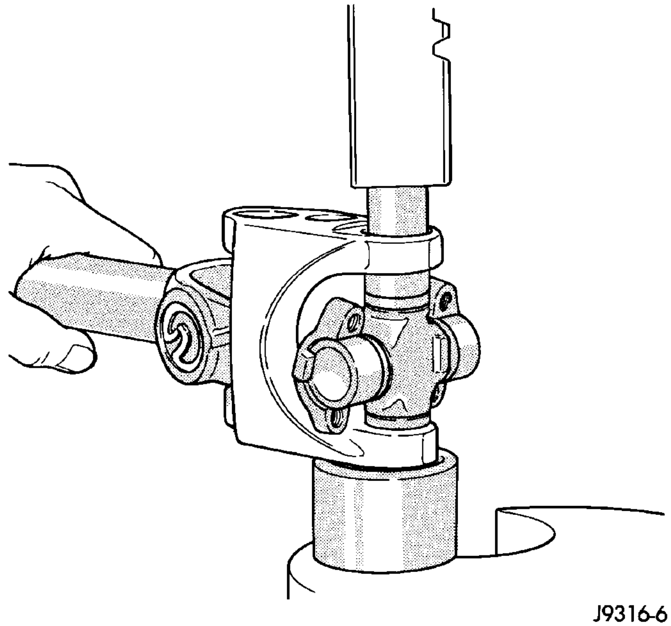


Fig. 22 PRESS OUT BEARING

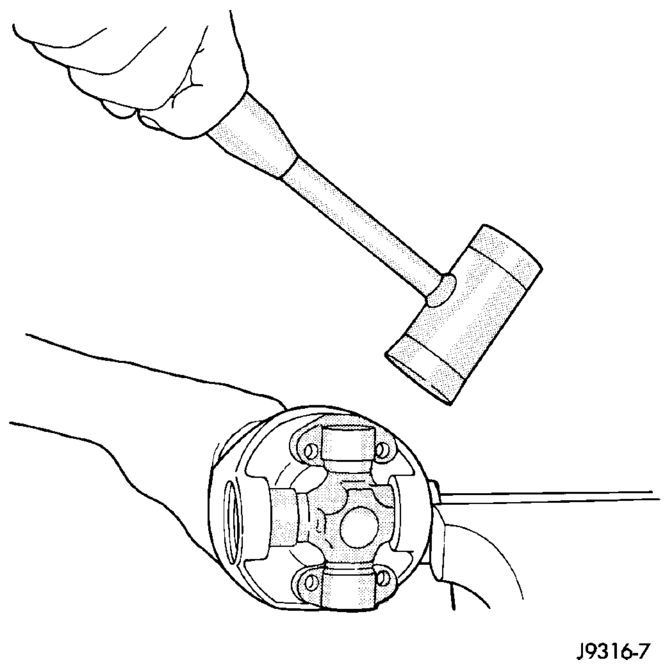


Fig. 23 REMOVE BEARING FROM YOKE

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(9) Flip assembly and repeat Step 5, Step 6, Step 7 and Step 8 to remove the opposite bearing cap.

(10) Remove cross centering kit assembly and spring (Fig. 24).

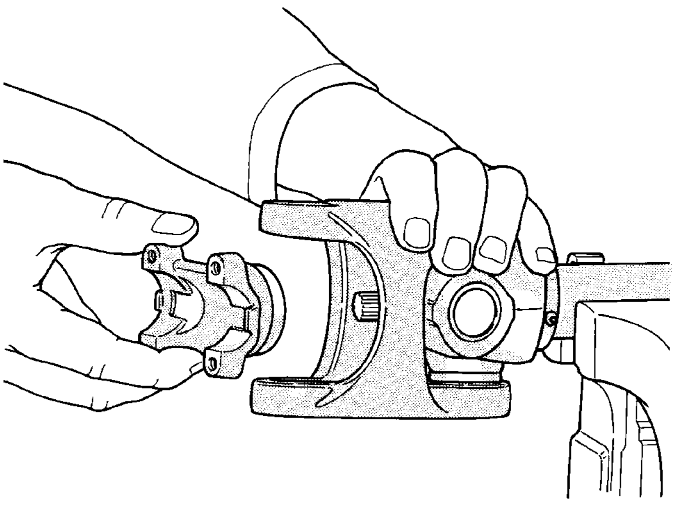


Fig. 24 CENTERING KIT

(11) Press remaining bearing caps out the other end of the link yoke, as described above to complete the disassembly.

ASSEMBLY

CAUTION: Alignment marks on link yoke and propeller shaft yoke must be aligned during assembled. Keep needle bearings upright in the bearing cap. Failure to heed caution may result in damage.

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores.

(2) Fit a cross into propeller shaft yoke (Fig. 25).

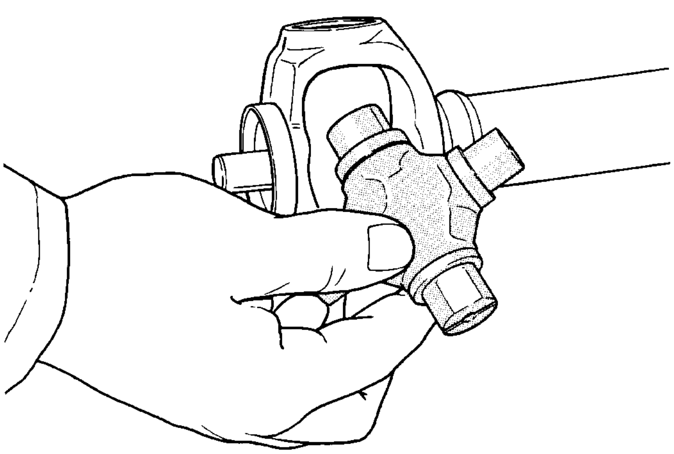


Fig. 25 INSTALL CROSS IN YOKE

(3) Place a bearing cap over the trunnion and align cap with the yoke bore (Fig. 26).

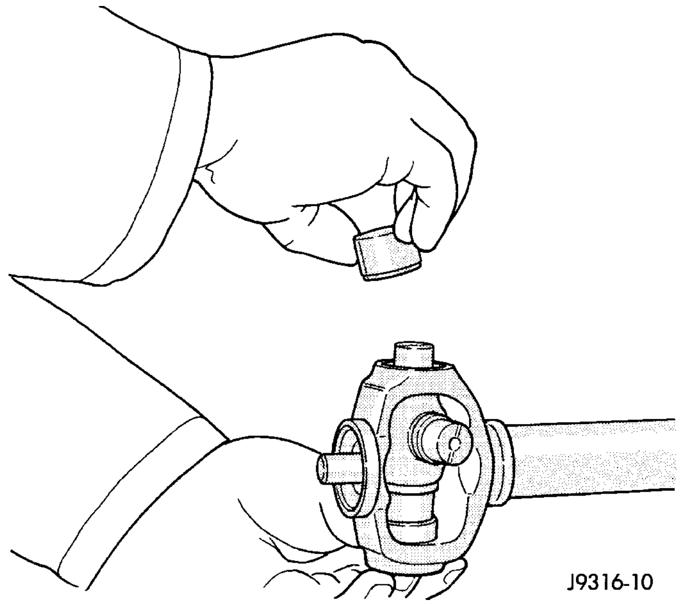


Fig. 26 INSTALL BEARING CAP

(4) Press bearing cap into the yoke bore enough to clear snap ring groove (Fig. 27).

(5) Install a snap ring.

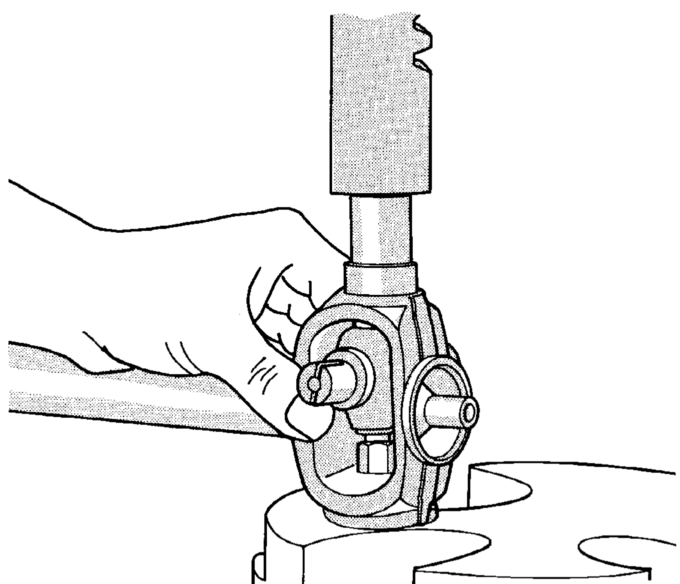


Fig. 27 PRESS BEARING CAP

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(6) Flip propeller shaft yoke and install other bearing cap onto the opposite trunnion and install a snap ring (Fig. 28).

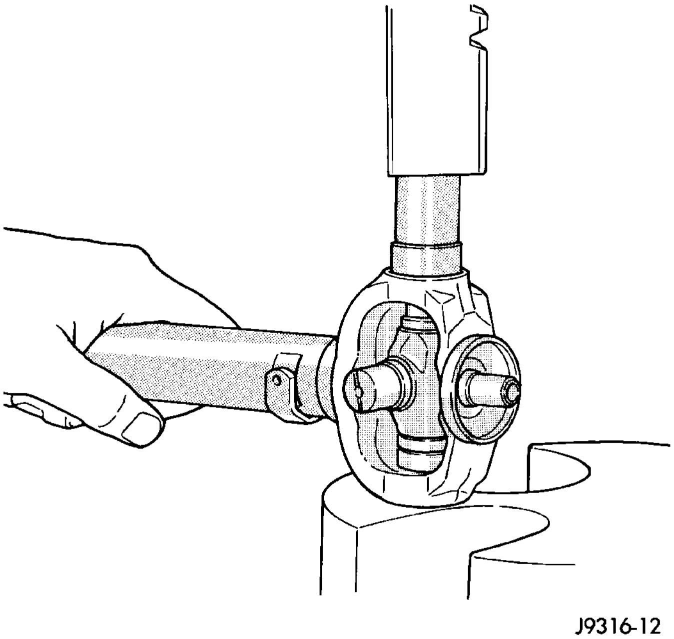


Fig. 28 PRESS BEARING CAP

(7) Fit link yoke onto the remaining trunnions and press both bearing caps into place and install snap rings (Fig. 29).

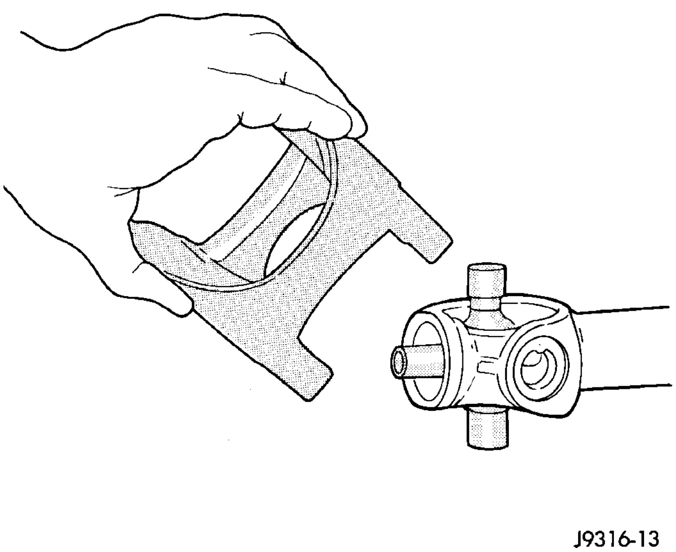


Fig. 29 INSTALL LINK YOKE

(8) Install centering kit assembly inside the link yoke (Fig. 30).

NOTE: Making sure the spring is properly positioned.

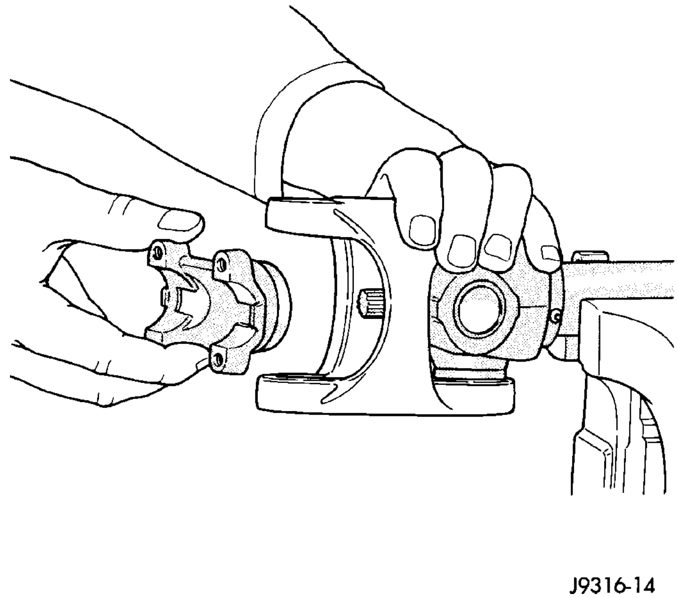


Fig. 30 CENTERING KIT

(9) Place two bearing caps on opposite trunnions of the remaining cross. Fit open trunnions into the link yoke bores and the bearing caps into the centering kit (Fig. 31).

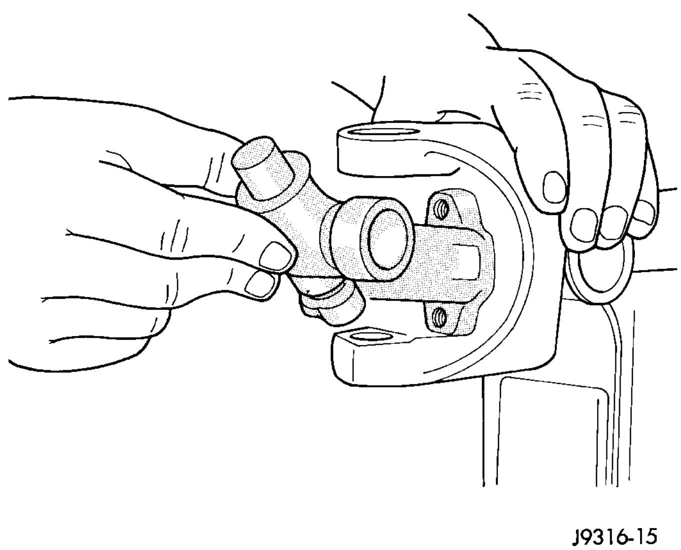


Fig. 31 REMAINING CROSS

DOUBLE CARDAN UNIVERSAL JOINTS (Continued)

(10) Press remaining two bearing caps into place and install snap rings (Fig. 32).

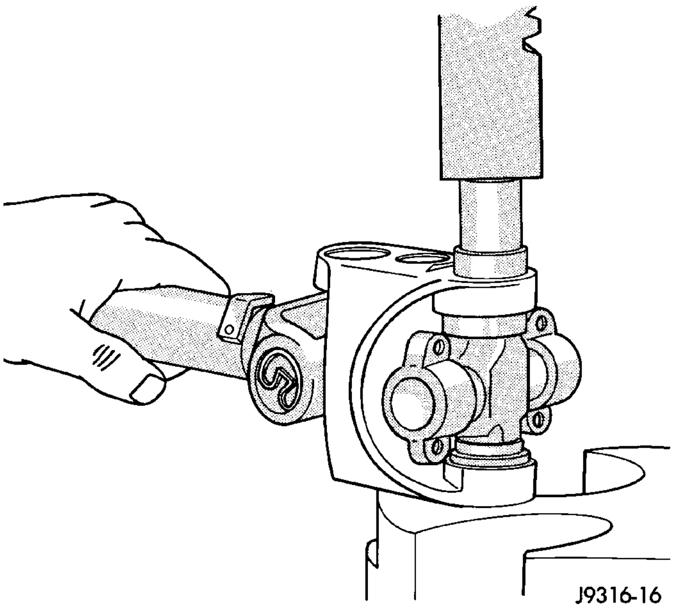


Fig. 32 PRESS BEARING CAP

(11) Tap snap rings to seat them into the grooves (Fig. 33).

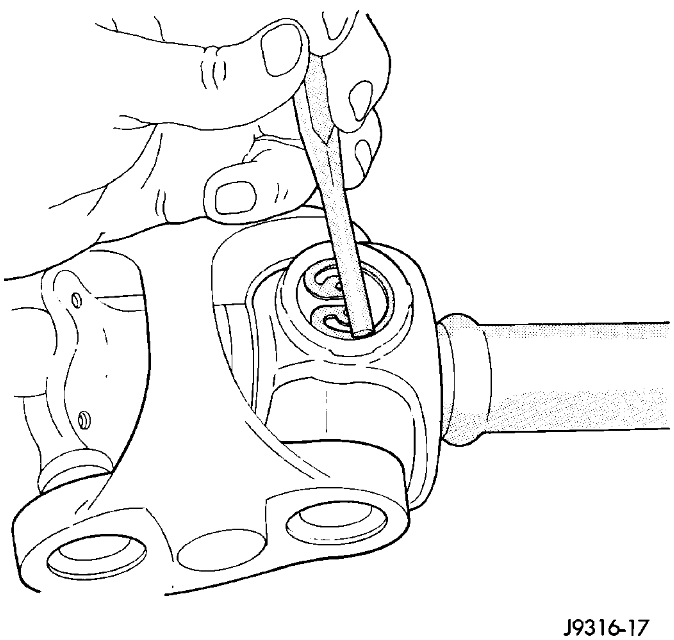


Fig. 33 SEAT SNAP RINGS

(12) Flexing joint beyond center, the joint should snap over-center in both directions if assembled correctly (Fig. 34).

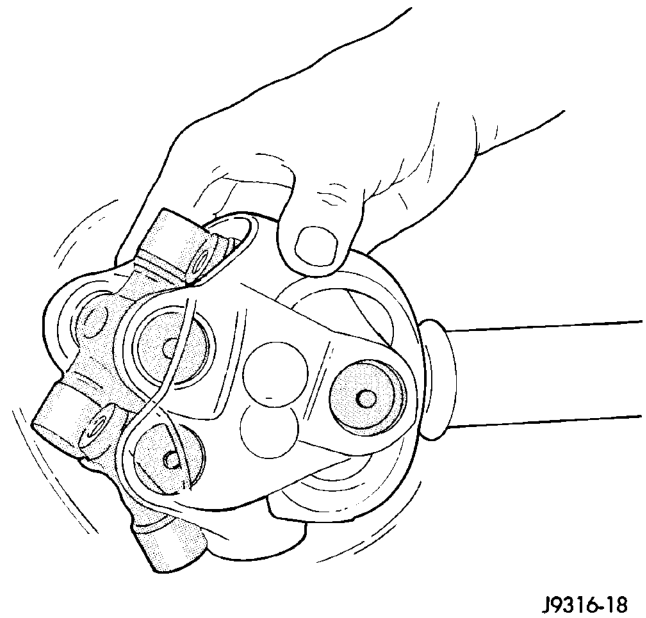


Fig. 34 VERIFY ASSEMBLY

FRONT AXLE - 181FBI

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FRONT AXLE - 181FBI

DIAGNOSIS AND TESTING

GEAR NOISE

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

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

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

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

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

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

FRONT AXLE - 181FBI (Continued)

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

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

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

Check for loose or damaged front end components or engine/transmission mounts. These components can contribute to what appears to be a rear end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

DRIVELINE SNAP

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

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

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube. 2. Bent or sprung axle shaft. 3. End-play in pinion bearings. 4. Excessive gear backlash between the ring gear and pinion. 5. Improper adjustment of pinion gear bearings. 6. Loose pinion yoke nut. 7. Scuffed gear tooth contact surfaces.	1. Inspect axle tube alignment. Correct as necessary. 2. Inspect and correct as necessary. 3. Refer to pinion pre-load information and correct as necessary. 4. Check adjustment of the ring gear and pinion backlash. Correct as necessary. 5. Adjust the pinion bearings pre-load. 6. Tighten the pinion yoke nut. 7. Inspect and replace as necessary.

FRONT AXLE - 181FBI (Continued)

Condition	Possible Causes	Correction
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.

FRONT AXLE - 181FBI (Continued)

Condition	Possible Causes	Correction
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

FRONT AXLE - 181FBI (Continued)

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Position a lift under the axle and secure to the axle.

(3) Remove brake components.

(4) Remove vent hose from axle shaft tube.

(5) Remove propeller shaft.

(6) Remove stabilizer bar links at the axle (Fig. 1).

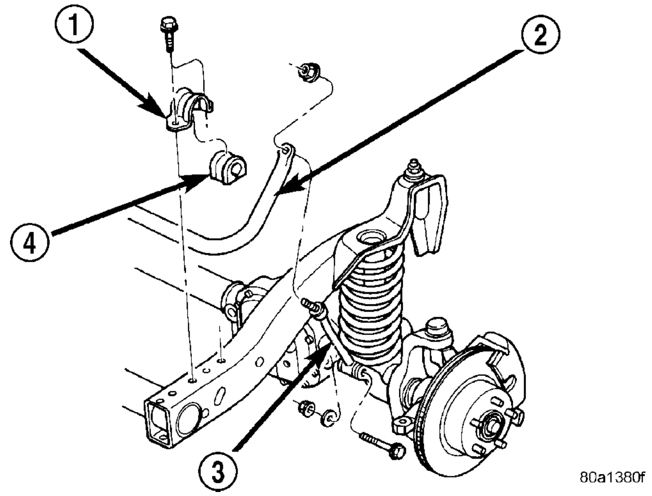

Fig. 1 STABILIZER BAR

1 - RETAINER
2 - STABILIZER BAR
3 - LINK
4 - BUSHING

(7) Remove shock absorbers from axle brackets (Fig. 2).

(8) Remove track bar from axle bracket (Fig. 3).

(9) Remove tie rod and drag link from steering knuckle.

(10) Remove steering damper from axle bracket.

(11) Remove upper and lower suspension arms from axle brackets.

(12) Lower lift enough to remove the axle. The coil springs will drop with the axle.

(13) Remove coil springs from the axle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. Failure to heed caution may result in damage.

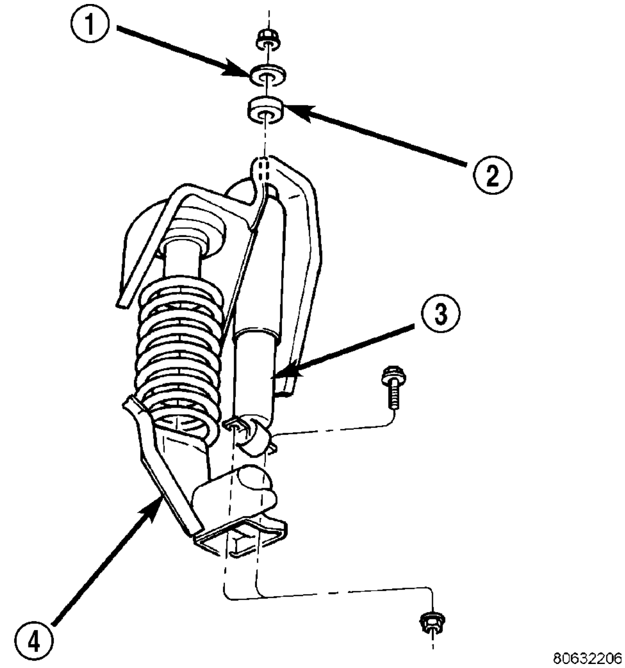

Fig. 2 COIL SPRING & SHOCK ABSORBER

1 - RETAINER
2 - GROMMET
3 - SHOCK
4 - FRONT AXLE

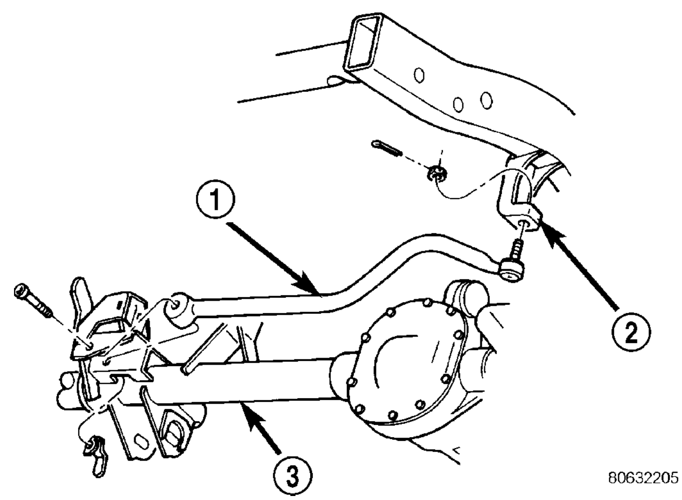

Fig. 3 TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - FRONT AXLE

(1) Install springs and retainers and tighten retainer bolts to 21 N·m (16 ft. lbs.).

(2) Position axle under vehicle and align it with the spring pads.

FRONT AXLE - 181FBI (Continued)

(3) Install upper and lower suspension arms in the axle brackets and loosely install bolts and nuts (Fig. 4).

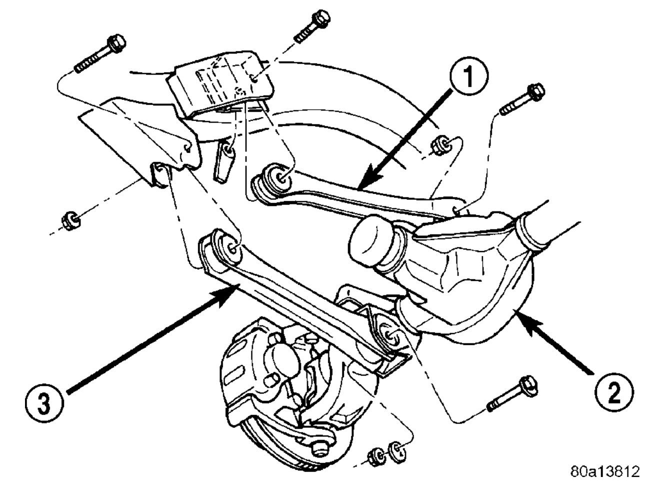

Fig. 4 UPPER & LOWER SUSPENSION ARMS

1 - UPPER SUSPENSION ARM
2 - FRONT AXLE
3 - LOWER SUSPENSION ARM

(4) Connect the vent hose to the axle shaft tube.

(5) Install track bar to the axle bracket and loosely install bolt (Fig. 5).

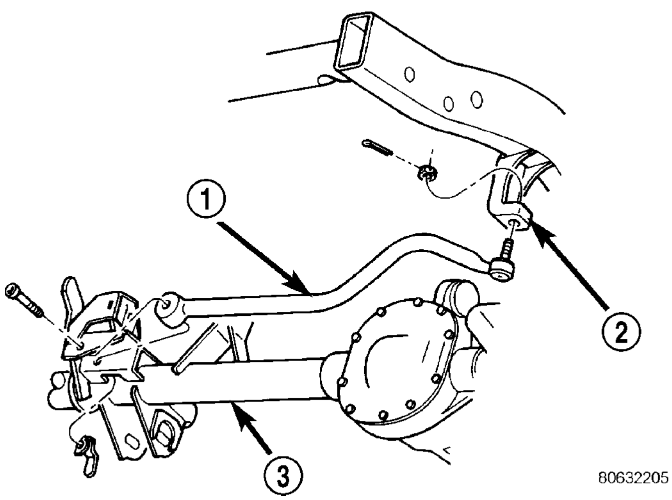

Fig. 5 TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - FRONT AXLE

(6) Install shock absorbers and tighten the bolts (Fig. 6) to torque specification.

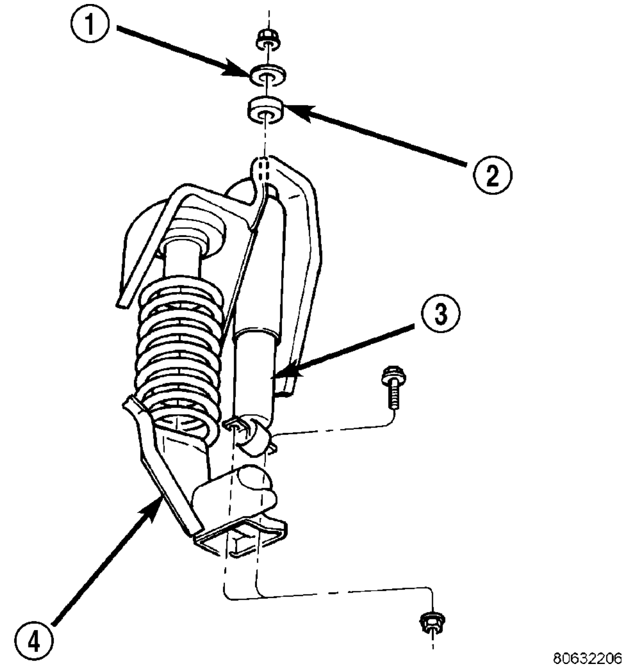

Fig. 6 COIL SPRING & SHOCK ABSORBER

1 - RETAINER
2 - GROMMET
3 - SHOCK
4 - FRONT AXLE

(7) Install stabilizer bar links to the axle brackets and tighten nuts (Fig. 7) to torque specification.

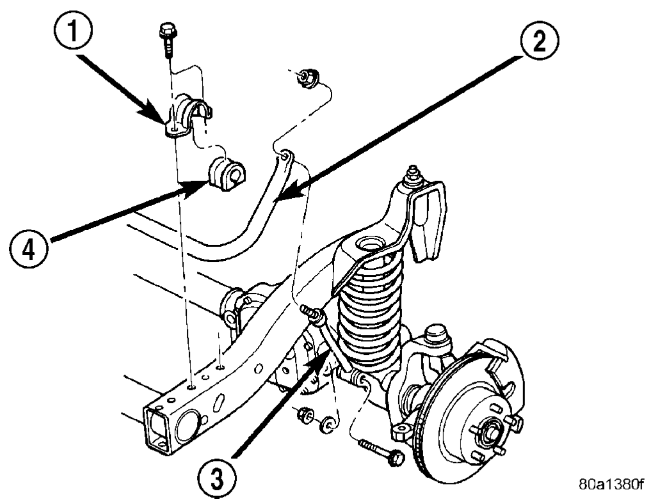

Fig. 7 STABILIZER BAR

1 - RETAINER
2 - STABILIZER BAR
3 - LINK
4 - BUSHING

FRONT AXLE - 181FBI (Continued)

(8) Install drag link and tie rod and tighten nut to torque specification

(9) Install steering damper to the axle bracket and tighten nut to torque specification.

(10) Install brake components.

(11) Install propeller shaft.

(12) Remove lift from the axle and lower vehicle.

(13) Tighten upper and lower control arm nuts to torque specification.

(14) Tighten track bar bolt at the axle bracket to torque specification.

(15) Check the front wheel alignment.

ADJUSTMENTS

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched/marked onto each gear (Fig. 8). A plus (+) number, minus (–) number or zero (0) is etched/marked on the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched/marked with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 92.08 mm (3.625 in.). The standard depth provides the best gear tooth contact pattern.

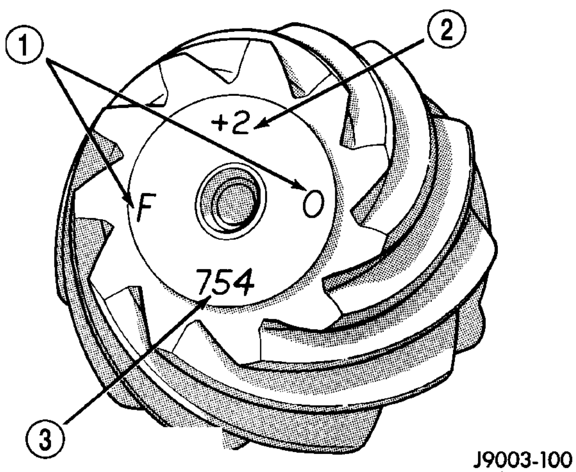

Fig. 8 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER

Compensation for pinion depth variance is achieved with a select shim/oil slinger. The shims are placed between the rear pinion bearing and the pinion gear head (Fig. 9).

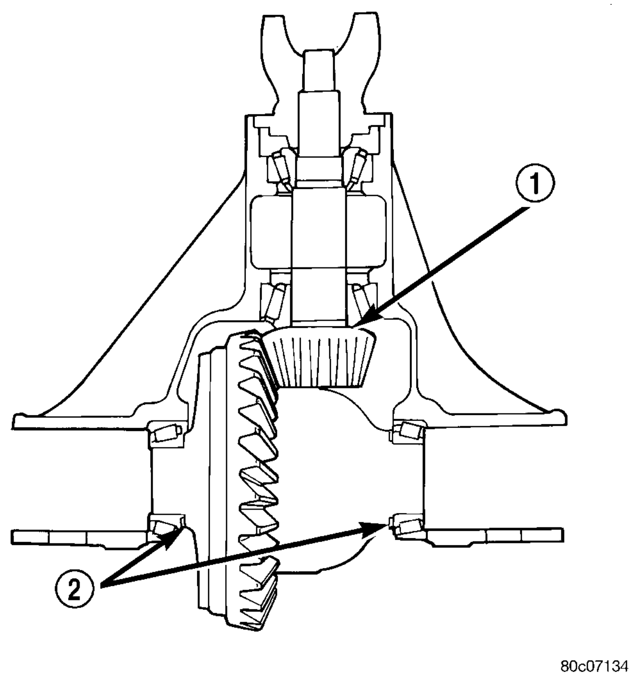

Fig. 9 SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM/OIL SLINGER
2 - DIFFERENTIAL BEARING SHIM

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Pinion Gear Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

FRONT AXLE - 181FBI (Continued)

PINION GEAR DEPTH VARIANCE

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

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 10).

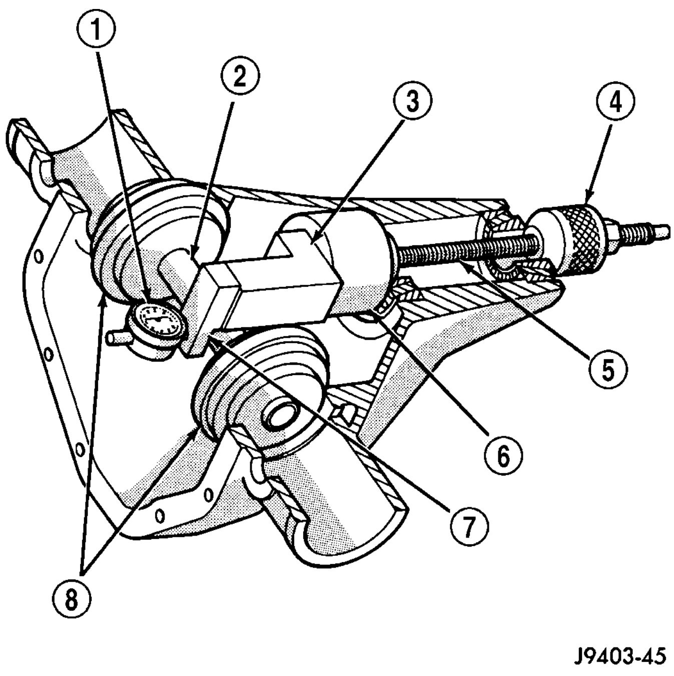

Fig. 10 PINION GEAR DEPTH GAUGE TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 6733 and rear pinion bearing onto Screw 6741 (Fig. 10).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 11).

(3) Install front pinion bearing and Cone-nut 6740 hand tight.

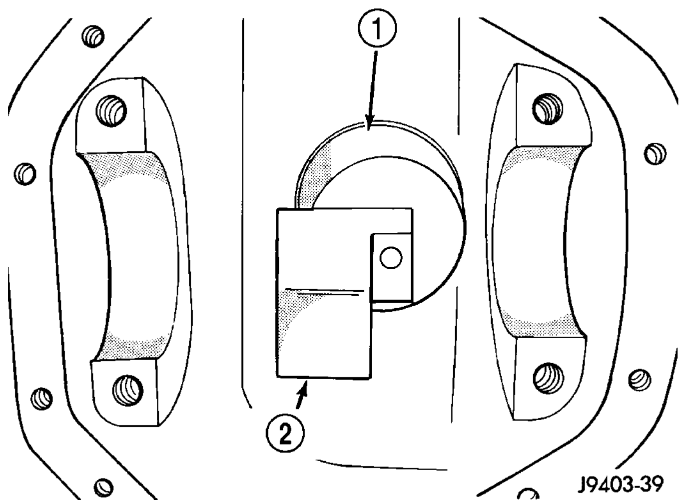

Fig. 11 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

FRONT AXLE - 181FBI (Continued)

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 12). Install differential bearing caps on arbor discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

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

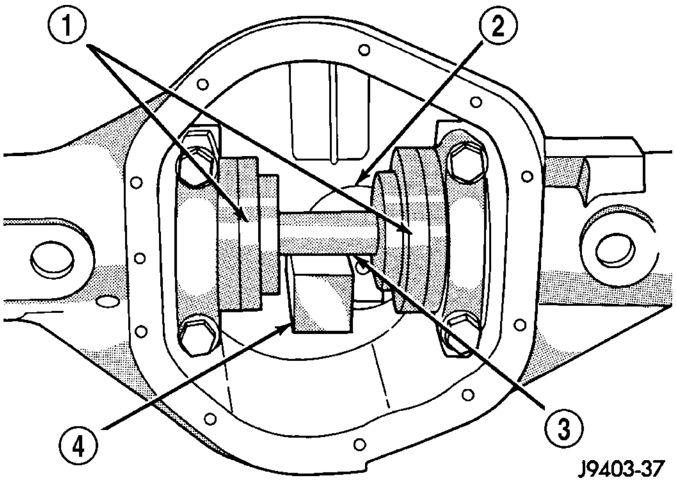

Fig. 12 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

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

(6) Position Scooter Block/Dial Indicator flush on the pinion height block. Hold scooter block and zero the dial indicator.

(7) Slowly slide the scooter block across the pinion height block over to the arbor (Fig. 13). Move the scooter block till the dial indicator probe crests the arbor and record the highest reading.

(8) Select a shim/oil baffle equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion (Fig. 8). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

DIFFERENTIAL SIDE BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential side bearing cones. The proper shim thickness can be determined using slip-fit Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 14). Differential shim measurements are performed with spreader W-129-B removed.

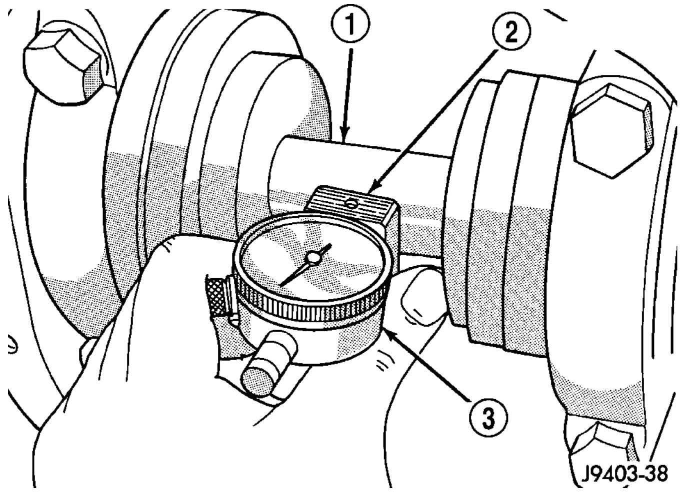

Fig. 13 PINION DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

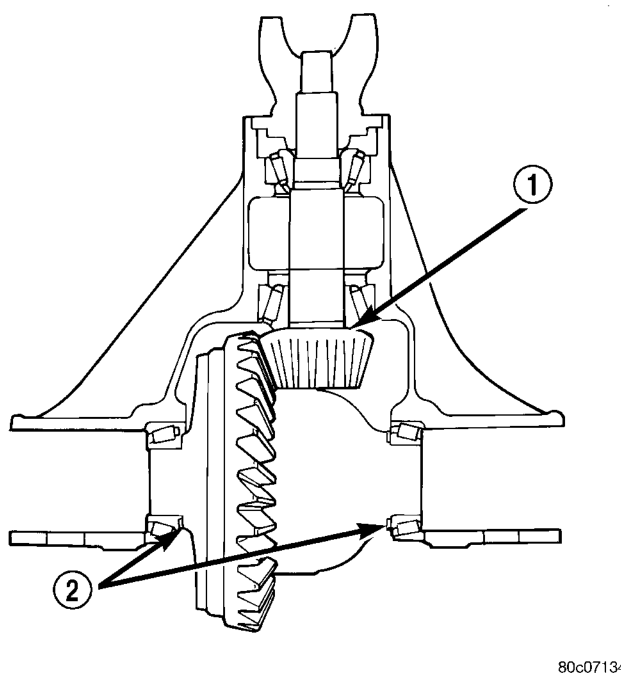

Fig. 14 SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM/OIL SLINGER
2 - DIFFERENTIAL BEARING SHIM

FRONT AXLE - 181FBI (Continued)

PRELOAD SHIM SELECTION

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

(1) Remove differential side bearings from differential case.

(2) Remove factory installed shims from differential case.

(3) Install ring gear on differential case and tighten bolts to specification.

(4) Install dummy side bearings D-348 on differential case.

(5) Install differential case in the housing.

(6) Install marked bearing caps in their correct positions. Install and snug the bolts (Fig. 15).

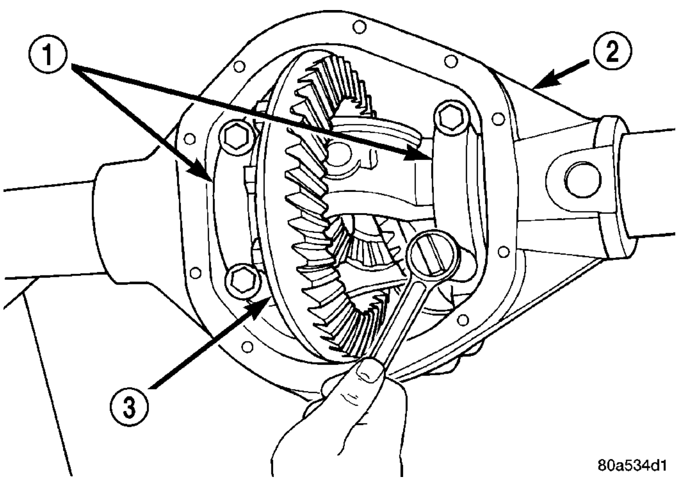

Fig. 15 BEARING CAP BOLTS

1 - BEARING CAP
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

(7) With a dead-blow hammer, seat the differential dummy bearings to each side of the housing (Fig. 16) and (Fig. 17).

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 18).

(9) Attach the Dial Indicator C-3339 to pilot stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 18).

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 19).

(11) Push and hold differential case to ring gear side of the housing and record the dial indicator reading (Fig. 20).

(12) Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims to compress or preload the new bearings when the differential is installed.

(13) Rotate dial indicator out of the way on the pilot stud.

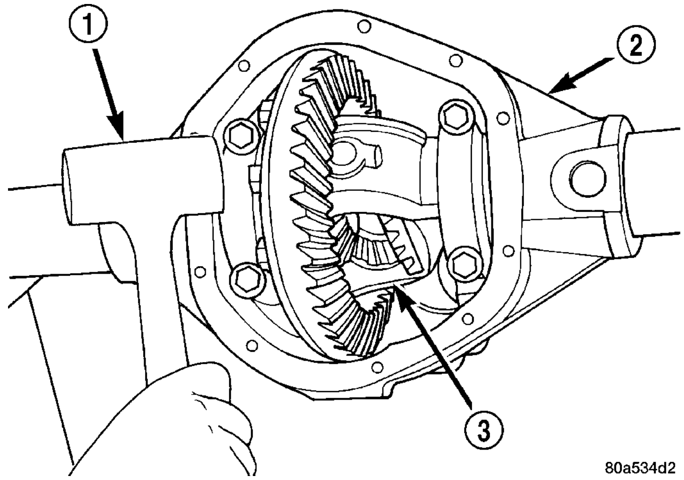

Fig. 16 SEAT DUMMY BEARINGS PINION SIDE

1 - MALLET
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

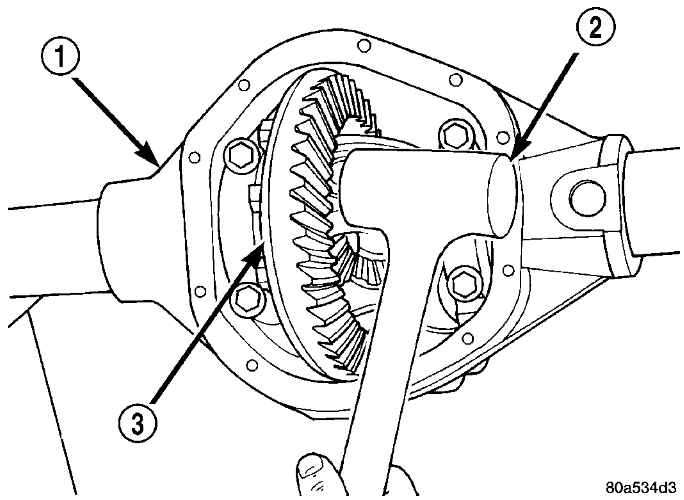

Fig. 17 SEAT DUMMY BEARING RING GEAR SIDE

1 - DIFFERENTIAL HOUSING
2 - MALLET
3 - DIFFERENTIAL CASE

(14) Remove differential case and dummy bearings from the housing.

(15) Install the pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.

(16) Install differential case and dummy bearings D-348 in the housing (without shims), install bearing caps and tighten bolts snug.

(17) Seat ring gear side dummy bearing (Fig. 17).

FRONT AXLE - 181FBI (Continued)

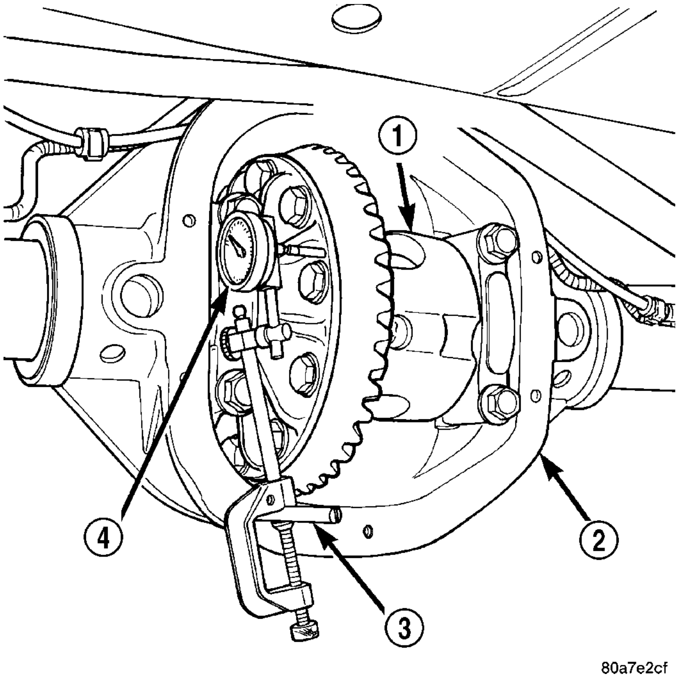

Fig. 18 DIFFERENTIAL SIDE PLAY MEASUREMENT

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

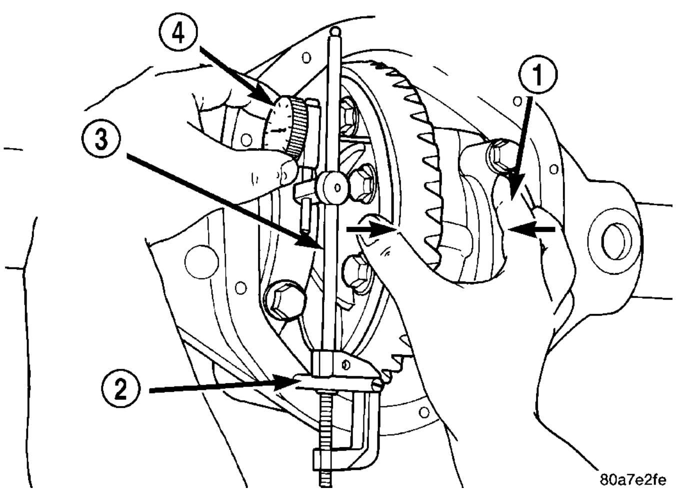

Fig. 19 DIAL INDICATOR LOCATION

1 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - DIAL INDICATOR
4 - ZERO DIAL INDICATOR FACE

(18) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 18).

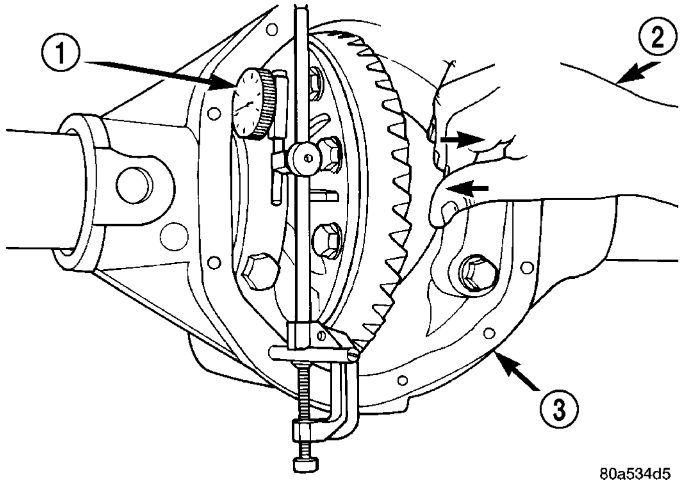

Fig. 20 READ DIAL INDICATOR

1 - READ DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(19) Push and hold differential case toward pinion gear and zero the dial indicator (Fig. 21).

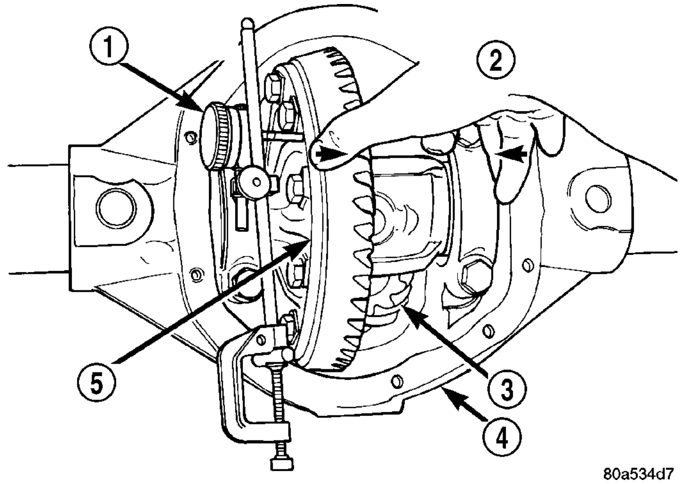

Fig. 21 ZERO DIAL INDICATOR

1 - ZERO DIAL INDICATOR FACE
2 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

FRONT AXLE - 181FBI (Continued)

(20) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 22).

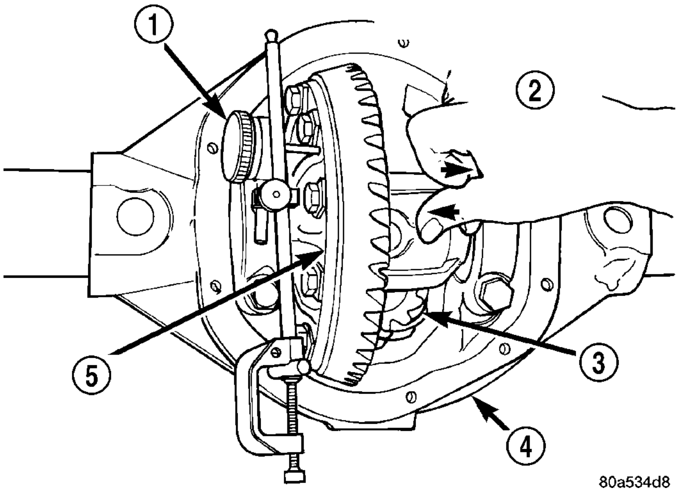

Fig. 22 DIFFERENTIAL CASE RING GEAR SIDE

1 - READ DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(21) Subtract 0.05 mm (0.002 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

(22) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.

(23) Rotate dial indicator out of the way on pilot stud.

(24) Remove differential case and dummy bearings from the housing.

(25) Install the selected shims onto the differential case hubs.

(26) Install side bearings and cups on differential case.

(27) Install spreader W-129-B and adaters from Adapter Set 6987, onto housing. Spread the housing to receive differential case.

(28) Install differential case into the housing.

(29) Remove spreader from the housing.

(30) Install bearing caps and tighten bolts to 61 N·m (45 ft. lbs.).

(31) Rotate the differential case several times to seat the side bearings.

(32) Position the indicator plunger against a ring gear tooth (Fig. 23).

(33) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(34) Zero dial indicator face to pointer.

(35) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in. - 0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other (Fig. 24).

(36) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

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

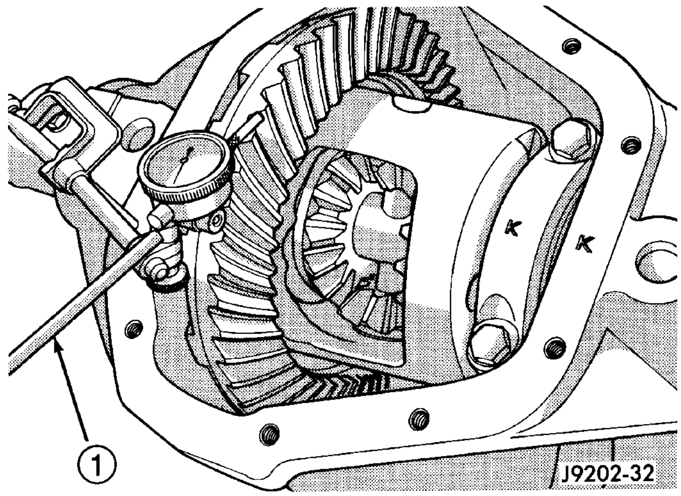

Fig. 23 RING GEAR BACKLASH MEASUREMENT

1 - DIAL INDICATOR

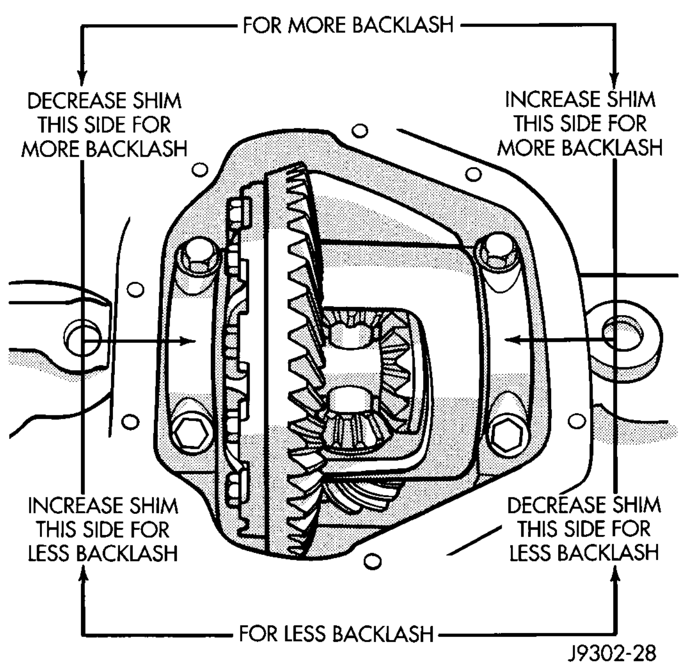

Fig. 24 BACKLASH SHIM

FRONT AXLE - 181FBI (Continued)

GEAR CONTACT PATTERN

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

The TOP LAND of the gear tooth is the top surface of the tooth. The PROFILE of the gear tooth is the depth of the tooth. The TOE of the gear is the portion of the tooth surface at the end towards the center. The HEEL of the gear is the portion of the tooth at the outer-end. The ROOT of the gear tooth is the lowest portion of the tooth (Fig. 25).

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

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) With a boxed end wrench on the ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

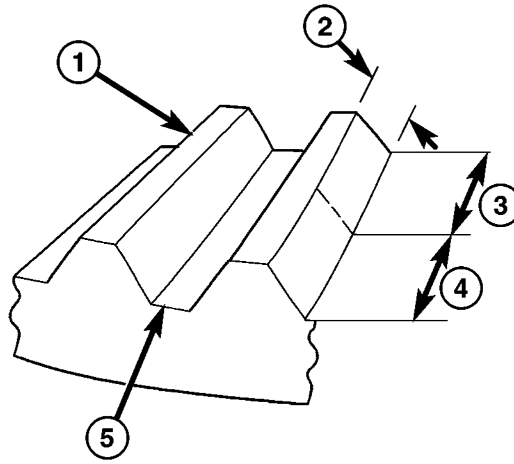

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Fig. 25 GEAR DESCRIPTION

1 - TOP LAND
2 - PROFILE
3 - TOE
4 - HEEL
5 - ROOT

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeeze the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 26) and (Fig. 27) and adjust pinion depth and gear backlash as necessary.

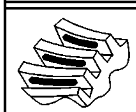
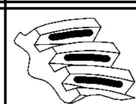
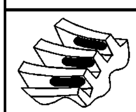
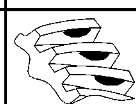
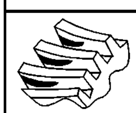
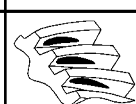
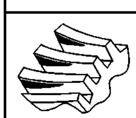
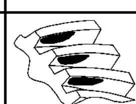
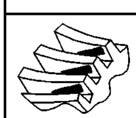
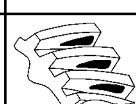
DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	**Desirable pattern.** The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		**Desirable pattern.** The coast pattern should be centered on the tooth,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

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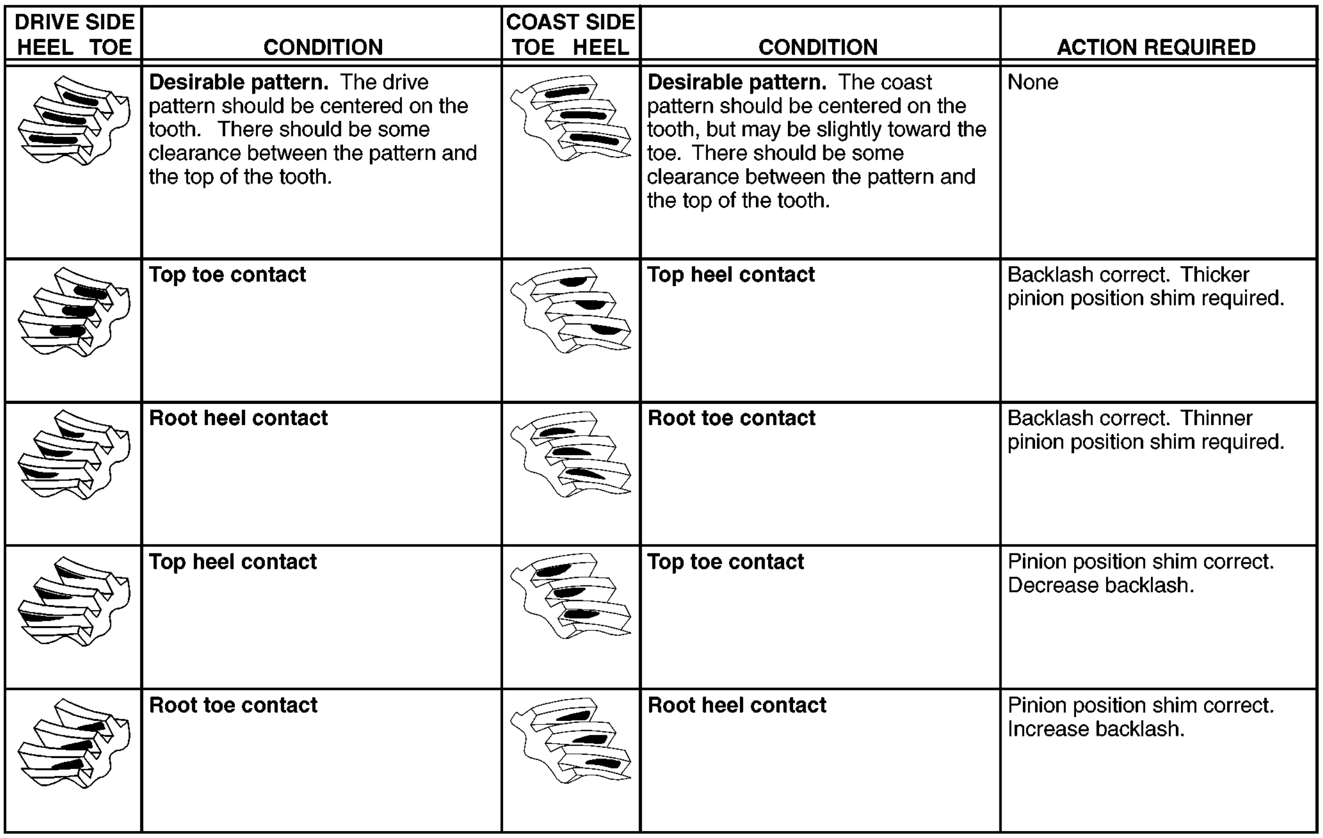
Fig. 26 PATTERN INTERPRETATION (GEAR CUT 2 AXIS)

FRONT AXLE - 181FBI (Continued)



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

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Fig. 27 PATTERN INTERPRETATION (GEAR CUT 3 AXIS)

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

FRONT AXLE - 181FBI (Continued)

SPECIFICATIONS

FRONT AXLE

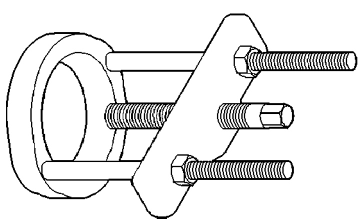
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	3.07, 3.73, 4.10, 4.56
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Pinion Bearing Preload - Original Bearings	1.13-2.26 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	2-3.4 N·m (15-30 in. lbs.)

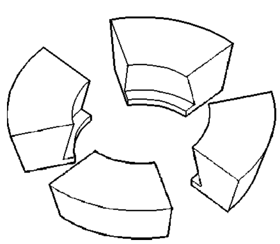
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	61	45	-
Ring Gear Bolts	108	80	-
Pinion Bearing Nut Min - Max	217 - 678	160 - 500	-
Axle Nut	237	175	-
Hub Bearing Bolts	102	75	-

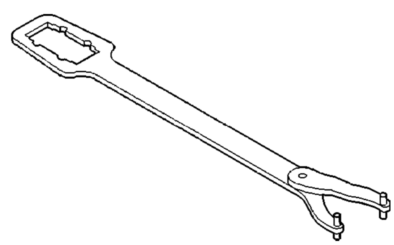
SPECIAL TOOLS



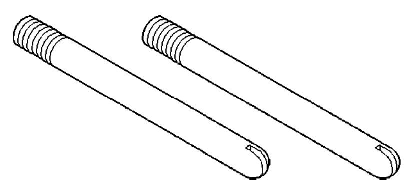
PULLER C-293-PA



ADAPTER C-293-39

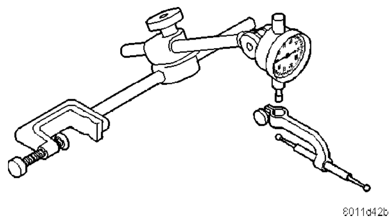


WRENCH C-3281

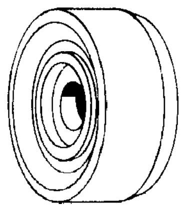


PILOT STUD C-3288-B

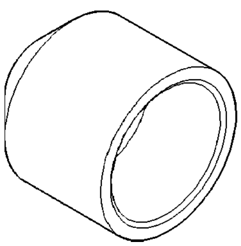
FRONT AXLE - 181FBI (Continued)



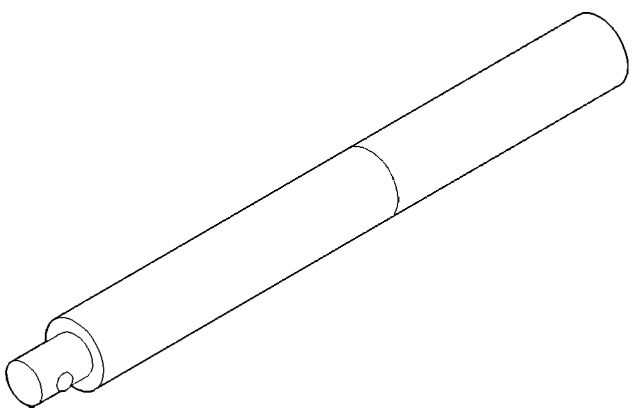
DIAL INDICATOR C-3339



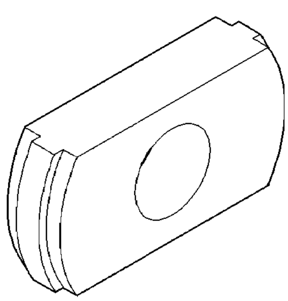
INSTALLER C-3716-A



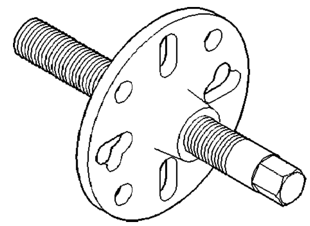
INSTALLER C-3972-A



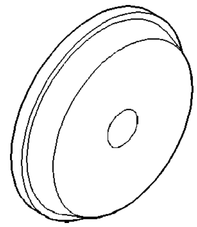
HANDLE C-4171



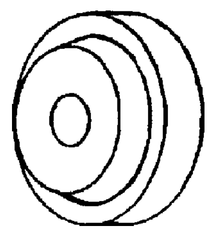
REMOVER C-4345



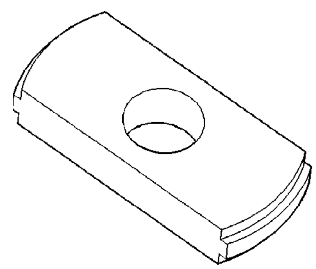
PULLER C-452



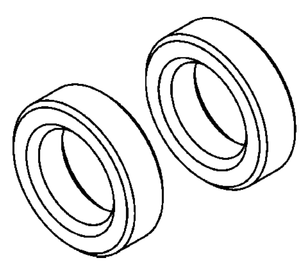
INSTALLER D-130



INSTALLER D-146

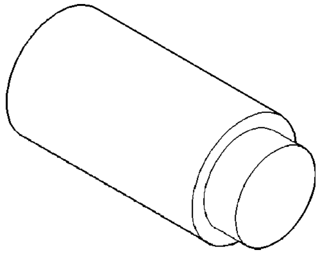


REMOVER D-149

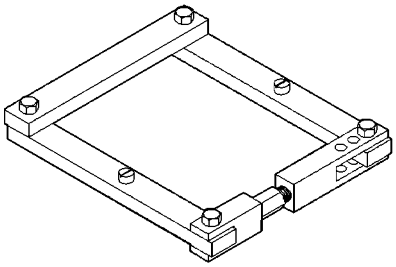


DUMMY BEARINGS D-348

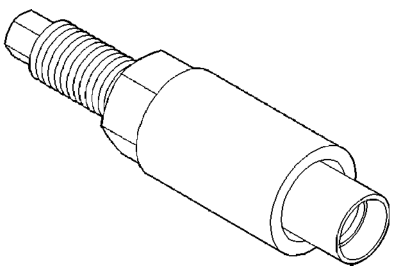
FRONT AXLE - 181FBI (Continued)



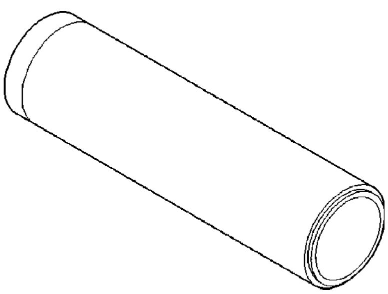
PLUG SP-3289



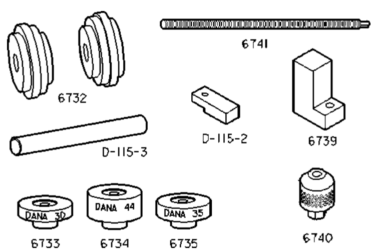
SPREADER W-129-B



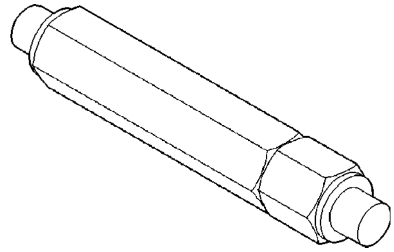
INSTALLER W-162-D



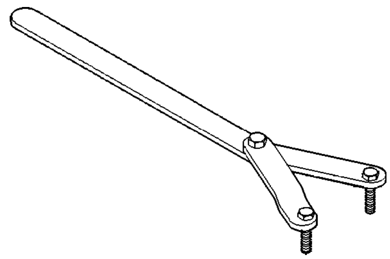
INSTALLER W-262



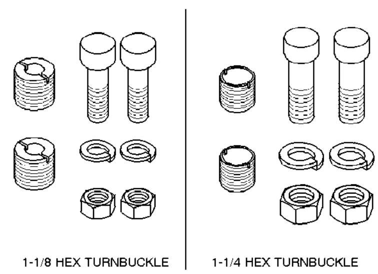
PINION DEPTH SET 6774



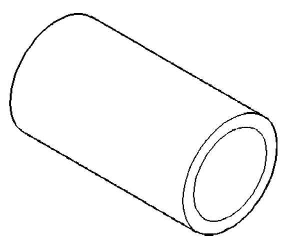
TURNBUCKLE 6797



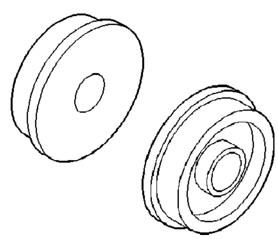
SPANNER WRENCH 6958



ADAPTER KIT 6987B



CUP 8109



INSTALLER DISCS 8110

AXLE SHAFTS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake components.

(3) Remove cotter pin, nut retainer and axle hub nut.

(4) Remove hub bearing bolts (Fig. 28).

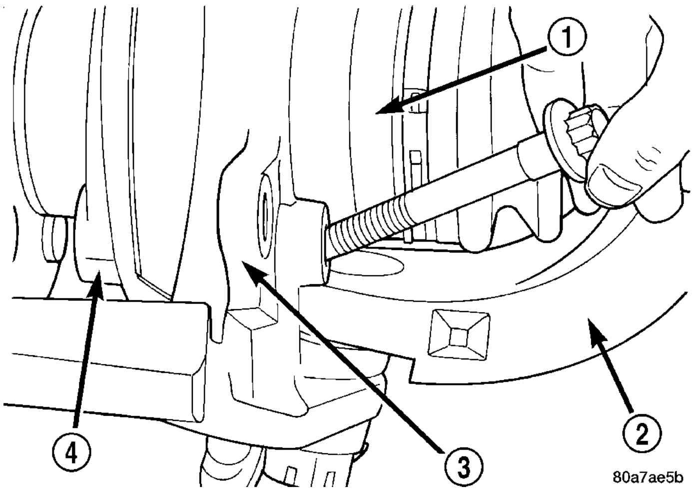


Fig. 28 HUB BEARING BOLTS

1 - AXLE SHAFT
2 - AXLE
3 - KNUCKLE
4 - HUB BEARING

(5) Remove hub bearing from steering knuckle.

(6) Remove axle shaft assembly (Fig. 29) from axle

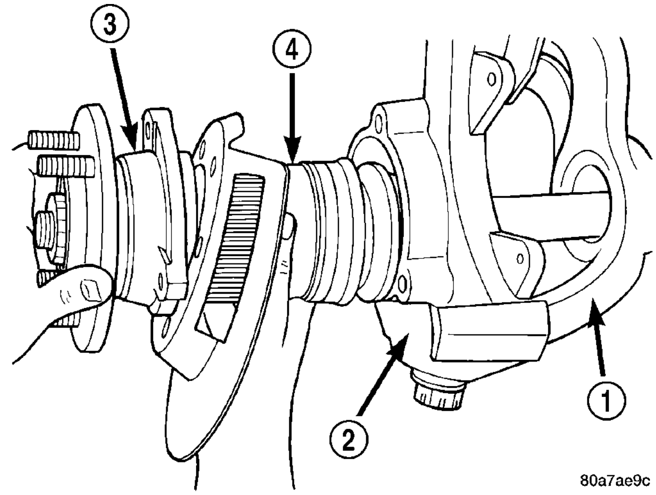


Fig. 29 HUB BEARING AND AXLE ASSEMBLY

1 - AXLE
2 - KNUCKLE
3 - HUB BEARING
4 - AXLE SHAFT

(7) Remove brake rotor shield from the hub bearing or knuckle.

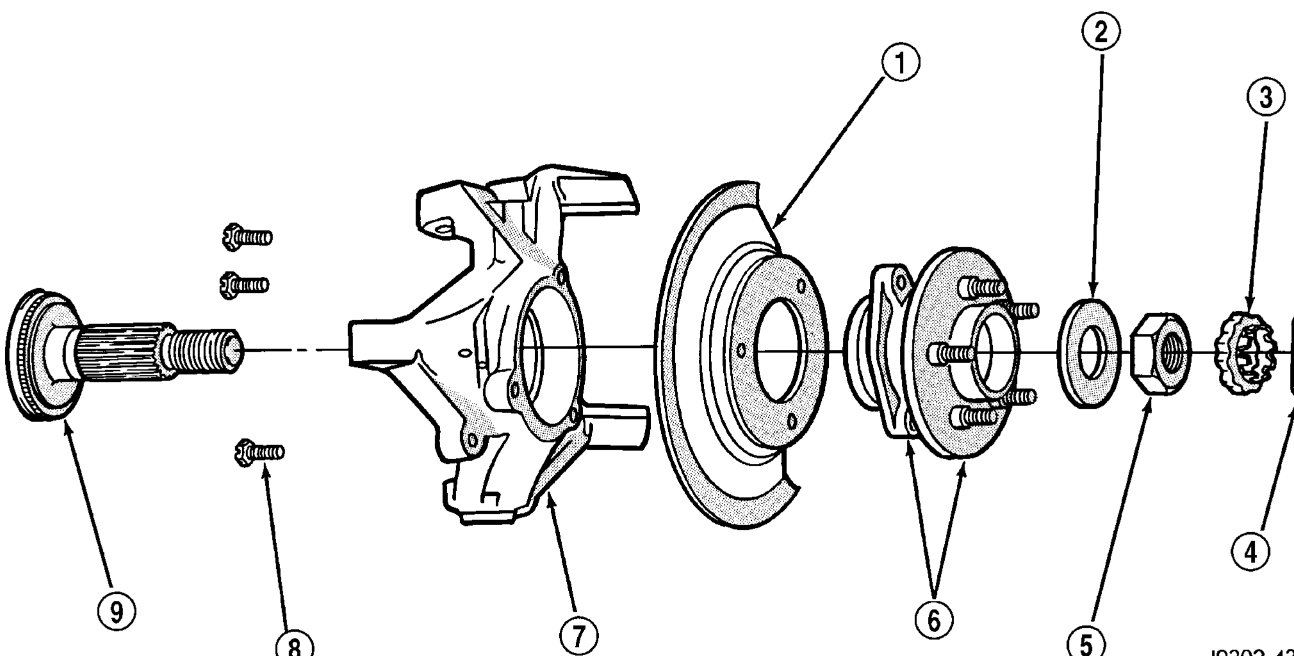


Fig. 30 HUB BEARING & KNUCKLE

1 - BRAKE SHIELD
2 - WASHER
3 - RETAINER
4 - COTTER PIN
5 - NUT
6 - HUB AND BEARING ASSEMBLY
7 - STEERING KNUCKLE
8 - BOLT
9 - TONE WHEEL (ABS)

AXLE SHAFTS (Continued)

INSTALLATION

(1) Clean axle shaft and apply a thin film of Mopar Wheel Bearing Grease or equivalent to the shaft splines, seal contact surface and hub bore.

(2) Install brake rotor shield on knuckle.

(3) Install axle shaft into differential side gears.

(4) Install hub bearing and tighten bolts to 102 N·m (75 ft. lbs.).

(5) Install axle washer and nut. Tighten nut to 237 N·m (175 ft. lbs.) and install nut retainer and cotter pin (Fig. 30).

(6) Install brake components.

AXLE SHAFT SEALS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove axle shafts (Fig. 31).

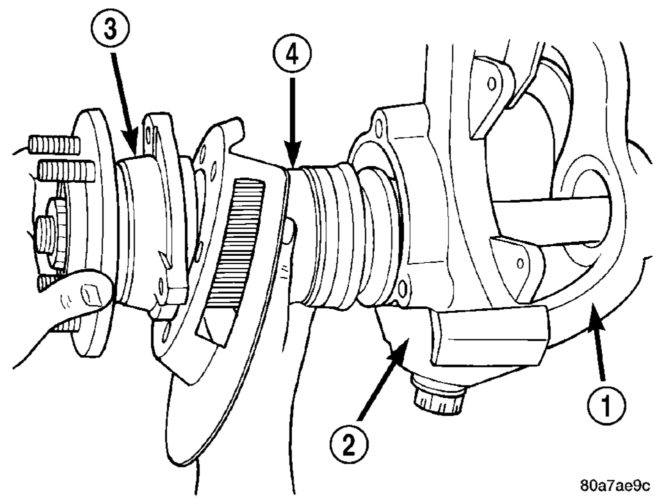


Fig. 31 HUB BEARING AND AXLE ASSEMBLY

1 - AXLE
2 - KNUCKLE
3 - HUB BEARING
4 - AXLE SHAFT

(3) Remove differential assembly (Fig. 32).

(4) Remove inner axle shaft seals with a pry bar.

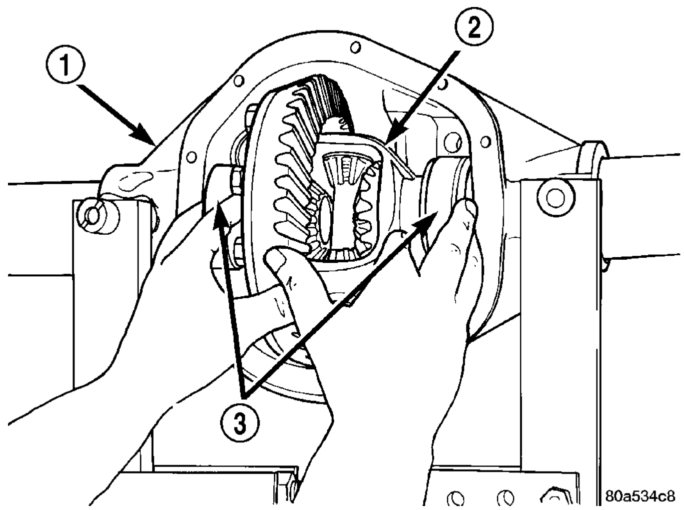


Fig. 32 DIFFERENTIAL CASE

1 - AXLE HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

INSTALLATION

(1) Remove any sealer remaining from original seals.

(2) Install oil seals with Discs 8110 and Turnbuckle 6797 (Fig. 33). Tighten tool until disc bottoms in housing.

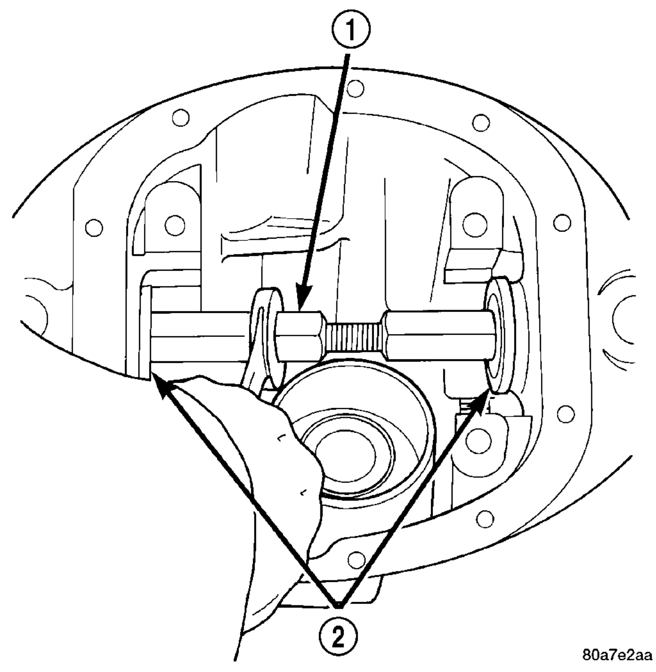


Fig. 33 AXLE SEAL INSTALLATION

1 - TURNBUCKLE
2 - DISCS

(3) Install differential and axle shafts.

SINGLE CARDAN UNIVERSAL JOINT

REMOVAL

CAUTION: Clamp only the narrow forged portion of the yoke in the vise. Failure to heed caution may result in damage.

(1) Remove axle shaft.

(2) Remove bearing cap retaining snap rings (Fig. 34).

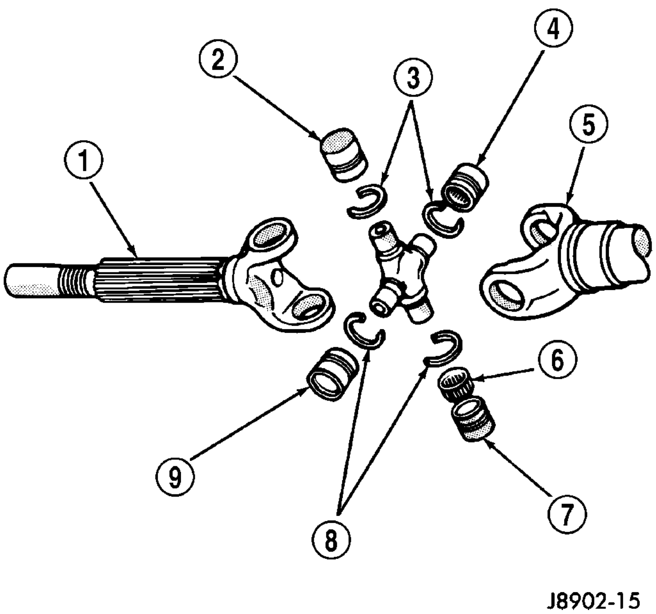


Fig. 34 AXLE SHAFT OUTER U-JOINT

1 - SHAFT YOKE
2 - BEARING CAP
3 - SNAP RINGS
4 - BEARING CAP
5 - SPINDLE YOKE
6 - BEARING
7 - BEARING CAP
8 - SNAP RINGS
9 - BEARING CAP

NOTE: Saturate the bearing caps with penetrating oil prior to removal.

(3) Place a socket (receiver) with an inside diameter larger than the bearing cap against the yoke and the perimeter of the bearing cap to be removed.

(4) Place a socket (driver) with an outside diameter smaller than the bearing cap against the opposite bearing cap.

(5) Position yoke with the sockets in a vise (Fig. 35).

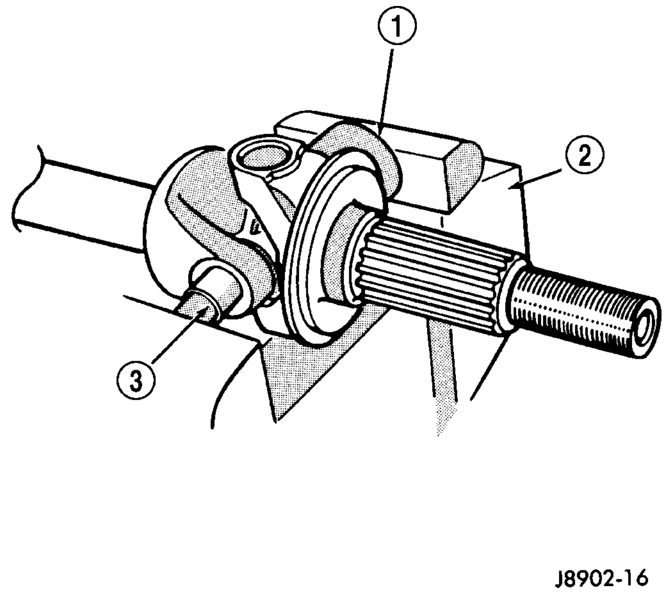


Fig. 35 YOKE BEARING CAP REMOVAL

1 - LARGE-DIAMETER SOCKET
2 - VISE
3 - SMALL-DIAMETER SOCKET

(6) Tighten vise jaws, to force bearing cap into the socket (receiver).

(7) Release vise jaws. Remove sockets and bearing cap forced out of the yoke.

(8) Repeat above procedure for the remaining bearing cap and remove cross from propeller shaft yoke.

SINGLE CARDAN UNIVERSAL JOINT (Continued)

INSTALLATION

CAUTION: Keep cross and bearing cap straight during installation. Failure to heed caution may result in damage.

(1) Pack bearing caps 1/3 full of wheel bearing lubricant (Fig. 36). Apply extreme pressure (EP), lithium-base lubricant to aid in installation.

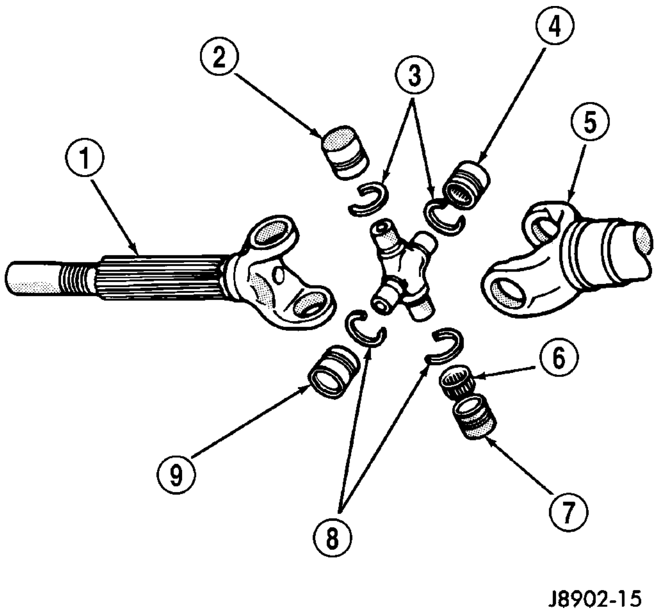


Fig. 36 AXLE SHAFT OUTER U-JOINT

1 - SHAFT YOKE
2 - BEARING CAP
3 - SNAP RINGS
4 - BEARING CAP
5 - SPINDLE YOKE
6 - BEARING
7 - BEARING CAP
8 - SNAP RINGS
9 - BEARING CAP

(2) Position cross in the yoke. Insert seals and bearings, then tap bearing caps into the yoke bores far enough to hold spider in position.

(3) Place socket (driver) against one bearing cap. Position yoke with the socket in a vise.

(4) Tighten vise to force bearing caps into the yoke. Force the caps enough to install retaining clips.

(5) Install bearing cap retaining clips.

(6) Install axle shaft.

PINION SEAL

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake rotors and calipers.

(3) Remove propeller shaft from the yoke.

(4) Rotate pinion gear three or four times.

(5) Record rotating torque of the pinion gear with an inch pound torque wrench, for installation reference.

(6) Hold pinion yoke with Wrench 6958 and remove pinion nut and washer.

(7) Remove pinion yoke with Remover C-452 and Wrench C-3281 (Fig. 37).

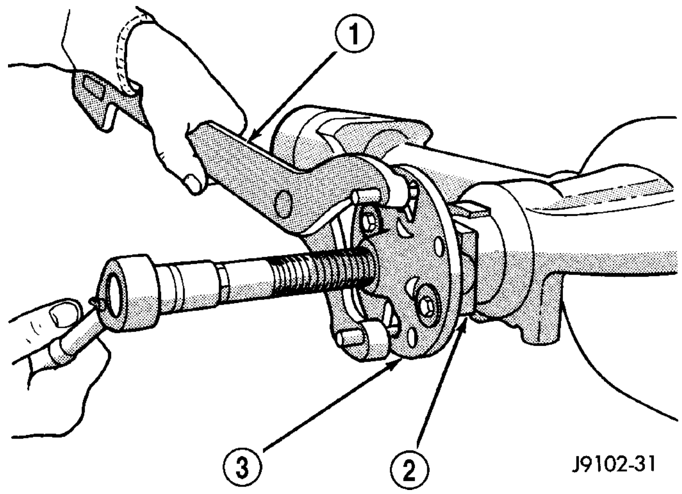


Fig. 37 PINION YOKE REMOVER

1 - WRENCH
2 - PINION YOKE
3 - REMOVER

(8) Remove seal with a pry tool or a slide hammer mounted screw.

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate installer (Fig. 38).

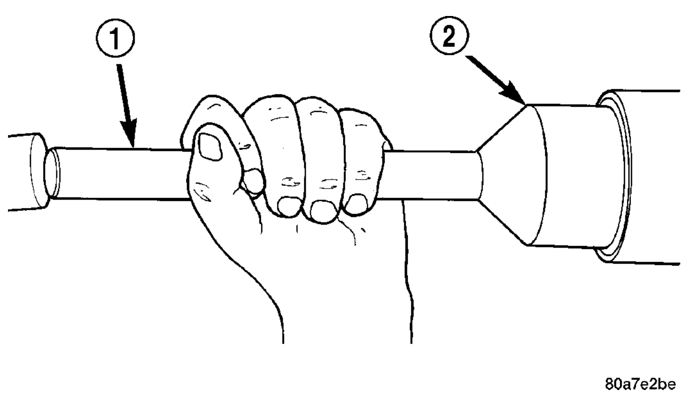


Fig. 38 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

PINION SEAL (Continued)

(2) Install yoke on pinion gear with Installer W-162-D, Cup 8109 and Holder 6958 (Fig. 39).

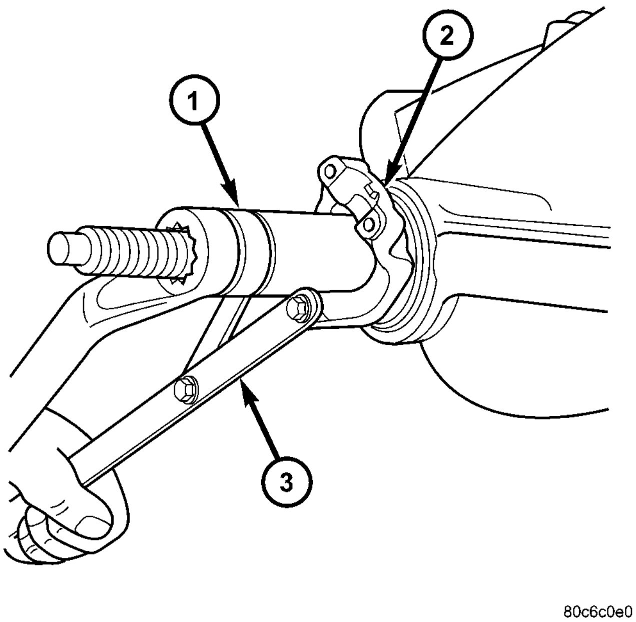


Fig. 39 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

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

(3) Install pinion washer and a **new** nut on the pinion gear shaft.

NOTE: Tighten nut only enough to remove the shaft end play.

(4) Tighten pinion nut to 217 N·m (160 ft. lbs.).

(5) Rotate pinion shaft using an inch pound torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 40).

(6) If rotating torque is low, use Spanner 6958 (Fig. 41) to hold the pinion yoke and tighten pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

(7) Install propeller shaft with reference marks aligned.

(8) Install brake rotors and calipers.

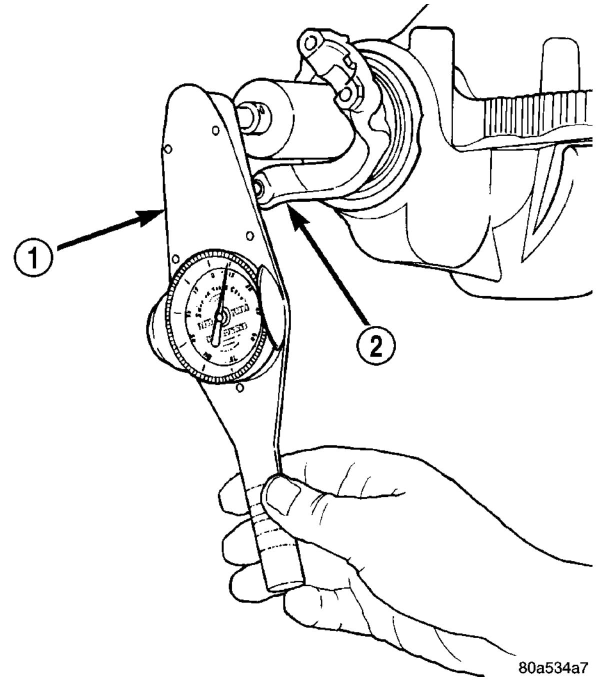


Fig. 40 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

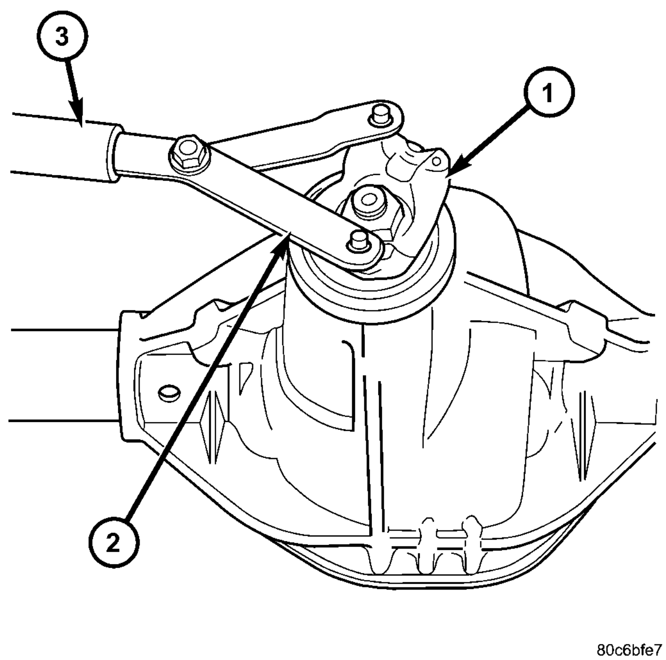


Fig. 41 YOKE HOLDER

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

COLLAPSIBLE SPACER

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake rotors and calipers.

(3) Remove propeller shaft from axle yoke.

(4) Rotate pinion gear three or four times.

(5) Record rotating torque of the pinion gear with an inch pound torque wrench.

(6) Hold pinion yoke with Spanner Wrench 6958 and remove pinion nut and washer.

(7) Remove pinion yoke with Remover C-452 and Flange Wrench C-3281 (Fig. 42).

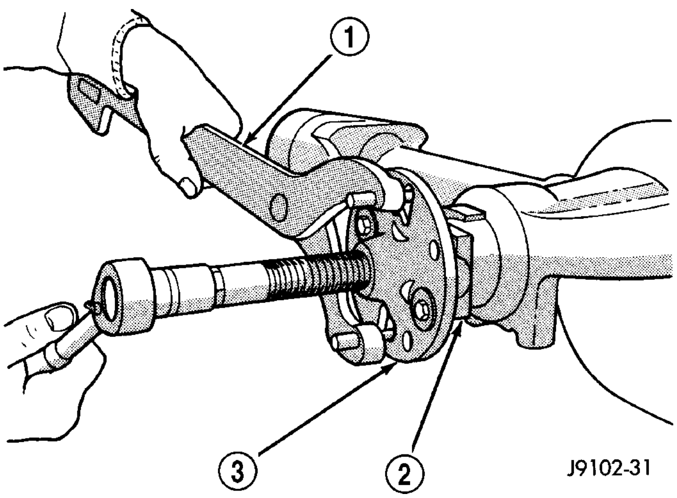


Fig. 42 PINION YOKE REMOVER

1 - WRENCH
2 - PINION YOKE
3 - REMOVER

(8) Remove pinion seal with a suitable pry tool or a slide hammer mounted screw.

(9) Remove front pinion bearing off pinion gear shaft, with a pair of pick tools. If bearing becomes bound on the shaft, lightly tap the end of the pinion gear with a rubber hammer.

(10) Remove collapsible spacer.

INSTALLATION

(1) Install **new** collapsible spacer on pinion shaft.

(2) Install front pinion bearing.

(3) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 43).

(4) Install yoke with Installer W-162-D, Cup 8109 and Spanner Wrench 6958 (Fig. 44).

(5) Install pinion washer and **new** nut and tighten nut to 217 N·m (160 ft. lbs.).

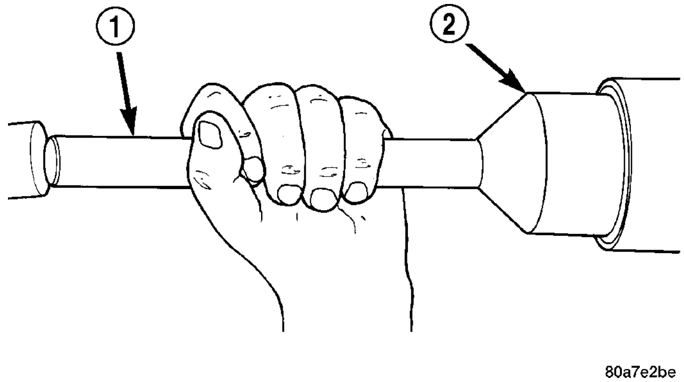


Fig. 43 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

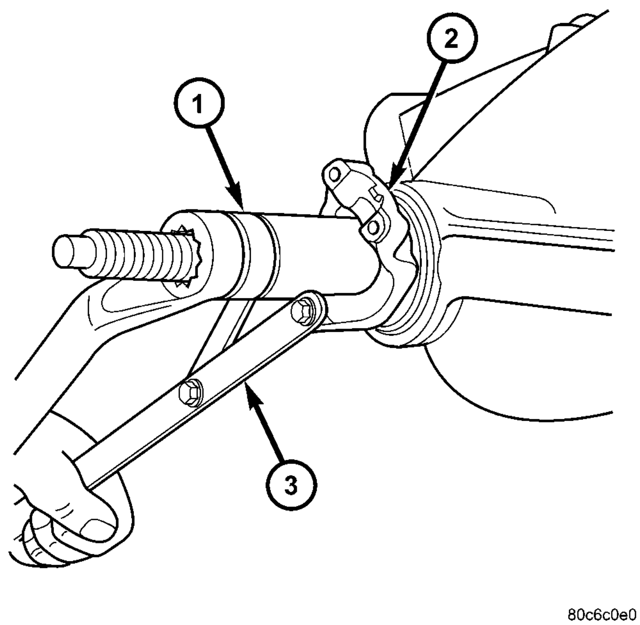


Fig. 44 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

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

COLLAPSIBLE SPACER (Continued)

(6) With yoke Spanner Wrench 6958 and a torque wrench set at 678 N·m (500 ft. lbs.), slowly tighten nut (Fig. 45) in 6.8 N·m (5 ft. lbs.) increments until rotating torque is achieved. Measure rotating torque with inch pound torque wrench frequently to avoid over crushing the collapsible spacer (Fig. 46).

CAUTION: If more than 687 N·m (500 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced. Failure to heed caution may result in damage.

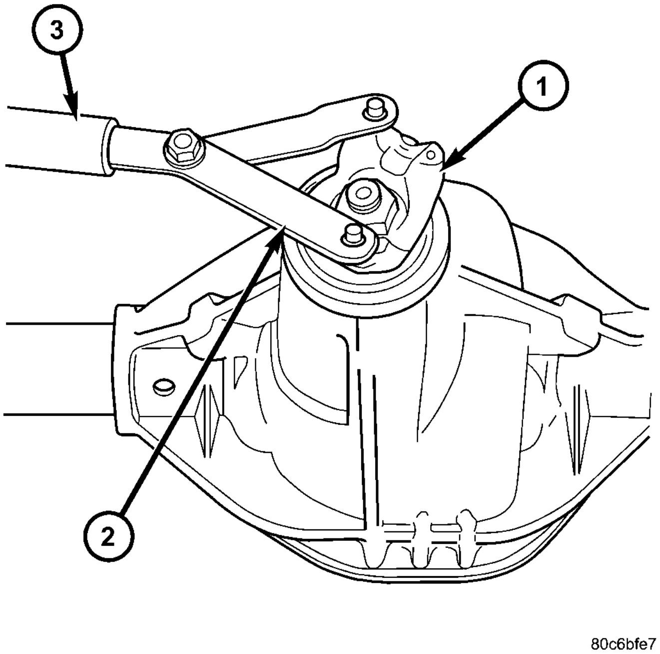


Fig. 45 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

(7) Rotating torque should be the recorded reading during removal, plus an additional 0.56 N·m (5 in. lbs.).

(8) Install propeller shaft.

(9) Install brake rotors and calipers.

DIFFERENTIAL COVER

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove drain plug.

(3) Remove cover bolts.

(4) Remove cover and drain lubricant.

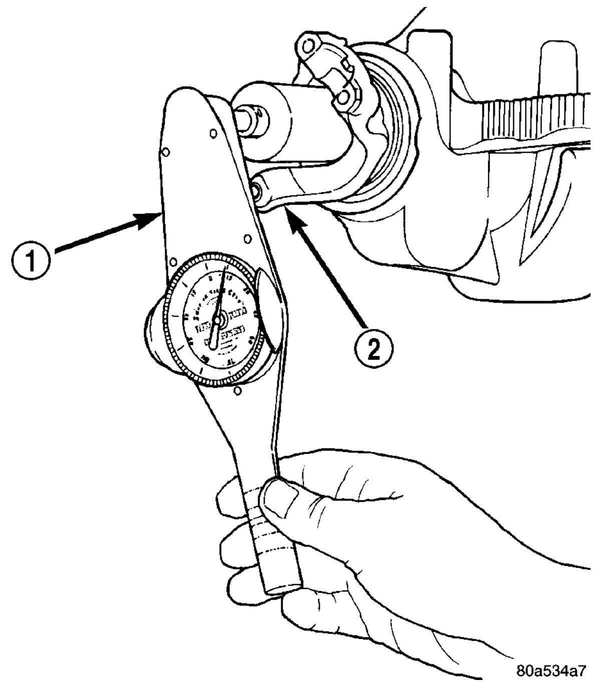


Fig. 46 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

INSTALLATION

(1) Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 47).

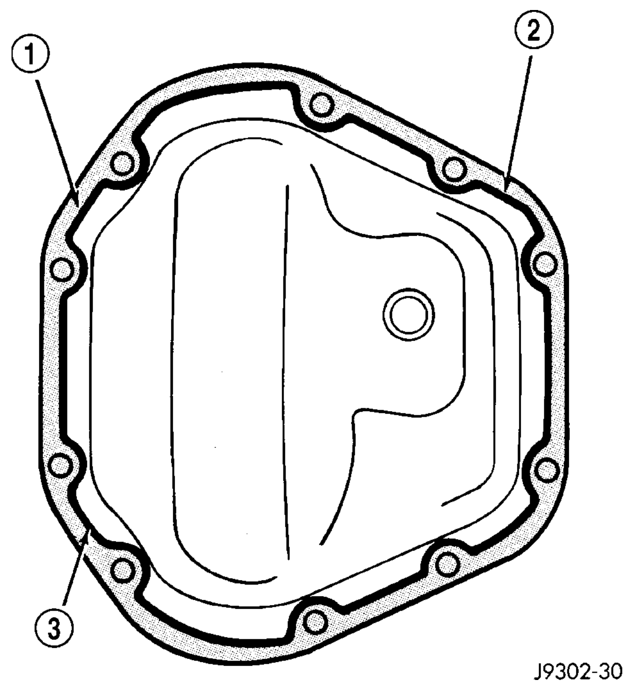


Fig. 47 HOUSING COVER - TYPICAL

1 - SEALANT SURFACE
2 - SEALANT
3 - SEALANT THICKESS

DIFFERENTIAL COVER (Continued)

CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.

(2) Install cover and identification tag. Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).

(3) Fill differential to specifications.

(4) Install fill plug and tighten to 34 N·m (25 ft. lbs.).

DIFFERENTIAL

REMOVAL

(1) Remove differential cover and fluid to drain.

(2) Remove hub bearings and axle shafts.

(3) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 48).

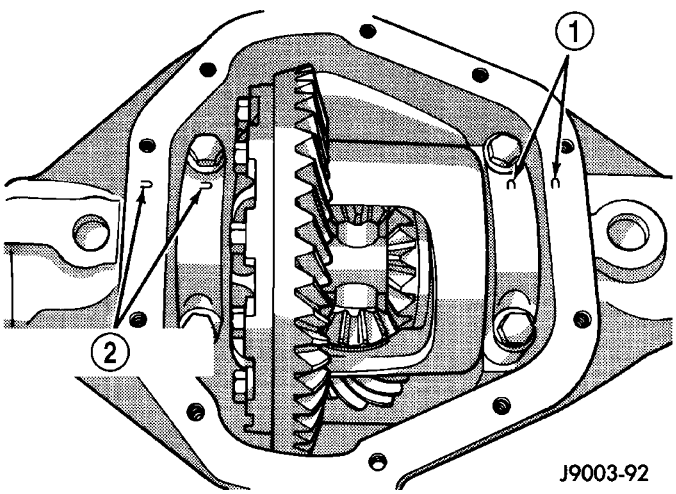


Fig. 48 BEARING CAP IDENTIFICATION

1 - INSTALLATION REFERENCE LETTERS
2 - INSTALLATION REFERENCE LETTERS

(4) Loosen the differential bearing cap bolts.

(5) Position Spreader W-129-B and Adapter from Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 49). Install holddown clamps and tighten the tool turnbuckle finger-tight.

(6) Install Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to guide pin. Load indicator plunger against the opposite side of the housing (Fig. 50) and zero indicator.

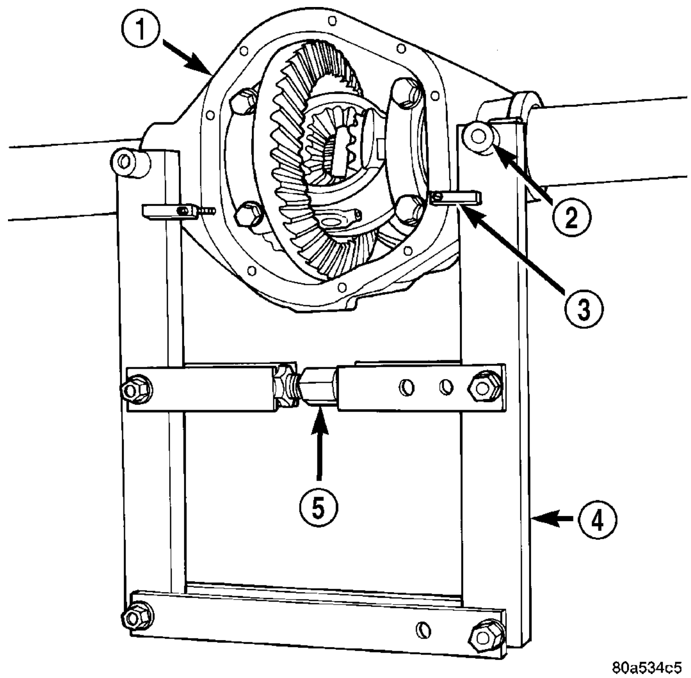


Fig. 49 SPREADER LOCATION

1 - AXLE HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

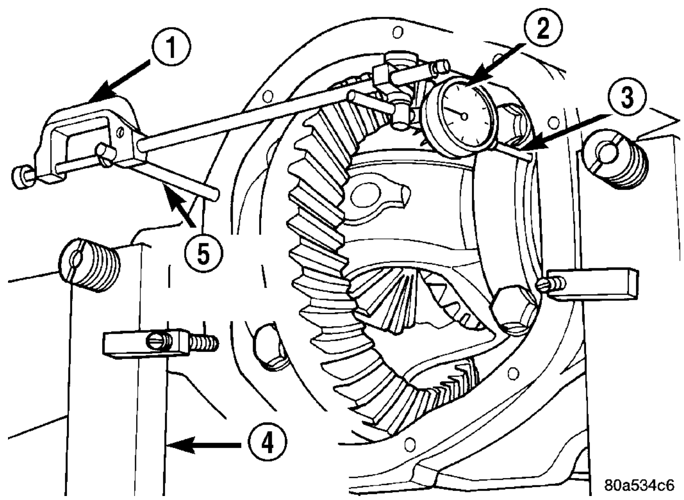


Fig. 50 DIAL INDICATOR LOCATION

1 - INDICATOR CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

DIFFERENTIAL (Continued)

(7) Spread housing while measuring the distance with the dial indicator (Fig. 51).

CAUTION: Do not spread over 0.50 mm (0.020 in). Failure to heed caution may result in damage.

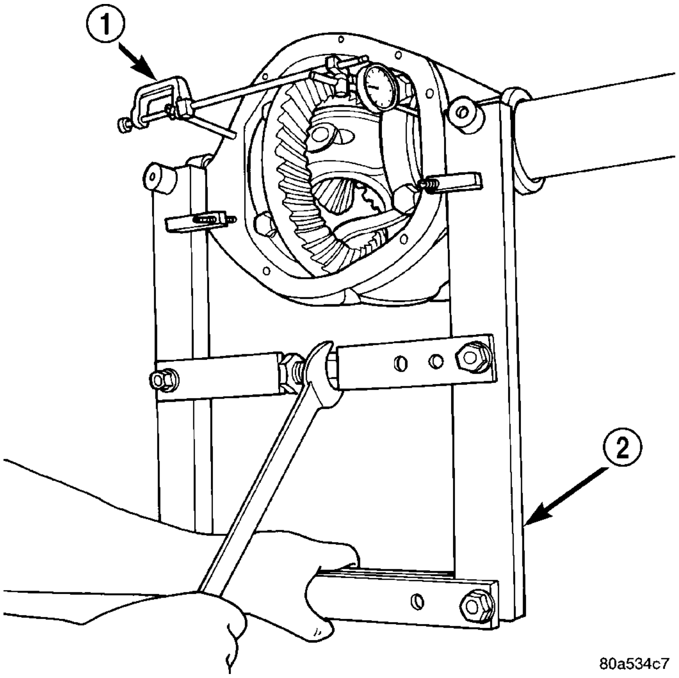


Fig. 51 SPREAD DIFFERENTIAL HOUSING

1 - INDICATOR
2 - SPREADER

(8) Remove dial indicator.

(9) Hold differential case in position while removing differential bearing caps.

(10) Remove differential from the housing (Fig. 52).

(11) Remove spreader from housing.

(12) Clean housing cavity with a flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

DISASSEMBLY

(1) Remove ring gear.

(2) Drive out roll pin holding pinion gear mate shaft with a punch (Fig. 53).

(3) Remove pinion gear mate shaft from the differential case and pinion mate gears.

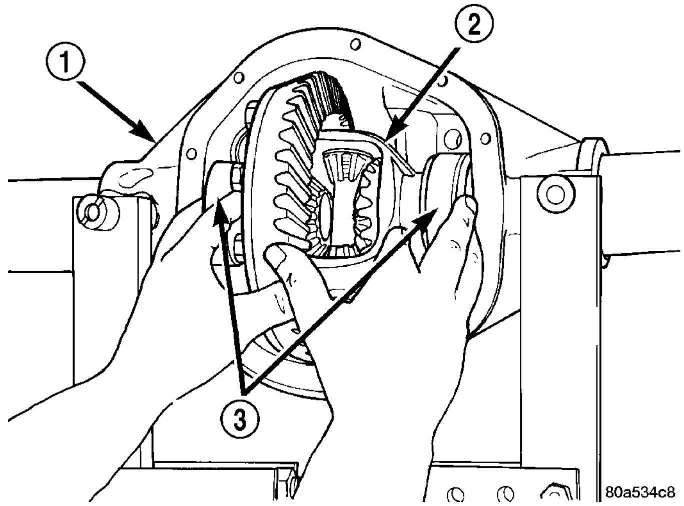


Fig. 52 DIFFERENTIAL CASE

1 - AXLE HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

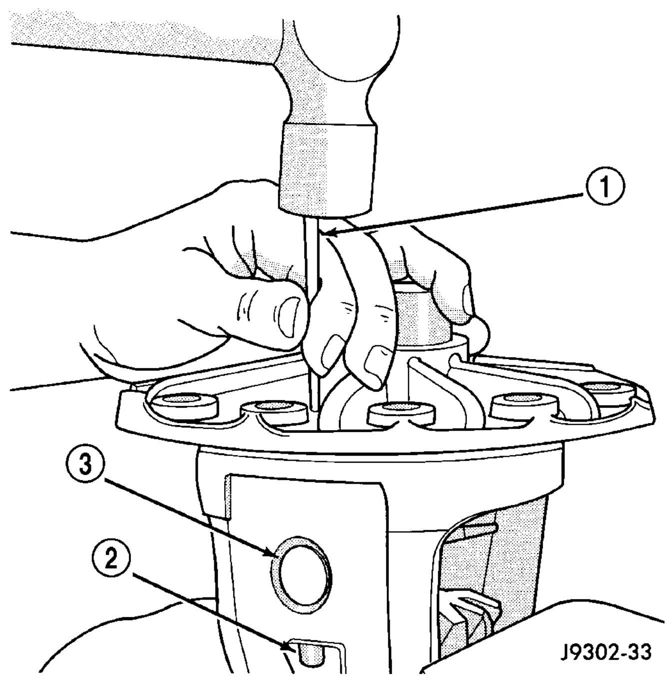


Fig. 53 MATE SHAFT ROLL PIN

1 - DRIFT
2 - LOCKPIN
3 - MATE SHAFT

DIFFERENTIAL (Continued)

(4) Rotate differential side gears and remove pinion mate gears and thrust washers (Fig. 54).

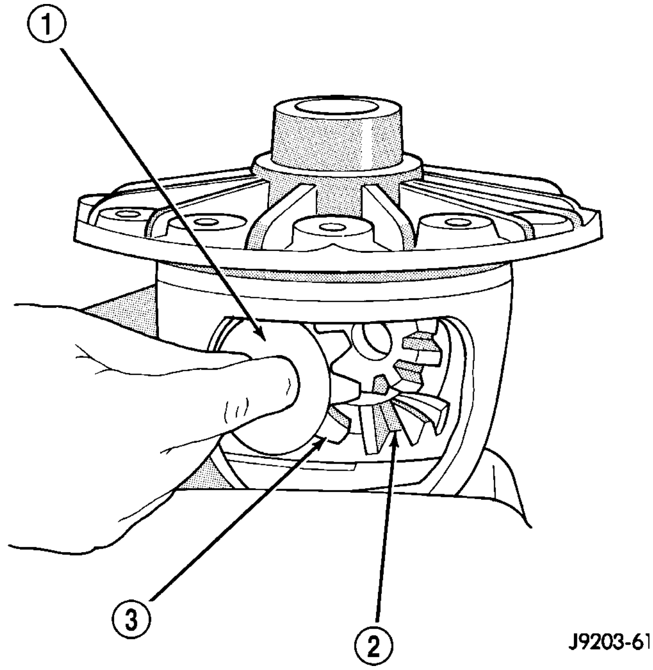


Fig. 54 PINION MATE GEAR

1 - THRUST WASHER
2 - SIDE GEAR
3 - PINION MATE GEAR

(5) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Install differential side gears and thrust washers.

(2) Install pinion mate gears and thrust washers.

(3) Install pinion gear mate shaft. Align roll pin holes in shaft and the differential case.

(4) Install pinion mate shaft roll pin in the differential case (Fig. 55).

(5) Install the ring gear.

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B and Adapter Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 56). Install holddown clamps and tighten turnbuckle finger-tight.

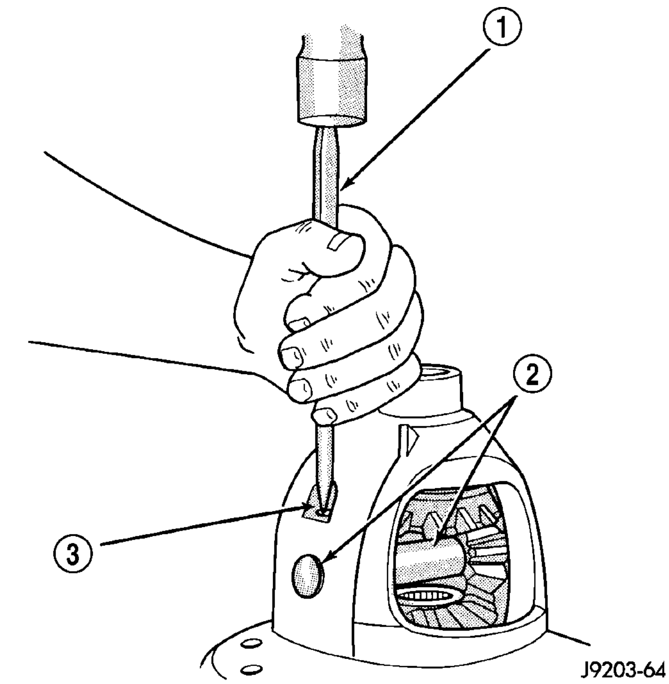


Fig. 55 MATE SHAFT ROLL PIN

1 - PUNCH
2 - PINION MATE SHAFT
3 - MATE SHAFT LOCKPIN

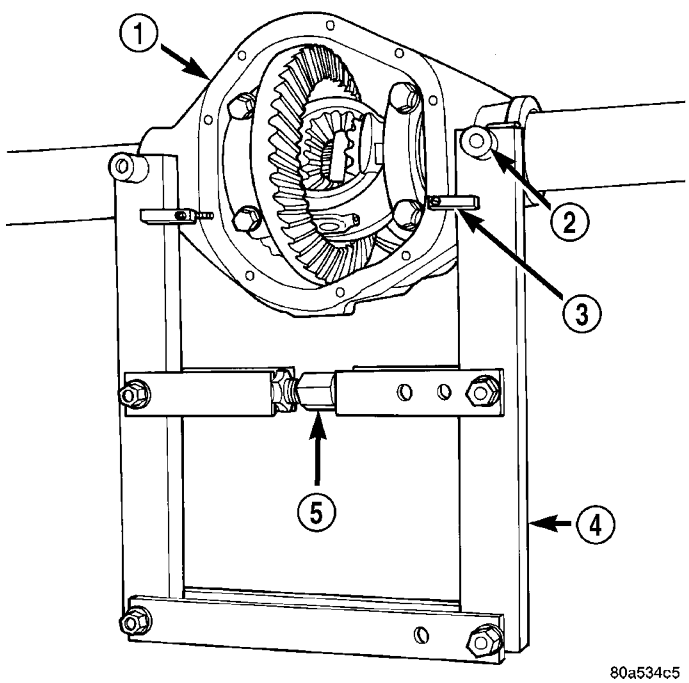


Fig. 56 SPREADER LOCATION

1 - AXLE HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL (Continued)

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the lever adapter against the opposite side of the housing (Fig. 57) and zero indicator.

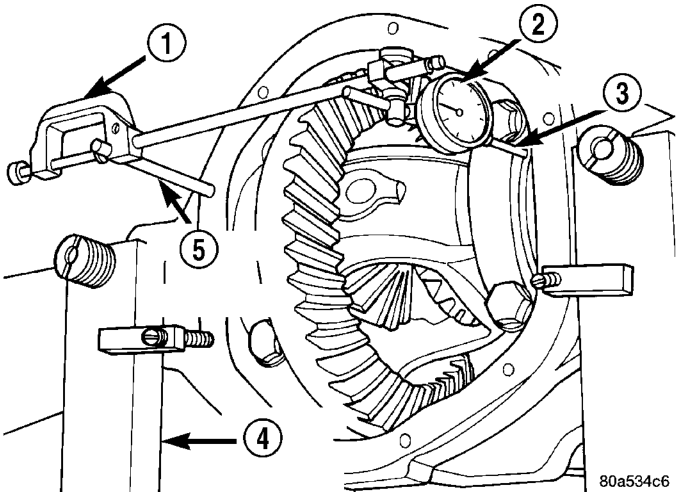


Fig. 57 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

(3) Spread housing while measuring the distance with the dial indicator (Fig. 58).

CAUTION: Do not spread over 0.50 mm (0.020 in). Failure to heed caution may result in damage.

(4) Remove dial indicator.
(5) Install differential case in the housing. Tap differential case to seat bearings cups in the housing.
(6) Install bearing caps at their original locations (Fig. 59).
(7) Loosely install differential bearing cap bolts.
(8) Remove axle housing spreader.
(9) Tighten bearing cap bolts to 61 N·m (45 ft. lbs.).
(10) Install hub bearings and axle shafts.
(11) Install differential cover.

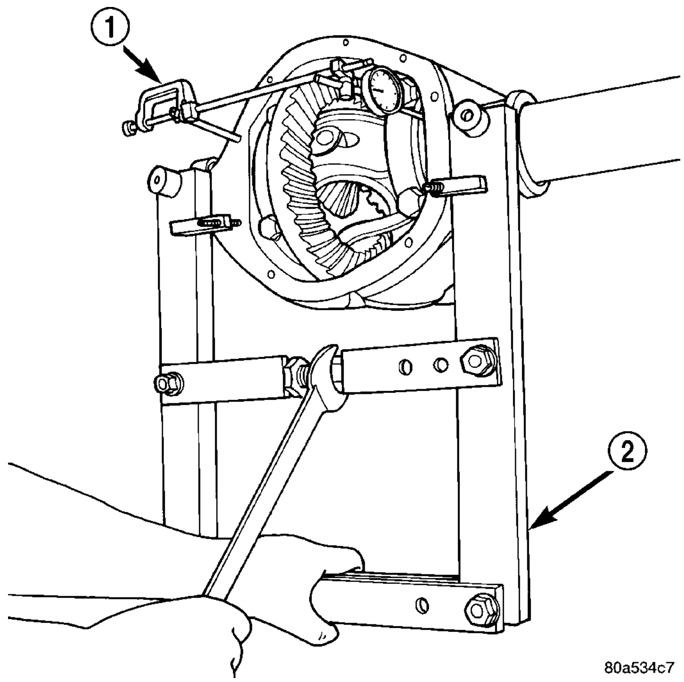


Fig. 58 SPREAD DIFFERENTIAL HOUSING

1 - INDICATOR
2 - SPREADER

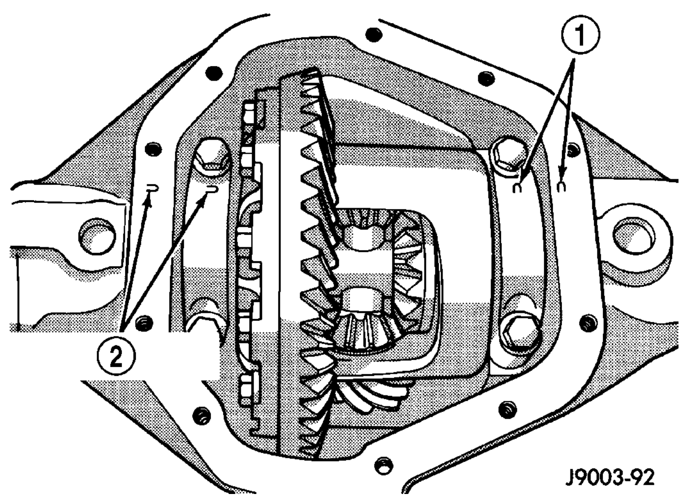


Fig. 59 BEARING CAP IDENTIFICATION

1 - INSTALLATION REFERENCE LETTERS
2 - INSTALLATION REFERENCE LETTERS

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Remove bearings from the differential case with Puller/Press C-293-PA, C-293-39 Adapter and Plug SP-3289 (Fig. 60).

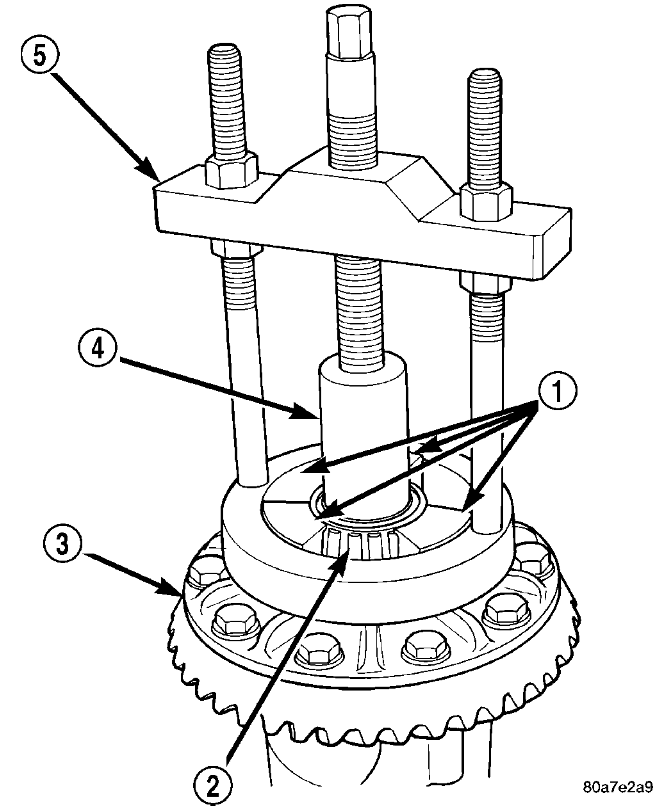


Fig. 60 DIFFERENTIAL BEARING

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

INSTALLATION

NOTE: If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Install differential side bearing shims onto differential case hubs.

(2) Install differential side bearings with Installer C-3716-A and Handle C-4171 (Fig. 61).

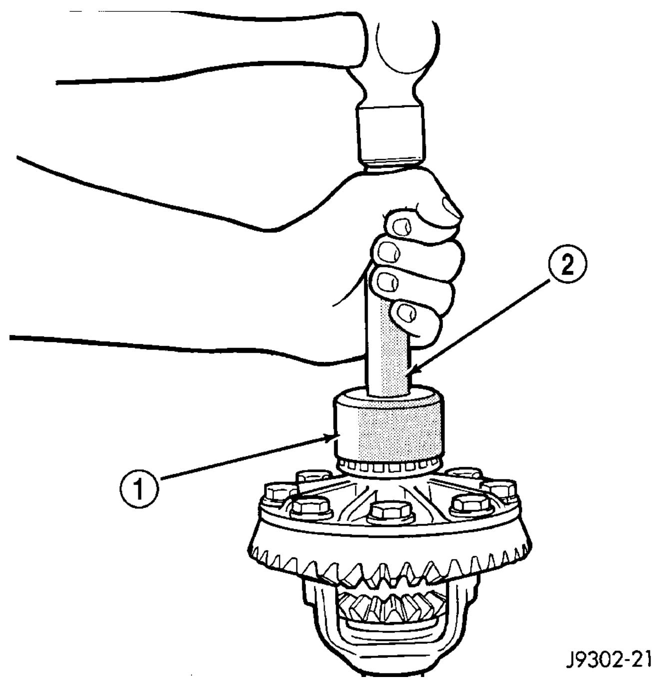


Fig. 61 DIFFERENTIAL CASE BEARING

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR

REMOVAL

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

(1) Remove differential from axle housing.

(2) Secure differential case in a vise with soft metal jaw (Fig. 62).

(3) Remove ring gear bolts from the differential case.

(4) Drive ring gear off the differential case with a dead-blow hammer (Fig. 62).

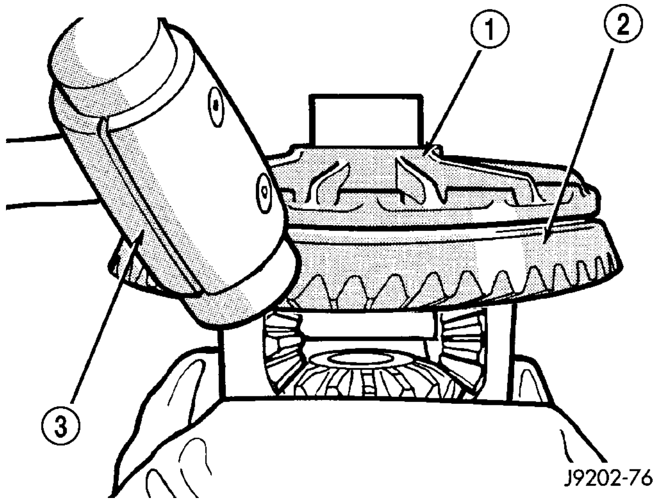


Fig. 62 RING GEAR

1 - DIFFERENTAIL CASE
2 - RING GEAR
3 - HAMMER

(5) Hold yoke with Spanner Wrench 6958 and remove the pinion nut and washer (Fig. 63).

(6) Remove pinion yoke with Remover C-452 and Flange Wrench C-3281 (Fig. 64).

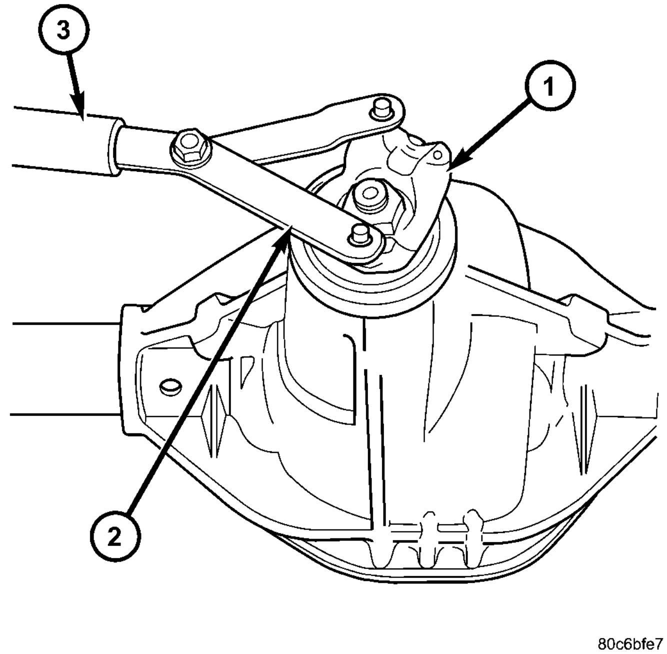


Fig. 63 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

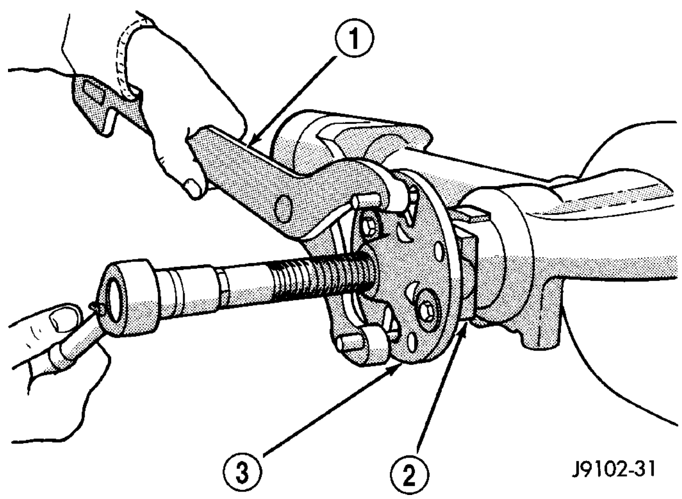


Fig. 64 PINION YOKE

1 - FLANGE WRENCH
2 - PINION YOKE
3 - REMOVER

PINION GEAR/RING GEAR (Continued)

(7) Remove pinion and collapsible spacer from the housing (Fig. 65).

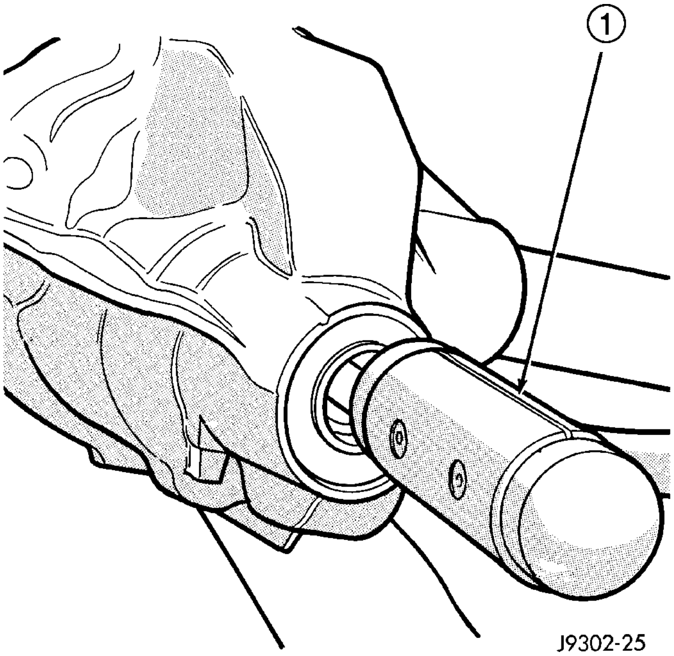


Fig. 65 PINION GEAR

1 - DEAD-BLOW HAMMER

(8) Remove front pinion bearing cup, bearing, oil slinger and pinion seal with Remover C-4345 and Handle C-4171 (Fig. 66).

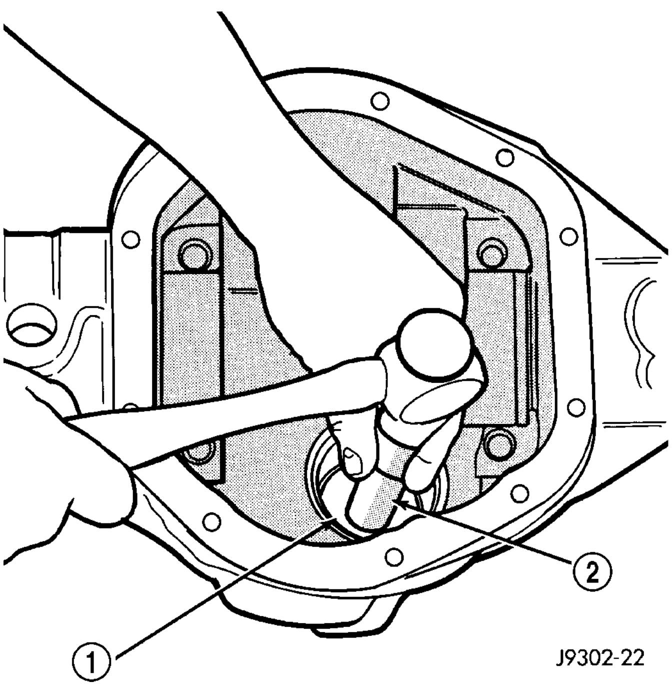


Fig. 66 FRONT BEARING CUP

1 - REMOVER
2 - HANDLE

(9) Remove rear pinion bearing cup from the housing (Fig. 67) with Remover D-149 and Handle C-4171.

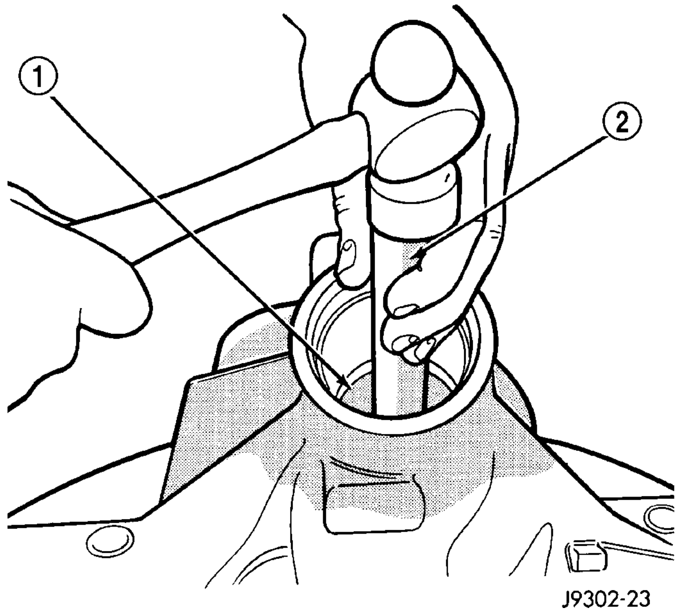


Fig. 67 REAR BEARING CUP

1 - REMOVER
2 - HANDLE

(10) Remove collapsible spacer from pinion shaft (Fig. 68).

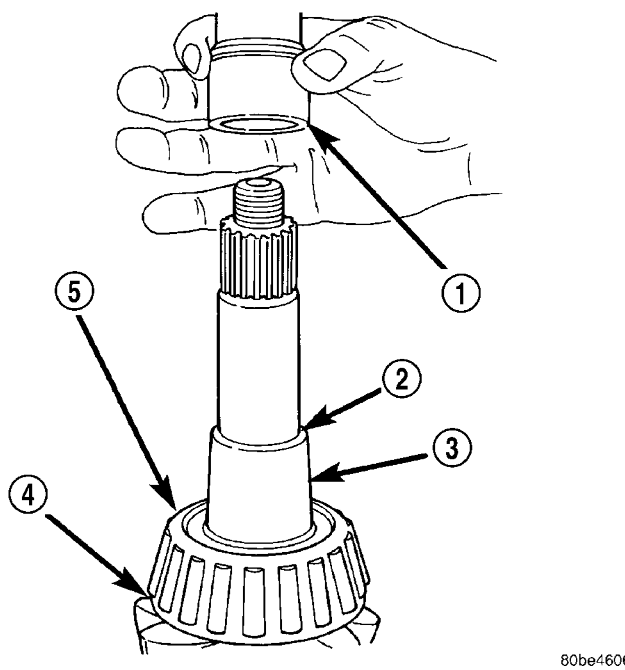


Fig. 68 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION
4 - PINION DEPTH SHIM
5 - REAR BEARING

PINION GEAR/RING GEAR (Continued)

(11) Remove rear pinion bearing with Puller/Press C-293-PA and Adapters C-293-39 (Fig. 69).

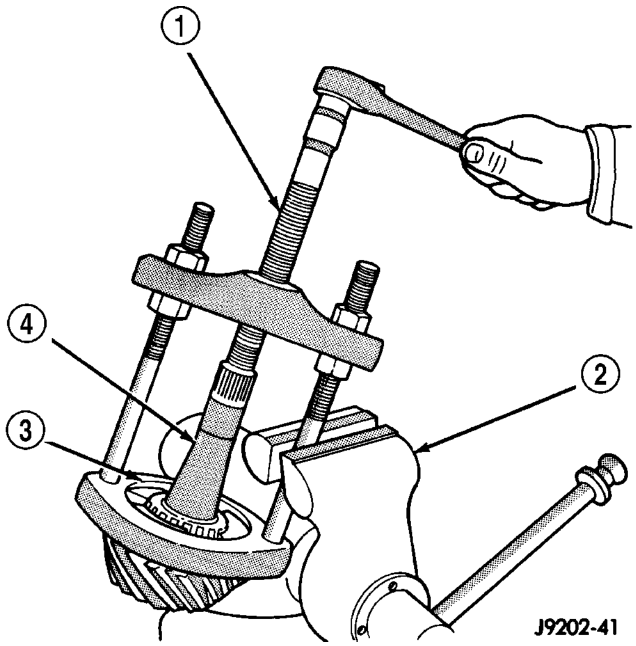


Fig. 69 REAR PINION BEARING

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION GEAR SHAFT

(12) Remove pinion depth shim/oil slinger from the pinion shaft and record thickness.

INSTALLATION

NOTE: A pinion depth shim/oil slinger is placed between the rear pinion bearing cone and the pinion head to achieve proper ring gear and pinion mesh. If ring gear and pinion are reused, the pinion depth shim/oil slinger should not require replacement. Refer to Adjustment (Pinion Gear Depth) to select the proper thickness shim/oil slinger if ring and pinion gears are replaced.

(1) Apply Mopar® Door Ease or equivalent lubricant to outside surface of the pinion bearing cups. Install rear bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 70) and verify cup is seated.

(2) Install front bearing cup with Installer D-130 and Handle C-4171 (Fig. 71) and verify cup is seated.

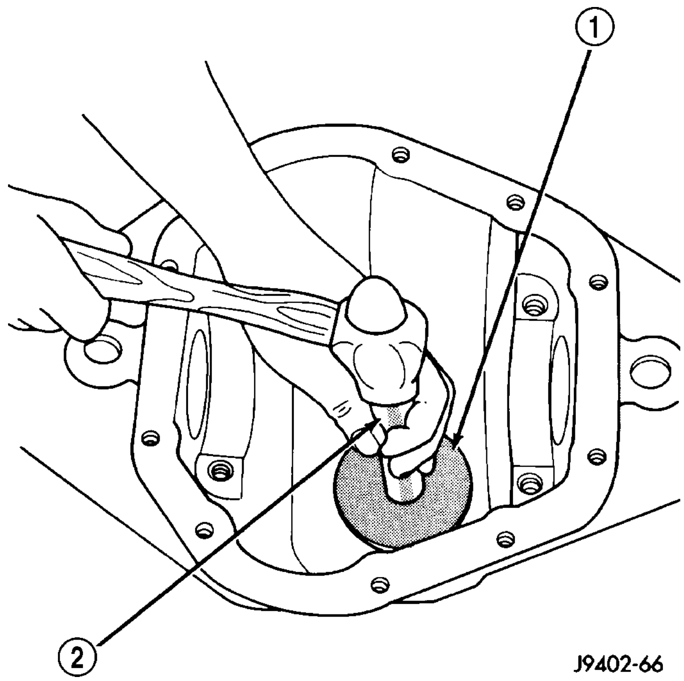


Fig. 70 REAR PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

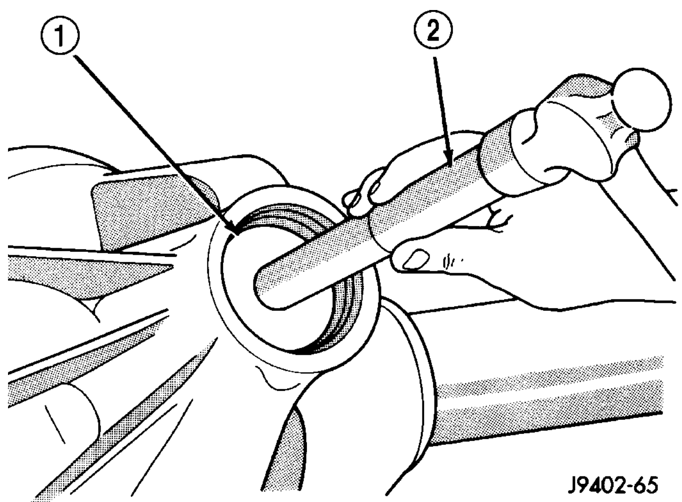


Fig. 71 FRONT PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR (Continued)

(3) Install front pinion bearing, and oil slinger.

(4) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 72).

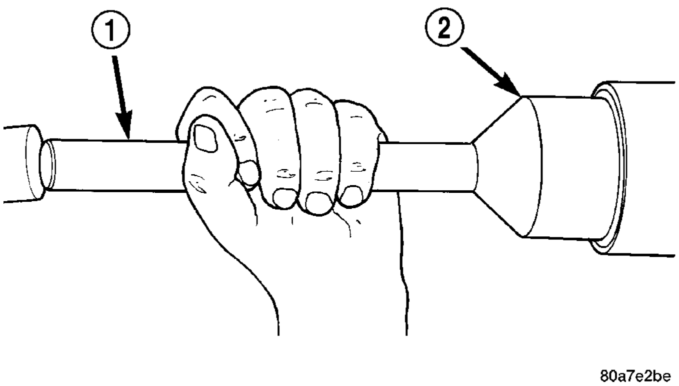


Fig. 72 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(5) Install rear pinion depth shim/oil slinger and bearing on the pinion shaft with Installer W-262 and a press (Fig. 73).

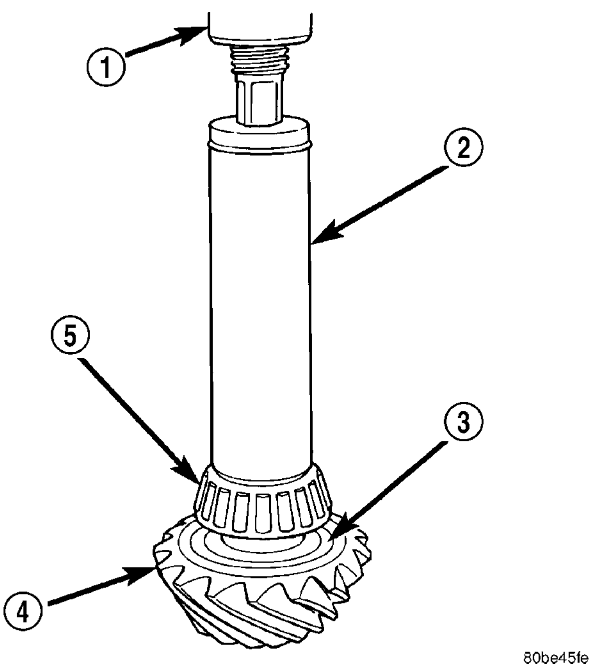


Fig. 73 REAR PINION BEARING

1 - PRESS
2 - INSTALLATER
3 - PINION DEPTH SHIM/OIL SLINGER
4 - DRIVE PINION
5 - REAR PINION BEARING

(6) Install **new** collapsible spacer on pinion shaft and install pinion into the housing (Fig. 74).

(7) Install yoke with Installer W-162-B, Cup 8109 and Spanner Wrench 6958 (Fig. 75).

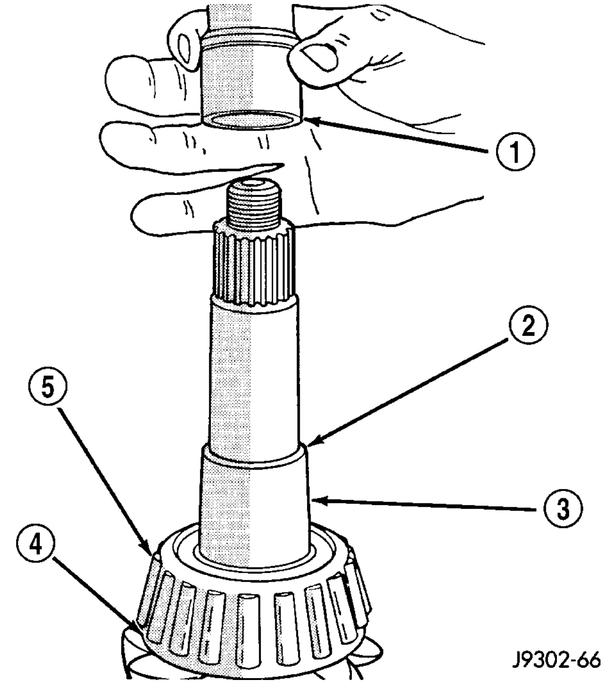


Fig. 74 COLLAPSIBLE PRELOAD SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - OIL SLINGER
5 - REAR BEARING

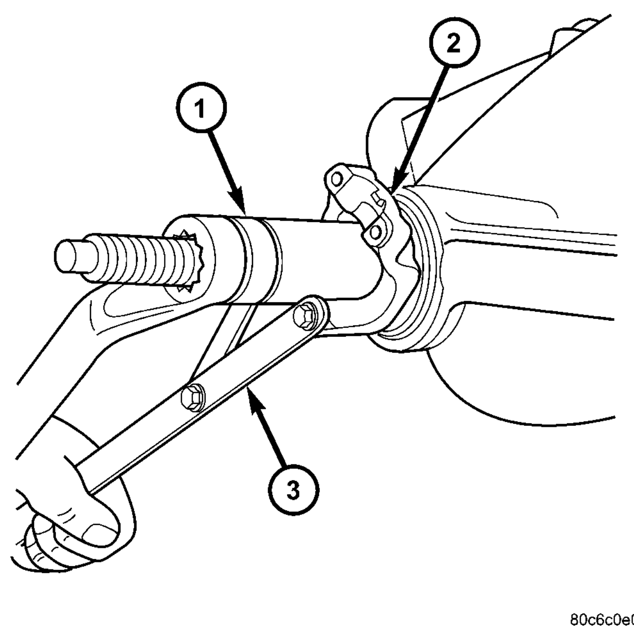


Fig. 75 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

(8) Install pinion washer and a **new** nut onto the pinion. Tighten the nut to 216 N·m (160 ft. lbs.).

PINION GEAR/RING GEAR (Continued)

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

(9) Using Spanner Wrench 6958 and torque wrench set at 678 N·m (500 ft. lbs.) (Fig. 76). Slowly tighten the nut in 6.8 N·m (5 ft. lb.) increments until the rotating torque is achieved. Measure rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 77).

CAUTION: If more than 678 N·m (500 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced. Failure to heed caution may result in damage.

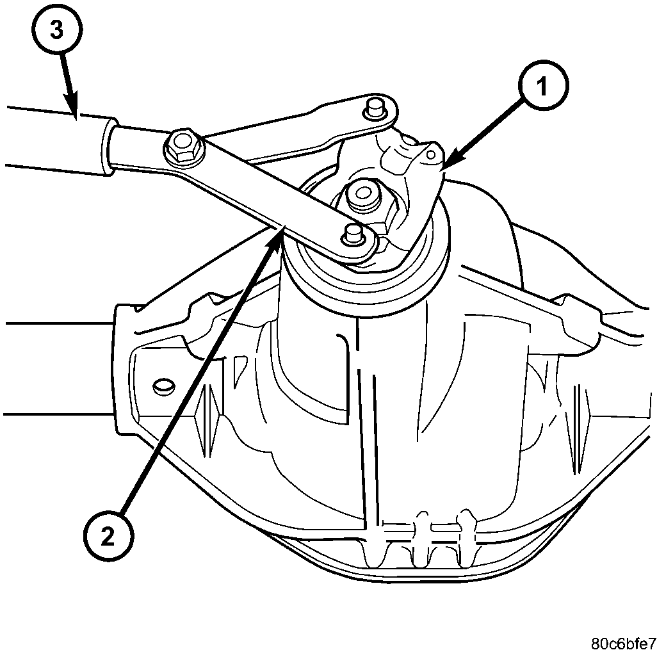


Fig. 76 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

(10) Check bearing rotating torque with an inch pound torque wrench (Fig. 77). The torque necessary to rotate the pinion should be:

- Original Bearings: 1.13 to 2.26 N·m (10 to 20 in. lbs.).
- New Bearings: 1.7 to 3.4 N·m (15 to 30 in. lbs.).

(11) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(12) Invert the differential case in the vise and install **new** ring gear bolts and alternately tighten to 108 N·m (80 ft. lbs.) (Fig. 78).

CAUTION: Never reuse ring gear bolts. Failure to heed caution may result in damage.

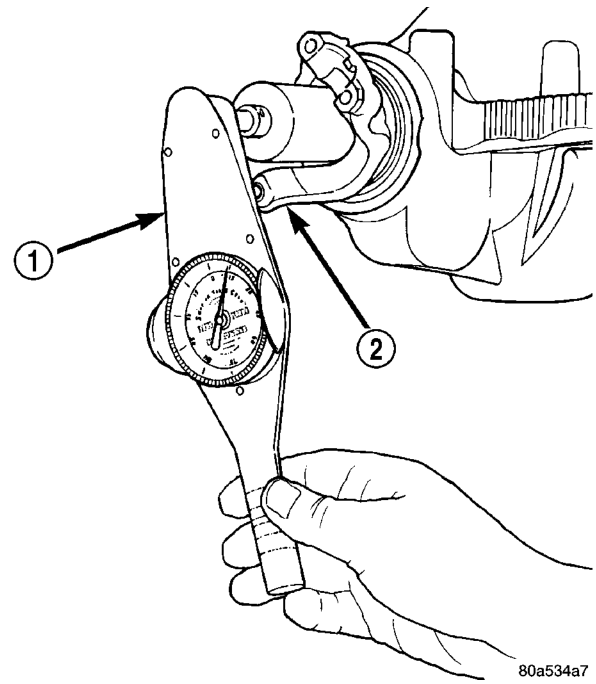


Fig. 77 PINION ROTATION TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

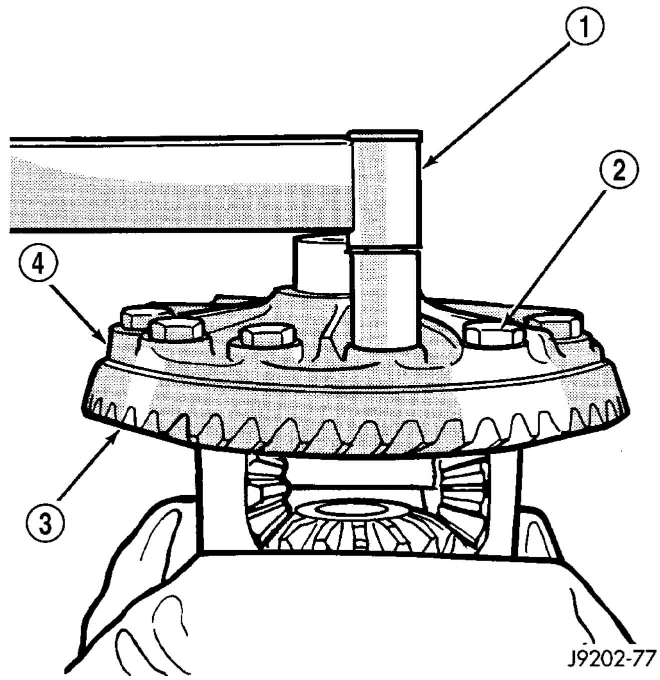


Fig. 78 RING GEAR BOLT

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

(13) Install differential and verify differential bearing preload, gear mesh and contact pattern.

FRONT AXLE - 216FBI

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FRONT AXLE - 216FBI

DIAGNOSIS AND TESTING

GEAR NOISE

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

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

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

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

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

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

FRONT AXLE - 216FBI (Continued)

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

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

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

Check for loose or damaged front end components or engine/transmission mounts. These components can contribute to what appears to be a rear end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

DRIVELINE SNAP

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

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

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube. 2. Bent or sprung axle shaft. 3. End-play in pinion bearings. 4. Excessive gear backlash between the ring gear and pinion. 5. Improper adjustment of pinion gear bearings. 6. Loose pinion yoke nut. 7. Scuffed gear tooth contact surfaces.	1. Inspect axle tube alignment. Correct as necessary. 2. Inspect and correct as necessary. 3. Refer to pinion pre-load information and correct as necessary. 4. Check adjustment of the ring gear and pinion backlash. Correct as necessary. 5. Adjust the pinion bearings pre-load. 6. Tighten the pinion yoke nut. 7. Inspect and replace as necessary.

FRONT AXLE - 216FBI (Continued)

Condition	Possible Causes	Correction
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored yoke.	5. Replace yoke and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.

FRONT AXLE - 216FBI (Continued)

Condition	Possible Causes	Correction
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

FRONT AXLE - 216FBI (Continued)

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Position a lift under the axle and secure to the axle.

(3) Remove brake components.

(4) Remove vent hose from axle shaft tube.

(5) Remove propeller shaft.

(6) Remove stabilizer bar links at the axle (Fig. 1).

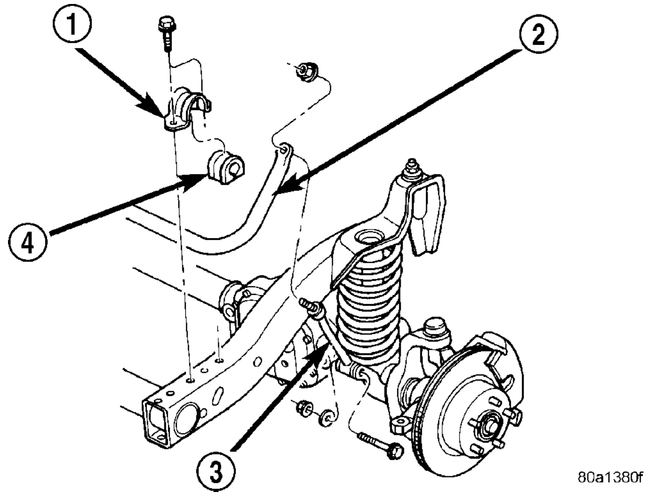

Fig. 1 STABILIZER BAR

1 - RETAINER
2 - STABILIZER BAR
3 - LINK
4 - BUSHING

(7) Remove shock absorbers from axle brackets (Fig. 2).

(8) Remove track bar from axle bracket (Fig. 3).

(9) Remove tie rod and drag link from steering knuckle.

(10) Remove steering damper from axle bracket.

(11) Remove upper and lower suspension arms from axle brackets.

(12) Lower lift enough to remove the axle. The coil springs will drop with the axle.

(13) Remove coil springs from the axle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. Failure to heed caution may result in damage.

(1) Install springs and retainers and tighten retainer bolts to 21 N·m (16 ft. lbs.).

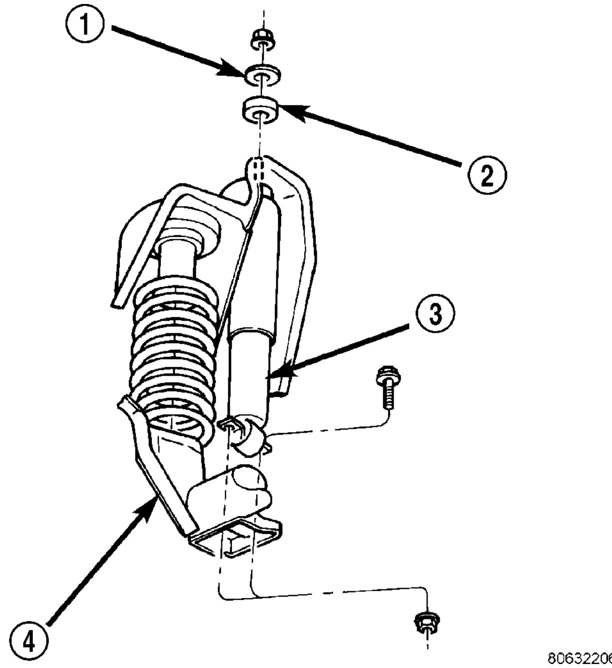

Fig. 2 COIL SPRING AND SHOCK ABSORBER

1 - RETAINER
2 - GROMMET
3 - SHOCK
4 - FRONT AXLE

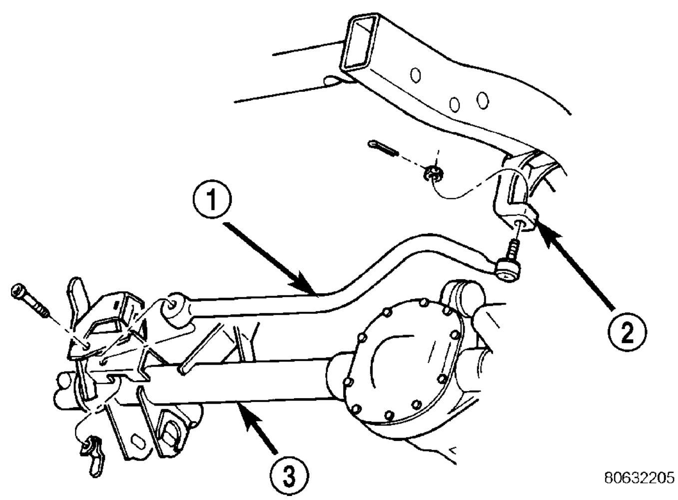

Fig. 3 TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - FRONT AXLE

(2) Position axle under vehicle and align it with the spring pads.

FRONT AXLE - 216FBI (Continued)

(3) Install upper and lower suspension arms in the axle brackets and loosely install bolts and nuts (Fig. 4).

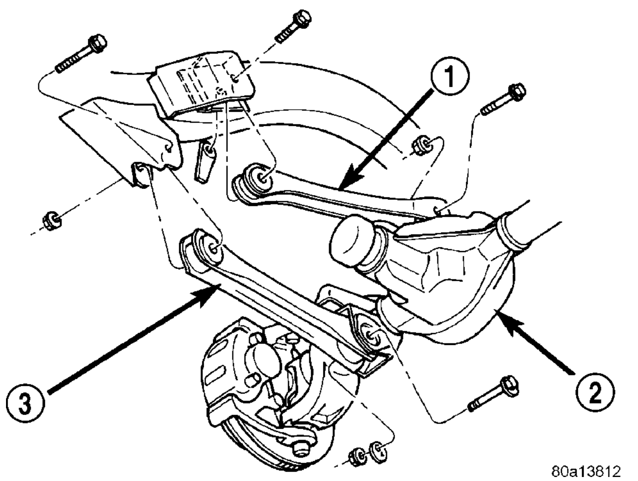

Fig. 4 UPPER AND LOWER SUSPENSION ARMS

1 - UPPER SUSPENSION ARM
2 - FRONT AXLE
3 - LOWER SUSPENSION ARM

(4) Connect the vent hose to the axle shaft tube.

(5) Install track bar to the axle bracket and loosely install bolt (Fig. 5).

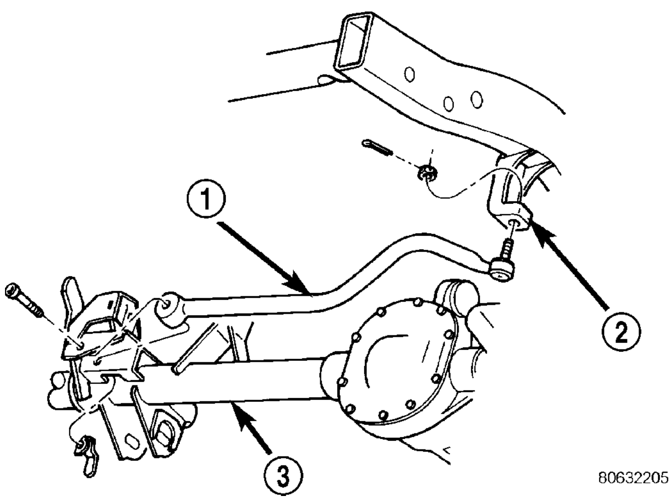

Fig. 5 TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - FRONT AXLE

(6) Install shock absorbers and tighten the bolts (Fig. 6) to torque specification.

(7) Install stabilizer bar links to the axle brackets and tighten nuts (Fig. 7) to torque specification.

(8) Install drag link and tie rod and tighten nut to torque specification

(9) Install steering damper to the axle bracket and tighten nut to torque specification.

(10) Install brake components.

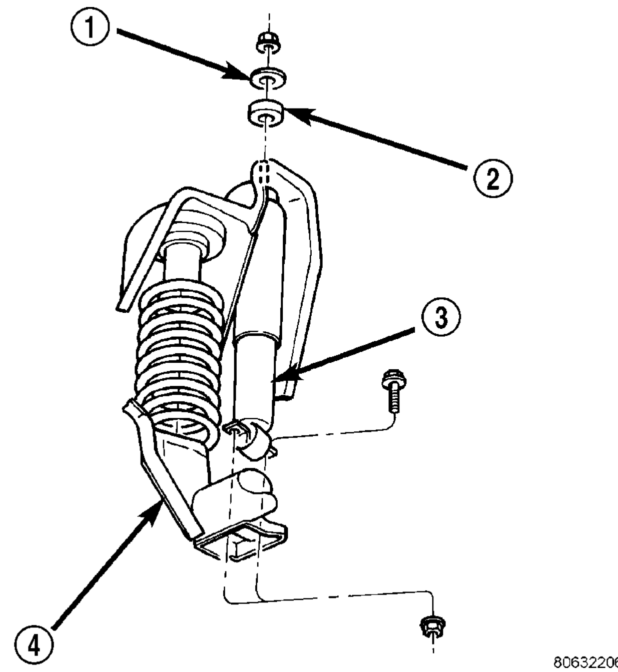

Fig. 6 COIL SPRING AND SHOCK ABSORBER

1 - RETAINER
2 - GROMMET
3 - SHOCK
4 - FRONT AXLE

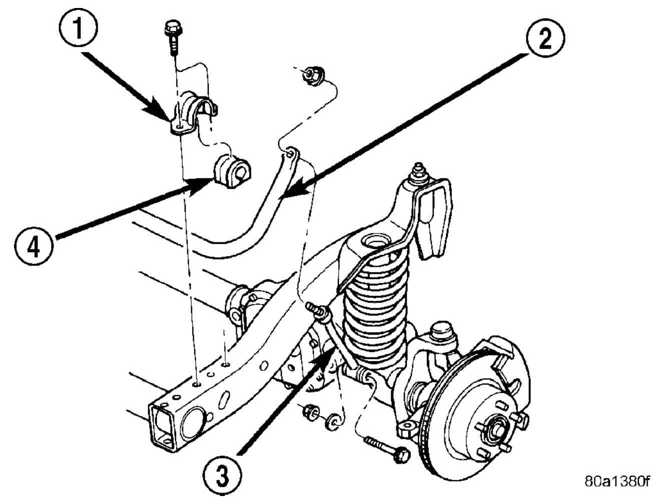

Fig. 7 STABILIZER BAR

1 - RETAINER
2 - STABILIZER BAR
3 - LINK
4 - BUSHING

(11) Install propeller shaft.

(12) Remove lift from the axle and lower vehicle.

(13) Tighten upper and lower control arm nuts to torque specification.

(14) Tighten track bar bolt at the axle bracket to torque specification.

(15) Check the front wheel alignment.

FRONT AXLE - 216FBI (Continued)

ADJUSTMENTS

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 8). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern in this section for additional information.

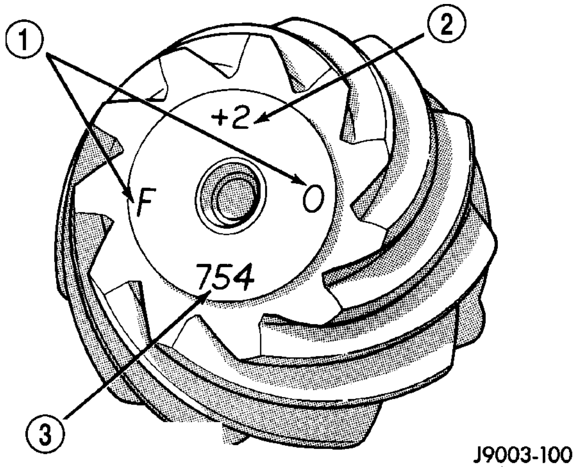

Fig. 8 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER

Compensation for pinion depth variance is achieved with a select shim/oil slinger. The shims are placed between the rear pinion bearing and the pinion gear head (Fig. 9).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion. Add or subtract this number from the thickness of the original depth shim/oil slinger to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

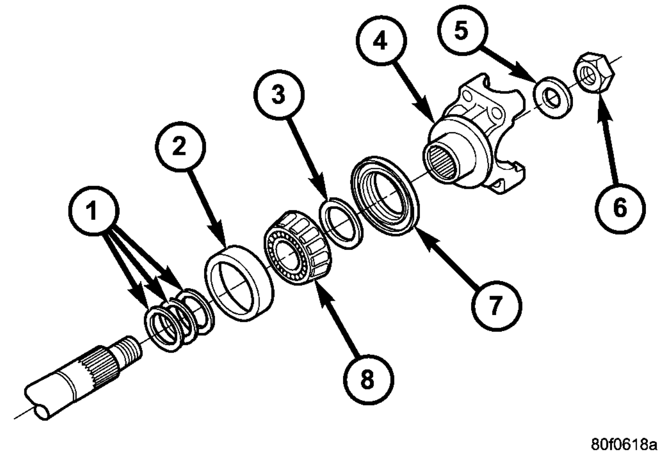

Fig. 9 PINION PRELOAD SHIMS

1 - PRELOAD SHIMS
2 - FRONT BEARING CUP
3 - SLINGER
4 - PINION YOKE
5 - WASHER
6 - PINION NUT
7 - PINION OIL SEAL
8 - FRONT PINION BEARING

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the pinion gear head (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

FRONT AXLE - 216FBI (Continued)

PINION GEAR DEPTH VARIANCE

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

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 10).

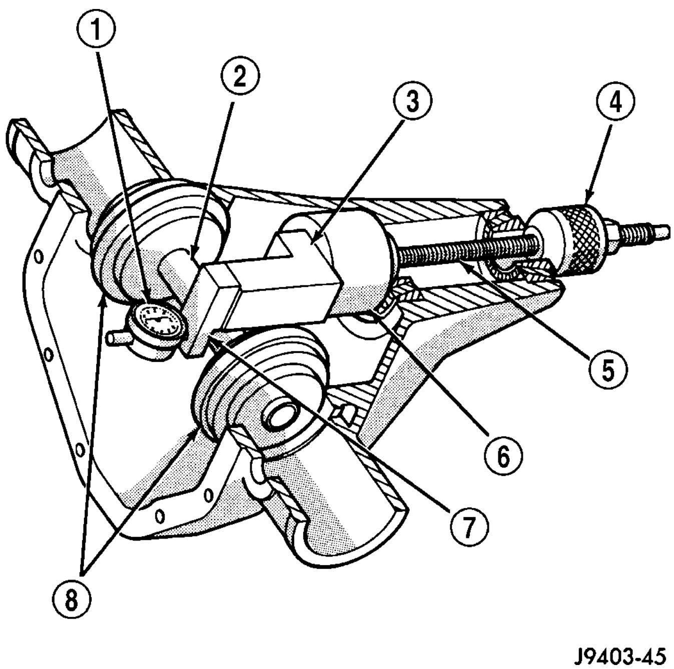

Fig. 10 PINION GEAR DEPTH GAUGE TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 6734 and rear pinion bearing onto Screw 6741 (Fig. 10).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 11).

(3) Install front pinion bearing and Cone-nut 6740 hand tight.

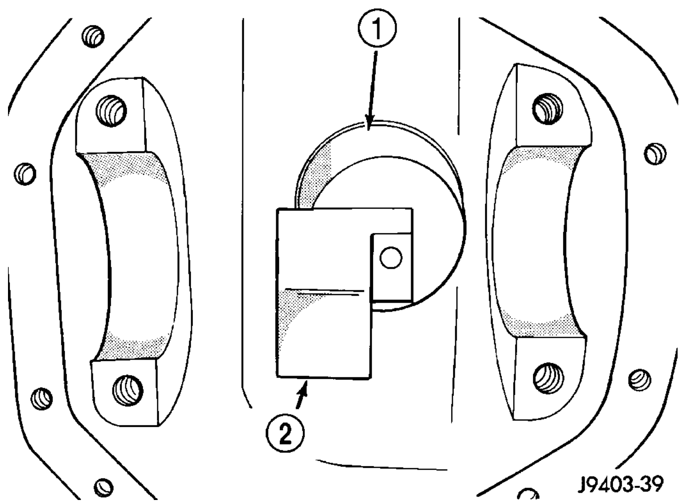

Fig. 11 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

FRONT AXLE - 216FBI (Continued)

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in the housing side bearing cradles (Fig. 12).

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

(5) Install differential bearing caps on arbor discs and install bearing cap bolts. Tighten bearing cap bolts to 108 N·m (80 ft. lbs.).

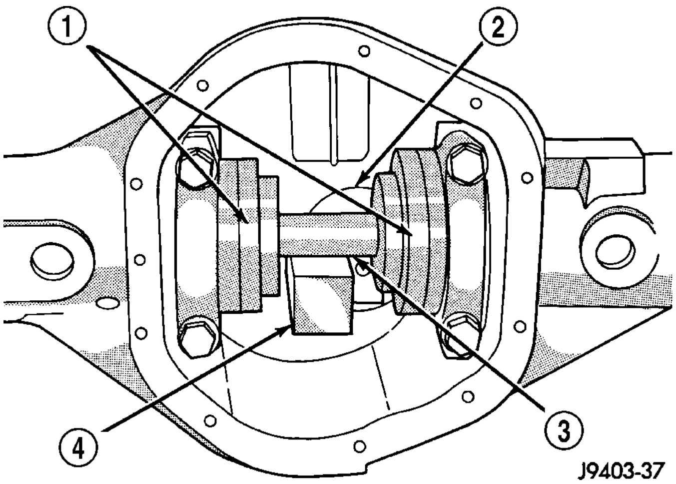

Fig. 12 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

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

(7) Position Scooter Block/Dial Indicator flush on the pinion height block. Hold scooter block and zero the dial indicator.

(8) Slowly slide the scooter block across the pinion height block over to the arbor (Fig. 13). Move the scooter block till dial indicator crests the arbor, then record the highest reading.

(9) Select a shim/oil slinger equal to the dial indicator reading plus the pinion depth variance number etched in the face of the pinion (Fig. 8). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

PRELOAD SHIM SELECTION

Differential side bearing preload and gear backlash is achieved by selective shims positioned between the differential side bearing cups and the housing. The proper shim thickness is determined using slip-fit Dummy Bearings D-345 in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 14). Differential shim measurements are performed with spreader W-129-B removed.

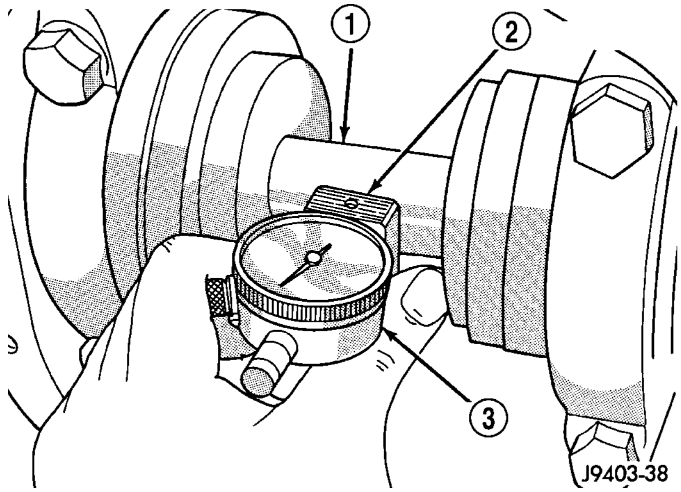

Fig. 13 PINION DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

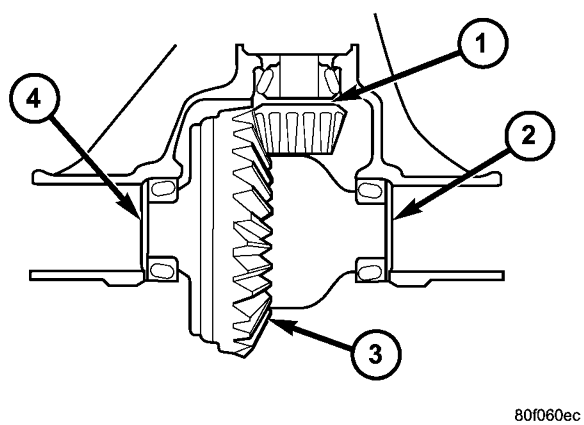

Fig. 14 SHIM LOCATION

1. PINION DEPTH SHIM
2. DIFFERENTIAL SHIM PINION GEAR SIDE
3. RING GEAR
4. DIFFERENTIAL SHIM RING GEAR SIDE

FRONT AXLE - 216FBI (Continued)

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

(1) Remove differential side bearings from differential case.

(2) Remove factory installed shims from differential case.

(3) Install ring gear on differential case and tighten bolts to specification.

(4) Install dummy side bearings D-345 on differential case.

(5) Install differential case in the housing.

(6) Install the marked bearing caps in their correct positions and snug the bolts (Fig. 15).

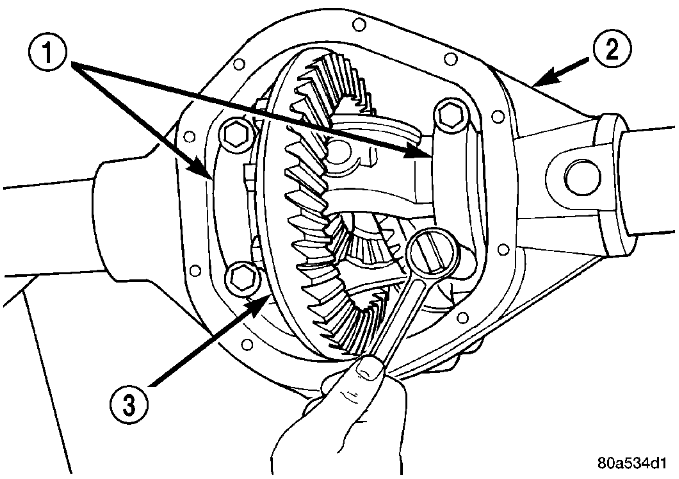

Fig. 15 BEARING CAP BOLTS

1 - BEARING CAP
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

(7) With a dead-blow hammer, seat the differential dummy bearings to each side of the housing (Fig. 16) and (Fig. 17).

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 18).

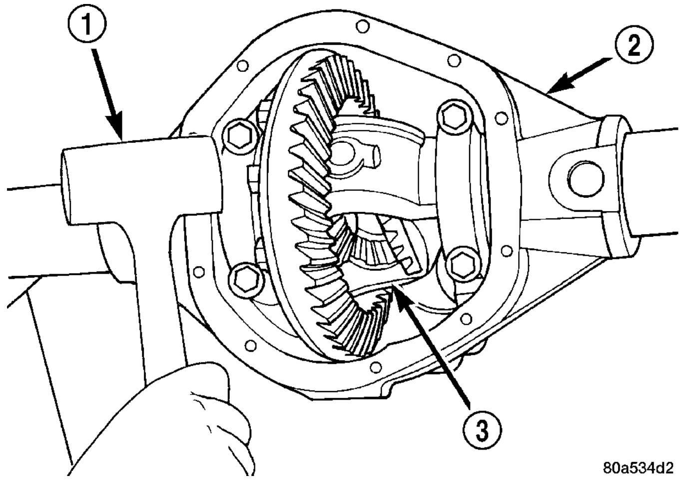

Fig. 16 SEAT DUMMY BEARING PINION SIDE

1 - DEAD-BLOW HAMMER
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

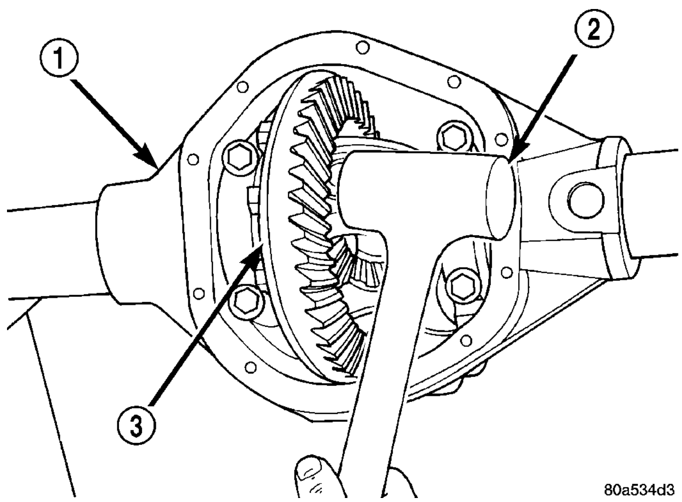

Fig. 17 SEAT DUMMY BEARING RING GEAR SIDE

1 - DIFFERENTIAL HOUSING
2 - DEAD-BLOW HAMMER
3 - DIFFERENTIAL CASE

FRONT AXLE - 216FBI (Continued)

(9) Attach the Dial Indicator C-3339 to pilot stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 18).

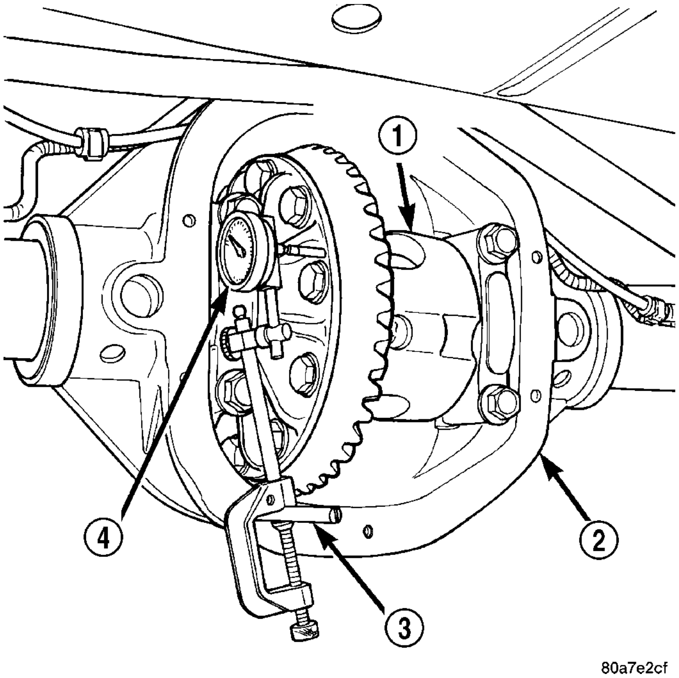

Fig. 18 DIFFERENTIAL SIDE PLAY MEASUREMENT

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 19).

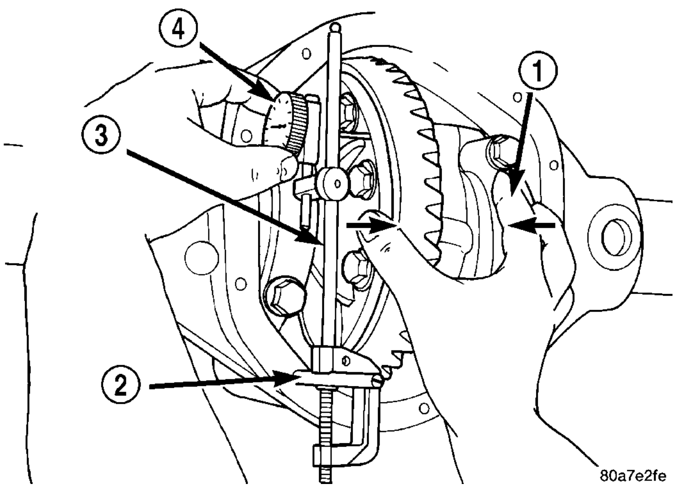

Fig. 19 DIAL INDICATOR LOCATION

1 - DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - DIAL INDICATOR ARM
4 - DIAL INDICATOR FACE

(11) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 20).

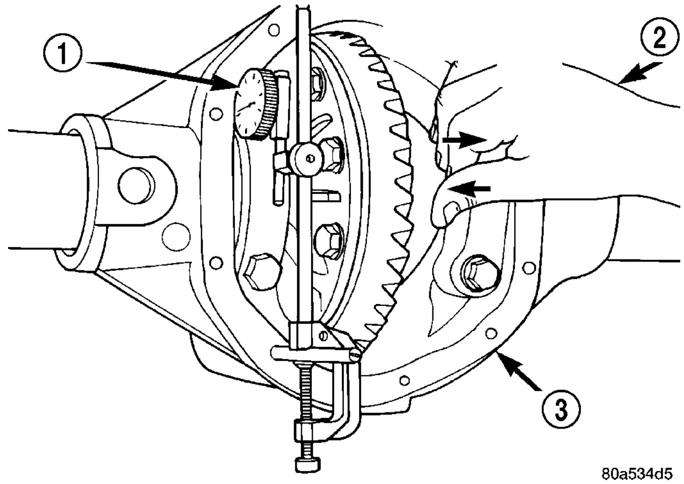

Fig. 20 RECORD DIAL INDICATOR READING

1 - DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(12) Add 0.25 mm (0.010 in.) to the zero end play total. This total represents the thickness of shims needed to preload the new bearings when the differential is installed.

(13) Rotate dial indicator out of the way on the pilot stud.

(14) Remove differential case and dummy bearings from the housing.

(15) Install the pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.

(16) Install differential case and dummy bearings D-345 in the housing (without shims), install bearing caps and tighten bolts snug.

(17) Seat ring gear side dummy bearing (Fig. 17).

(18) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 18).

FRONT AXLE - 216FBI (Continued)

(19) Push and hold differential case toward pinion gear and zero dial indicator (Fig. 21).

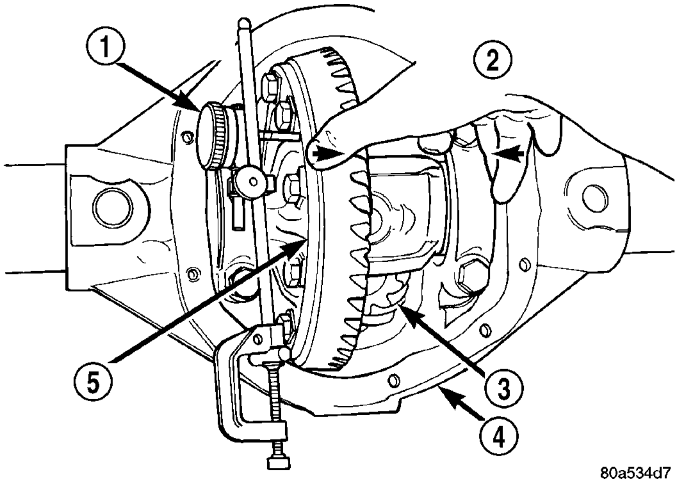

Fig. 21 ZERO DIAL INDICATOR

1 - DIAL INDICATOR FACE
2 - DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(20) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 22). Subtract 0.05 mm (0.002 in.) from this reading. This is the shim thickness for the ring gear side.

NOTE: This is the shim needed on the ring gear side for proper backlash.

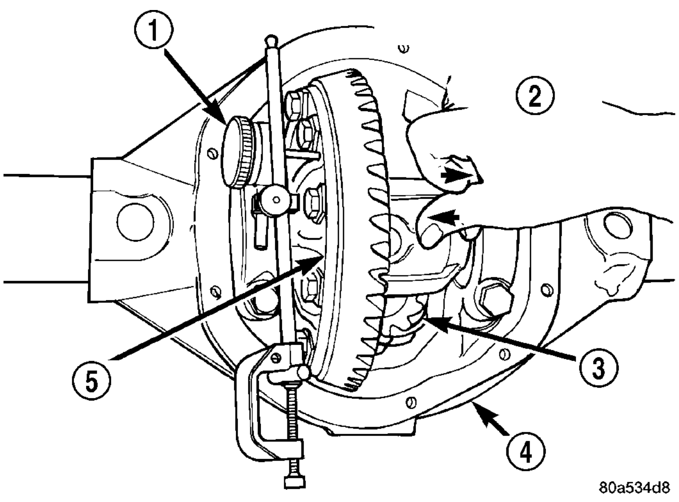

Fig. 22 RECORD DIAL INDICATOR READING

1 - DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(21) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.

(22) Rotate dial indicator out of the way on pilot stud.

(23) Remove differential case and dummy bearings from the housing.

(24) Install the selected shims onto the differential case hubs.

(25) Install side bearings on differential case hubs with Install C-3716-A and Handle C-4171.

(26) Install bearing cups on differential.

(27) Install Spreader W-129-B and some items from Adapter Set 6987 on the housing and spread open enough to receive differential case.

CAUTION: Do not spread housing over 0.38 mm (0.015 in.). Failure to heed caution may result in damage.

(28) Install differential case into the housing.

(29) Remove spreader from the housing.

(30) Rotate the differential case several times to seat the side bearings.

(31) Position the indicator plunger against a ring gear tooth (Fig. 23).

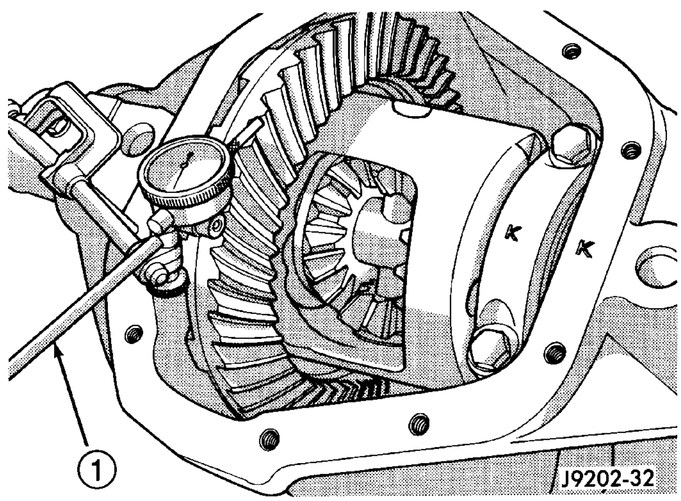

Fig. 23 RING GEAR BACKLASH MEASUREMENT

1 - DIAL INDICATOR

(32) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(33) Zero dial indicator face to pointer.

(34) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in. - 0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other (Fig. 24).

FRONT AXLE - 216FBI (Continued)

(35) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

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

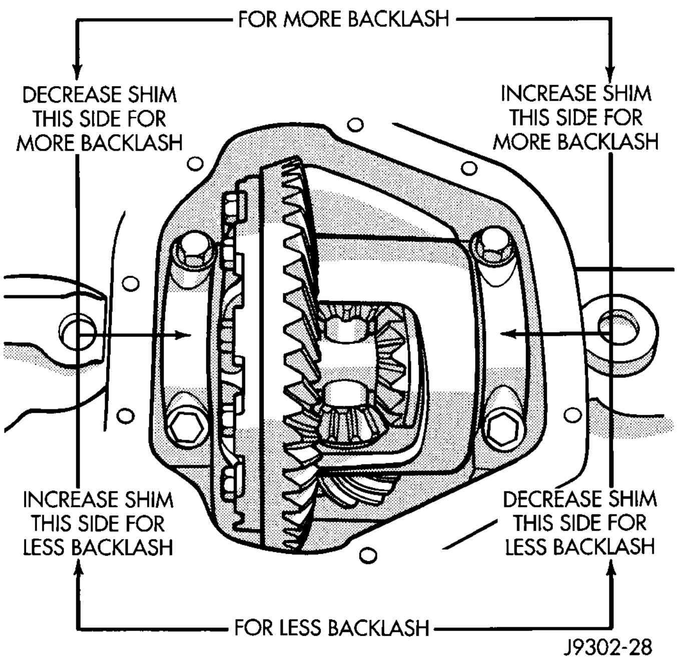

Fig. 24 BACKLASH SHIM

GEAR CONTACT PATTERN

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

The TOP LAND of the gear tooth is the top surface of the tooth. The PROFILE of the gear tooth is the depth of the tooth. The TOE of the gear is the portion of the tooth surface at the end towards the center. The HEEL of the gear is the portion of the tooth at the outer-end. The ROOT of the gear tooth is the lowest portion of the tooth (Fig. 25).

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

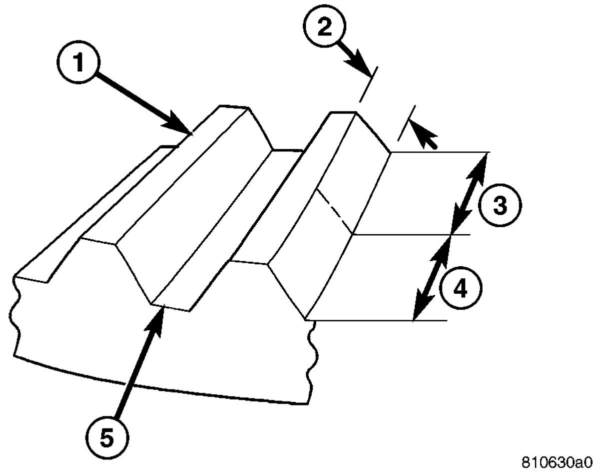

Fig. 25 GEAR DESCRIPTION

1 - TOP LAND
2 - PROFILE
3 - TOE
4 - HEEL
5 - ROOT

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) With a boxed end wrench on the ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 26) and (Fig. 27) and adjust pinion depth and gear backlash as necessary.

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

FRONT AXLE - 216FBI (Continued)

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

8106312d

Fig. 26 PATTERN INTERPRETATION (GEAR CUT 2 AXIS)

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

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Fig. 27 PATTERN INTERPRETATION (GEAR CUT 3 AXIS)

FRONT AXLE - 216FBI (Continued)

SPECIFICATIONS

FRONT AXLE

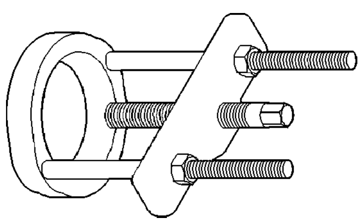
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	4.10
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Pinion Bearing Preload - Original Bearing	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearing	2.3-4.5 N·m (20-40 in. lbs.)

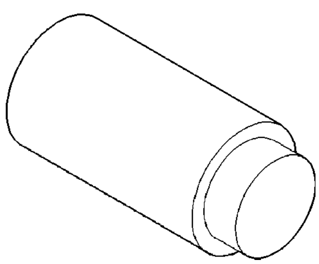
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Plug	34	25	-
Drain Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	108	80	-
Pinion Nut	217-271	160-200	-
Ring Gear Bolts	136	100	-
Axle Nut	237	175	-

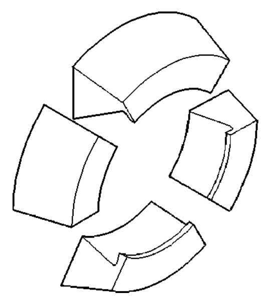
SPECIAL TOOLS



PULLER- C-293-PA

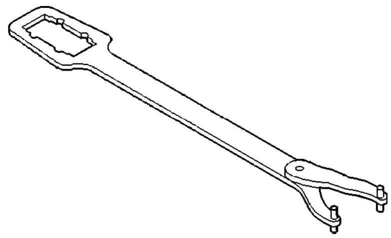


PLUG C-293-3

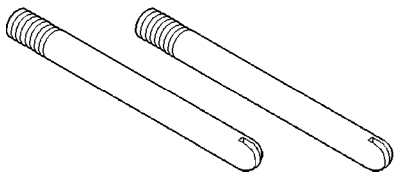


ADAPTERS C-293-39

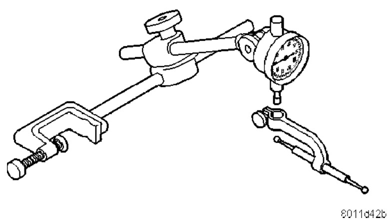
FRONT AXLE - 216FBI (Continued)



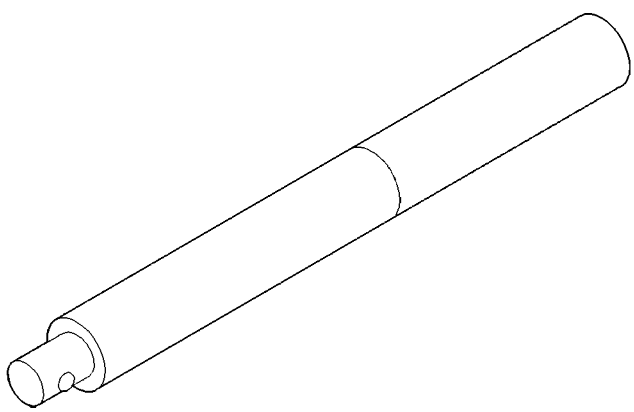
FLANGE WRENCH C-3281



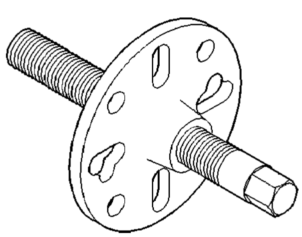
PILOT STUDS C-3288-B



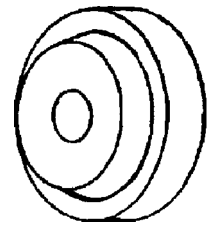
DIAL INDICATOR C-3339



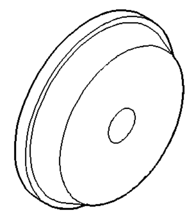
HANDLE C-4171



REMOVER C-452



INSTALLER D-144



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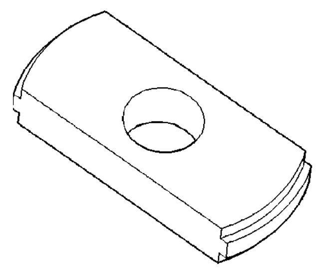

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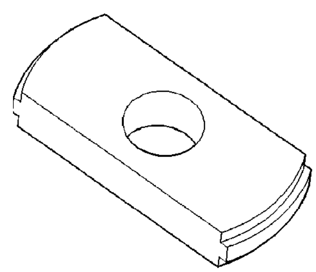
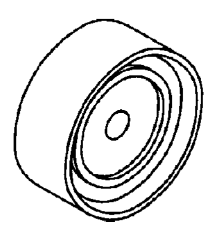
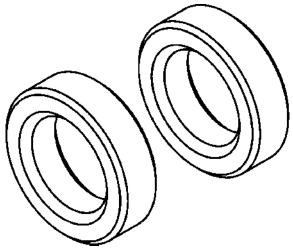


REMOVER D-148

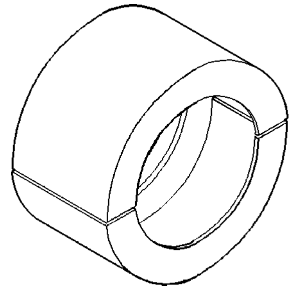


INSTALLER D-156

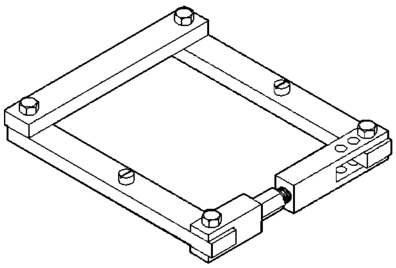
FRONT AXLE - 216FBI (Continued)



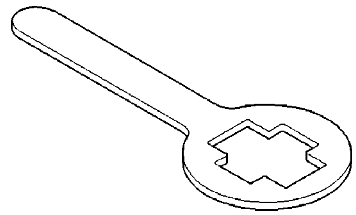
DUMMY BEARINGS D-345



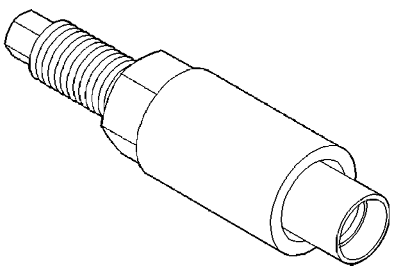
JAWS 6447



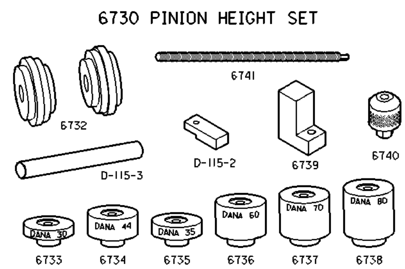
SPREADER W-129-B



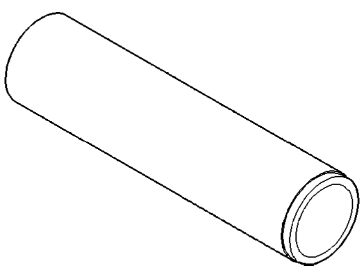
HOLDER YOKE 6719A



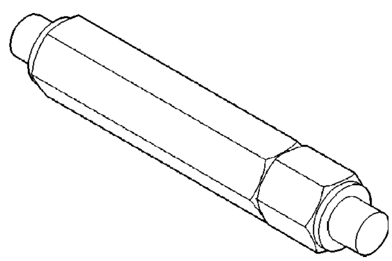
INSTALLER W-162-D



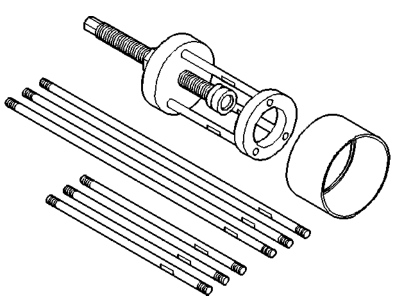
PINION DEPTH SET 6730



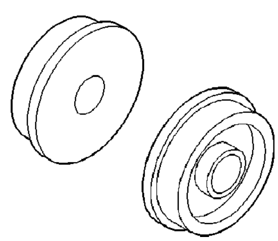
INSTALLER W-262



TURNBUCKLE 6797



PULLER 6444



INSTALLER DISCS 8110

AXLE SHAFTS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.
(2) Remove brake components.
(3) Remove cotter pin, nut retainer and axle hub nut.
(4) Remove hub bearing bolts (Fig. 28).

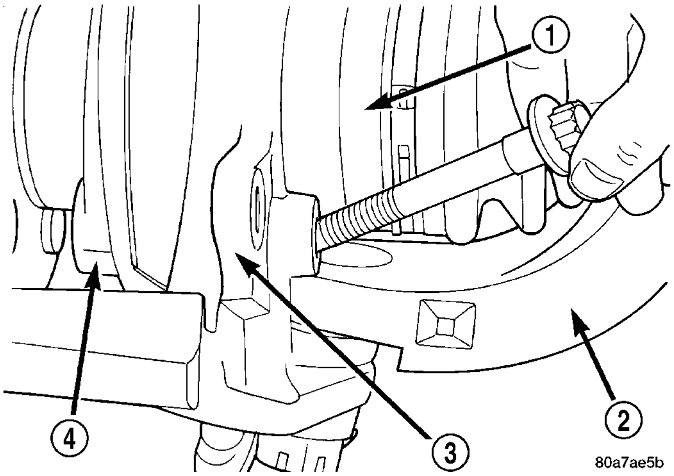


Fig. 28 HUB BEARING BOLTS

1 - AXLE SHAFT
2 - AXLE
3 - KNUCKLE
4 - HUB BEARING

(5) Remove hub bearing from steering knuckle.

(6) Remove axle shaft assembly (Fig. 29) from axle

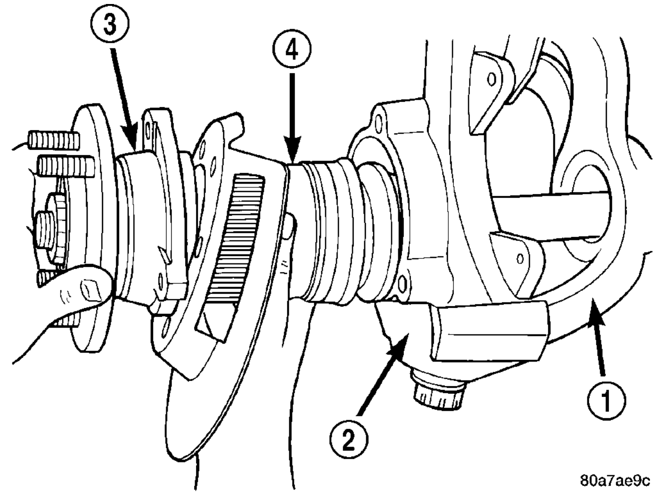


Fig. 29 HUB BEARING AND AXLE

1 - AXLE
2 - KNUCKLE
3 - HUB BEARING
4 - AXLE SHAFT

(7) Remove brake rotor shield from the hub bearing or knuckle.

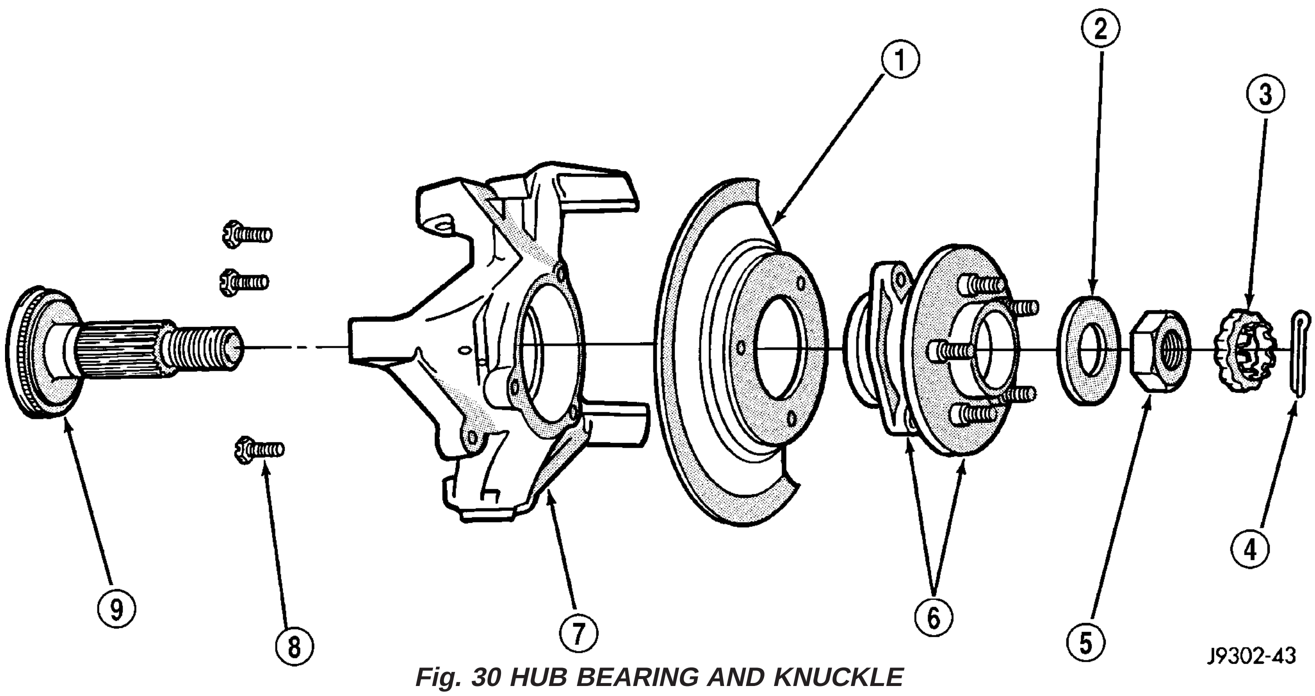


Fig. 30 HUB BEARING AND KNUCKLE

1 - BRAKE SHIELD
2 - WASHER
3 - RETAINER
4 - COTTER PIN
5 - NUT
6 - HUB AND BEARING ASSEMBLY
7 - STEERING KNUCKLE
8 - BOLT
9 - TONE WHEEL (ABS)

AXLE SHAFTS (Continued)

INSTALLATION

(1) Clean axle shaft and apply a thin film of Mopar Wheel Bearing Grease or equivalent to the shaft splines, seal contact surface and hub bore.

(2) Install brake rotor shield on knuckle.

(3) Install axle shaft into differential side gears.

(4) Install hub bearing and tighten bolts to 102 N·m (75 ft. lbs.).

(5) Install axle washer and nut. Tighten nut to 237 N·m (175 ft. lbs.) and install nut retainer and cotter pin (Fig. 30).

(6) Install brake components.

AXLE SHAFT SEALS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove axle shafts (Fig. 31).

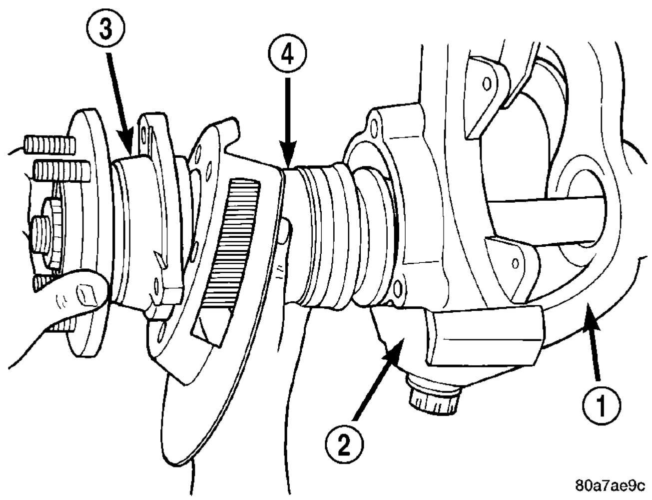


Fig. 31 HUB BEARING AND AXLE ASSEMBLY

1 - AXLE
2 - KNUCKLE
3 - HUB BEARING
4 - AXLE SHAFT

(3) Remove differential assembly (Fig. 32).

(4) Remove inner axle shaft seals with a pry bar.

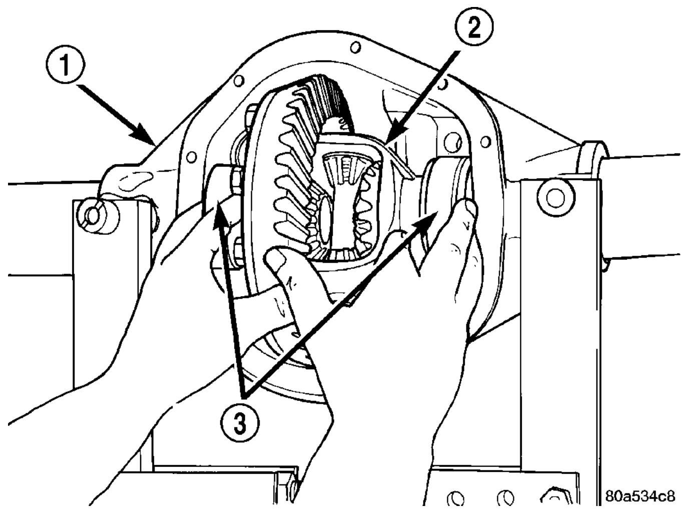


Fig. 32 DIFFERENTIAL CASE

1 - AXLE HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

INSTALLATION

(1) Remove any sealer remaining from original seals.

(2) Install oil seals with Discs 8110 and Turnbuckle 6797 (Fig. 33). Tighten tool until disc bottoms in housing.

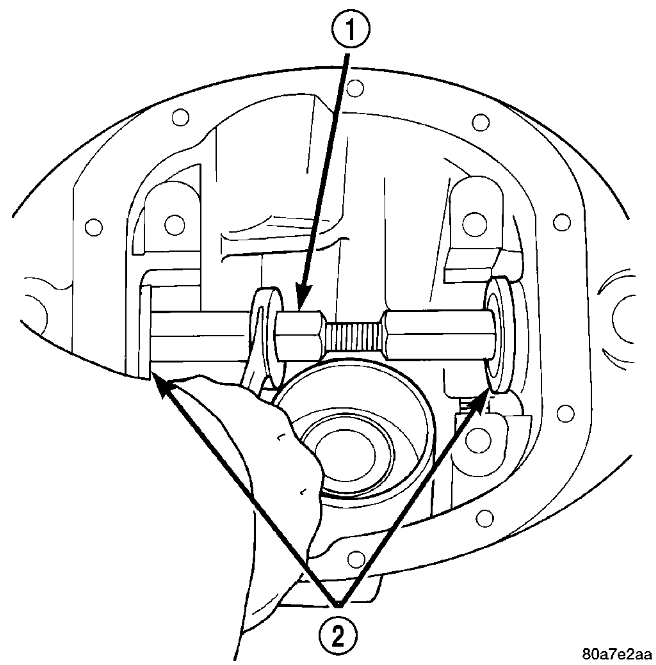


Fig. 33 AXLE SEAL INSTALLER

1 - TURNBUCKLE
2 - DISCS

(3) Install differential and axle shafts.

SINGLE CARDAN UNIVERSAL JOINT

REMOVAL

CAUTION: Clamp only the narrow forged portion of the yoke in the vise. Failure to heed caution may result in damage.

(1) Remove axle shaft.

(2) Remove bearing cap retaining snap rings (Fig. 34).

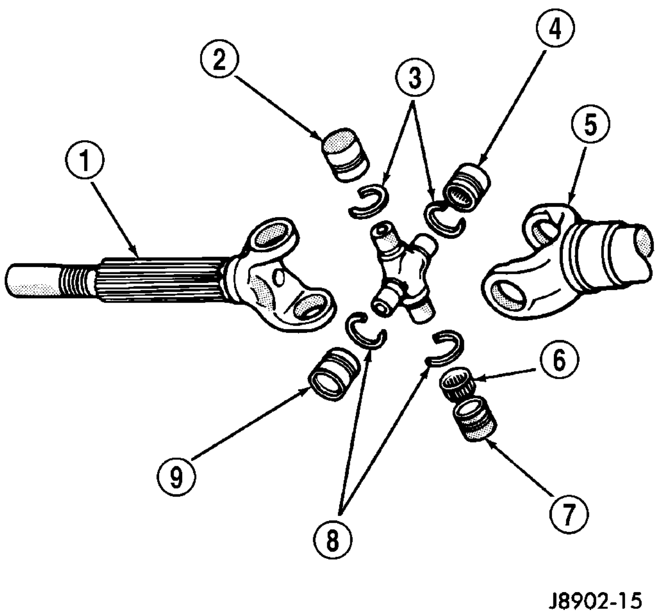


Fig. 34 AXLE SHAFT OUTER U-JOINT

1 - SHAFT YOKE
2 - BEARING CAP
3 - SNAP RINGS
4 - BEARING CAP
5 - SPINDLE YOKE
6 - BEARING
7 - BEARING CAP
8 - SNAP RINGS
9 - BEARING CAP

NOTE: Saturate the bearing caps with penetrating oil prior to removal.

(3) Place a socket (receiver) with an inside diameter larger than the bearing cap against the yoke and the perimeter of the bearing cap to be removed.

(4) Place a socket (driver) with an outside diameter smaller than the bearing cap against the opposite bearing cap.

(5) Position yoke with the sockets in a vise (Fig. 35).

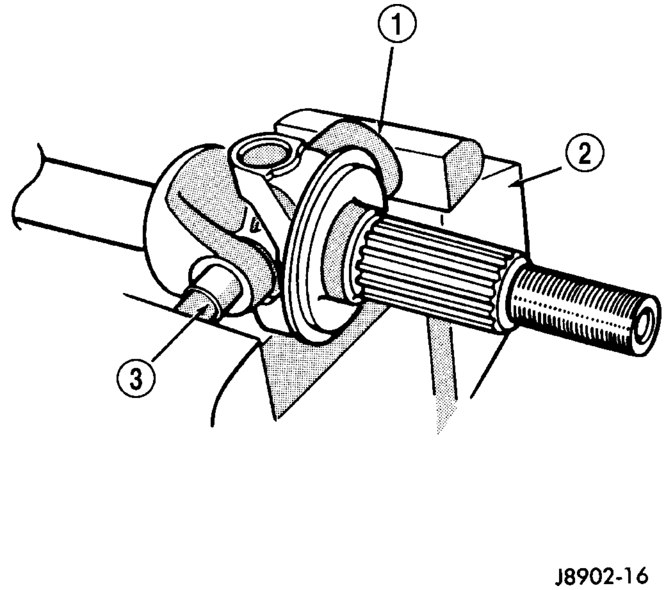


Fig. 35 YOKE BEARING CAP

1 - LARGE-DIAMETER SOCKET
2 - VISE
3 - SMALL-DIAMETER SOCKET

(6) Tighten vise jaws, to force bearing cap into the socket (receiver).

(7) Release vise jaws. Remove sockets and bearing cap forced out of the yoke.

(8) Repeat above procedure for the remaining bearing cap and remove cross from propeller shaft yoke.

INSTALLATION

CAUTION: Keep cross and bearing cap straight during installation. Failure to heed caution may result in damage.

(1) Pack bearing caps 1/3 full of wheel bearing lubricant (Fig. 36). Apply extreme pressure (EP), lithium-base lubricant to aid in installation.

(2) Position cross in the yoke. Insert seals and bearings, then tap bearing caps into the yoke bores far enough to hold spider in position.

(3) Place socket (driver) against one bearing cap. Position yoke with the socket in a vise.

(4) Tighten vise to force bearing caps into the yoke. Force the caps enough to install retaining clips.

(5) Install bearing cap retaining clips.

(6) Install axle shaft.

SINGLE CARDAN UNIVERSAL JOINT (Continued)

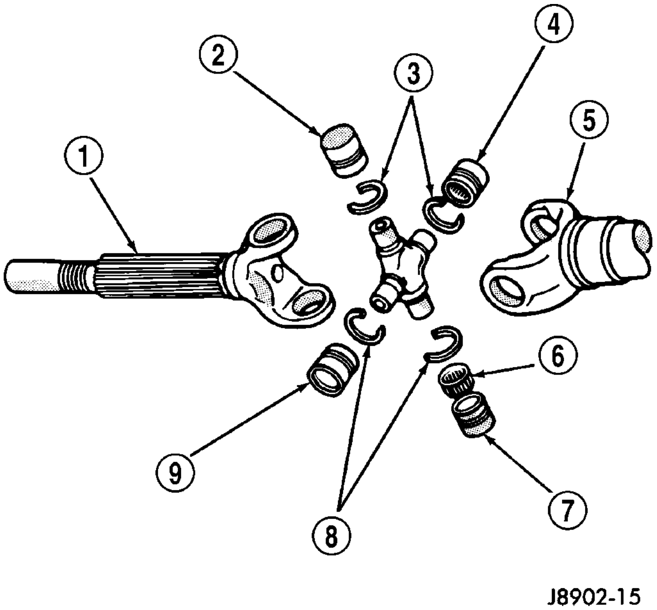


Fig. 36 AXLE SHAFT OUTER U-JOINT

1 - SHAFT YOKE
2 - BEARING CAP
3 - SNAP RINGS
4 - BEARING CAP
5 - SPINDLE YOKE
6 - BEARING
7 - BEARING CAP
8 - SNAP RINGS
9 - BEARING CAP

PINION SEAL

REMOVAL

(1) Mark the propeller shaft and pinion yoke for installation reference.

(2) Remove propeller shaft from the yoke.

(3) Rotate pinion gear three or four times and verify it rotates smoothly.

(4) Remove pinion yoke nut and washer with Remover C-452 and Flange Wrench C-3281 (Fig. 37).

(5) Remove pinion shaft seal with a pry tool or slide hammer mounted screw.

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with an appropriate installer (Fig. 38).

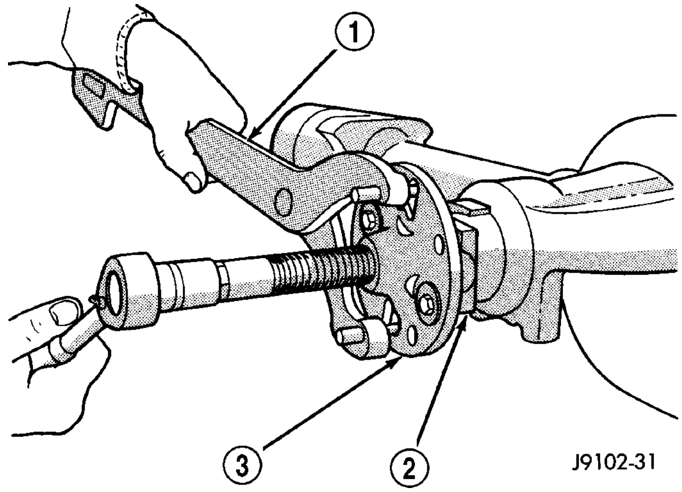


Fig. 37 PINION YOKE REMOVER

1 - WRENCH
2 - YOKE
3 - PULLER

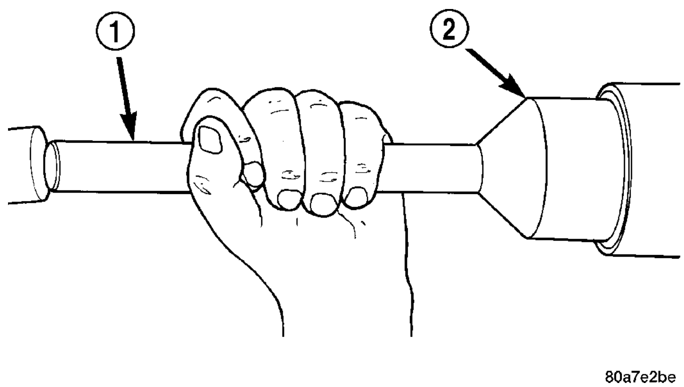


Fig. 38 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(2) Install yoke on the pinion gear with Installer W-162-D and Spanner Wrench 6958 (Fig. 39).

(3) Install a **new** nut on the pinion gear and tighten the nut to 217-271 N·m (160-200 in. lbs.) (Fig. 40).

(4) Installation propeller shaft with reference marks aligned.

(5) Check and add gear lubricant to axle if necessary.

PINION SEAL (Continued)

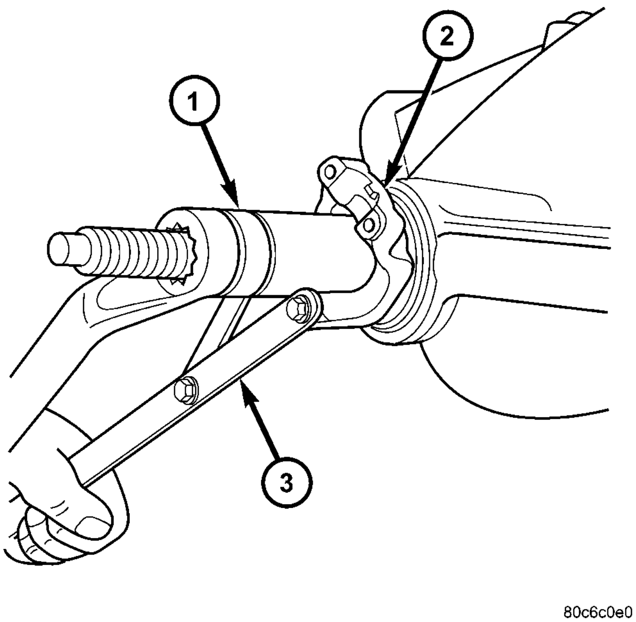


Fig. 39 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

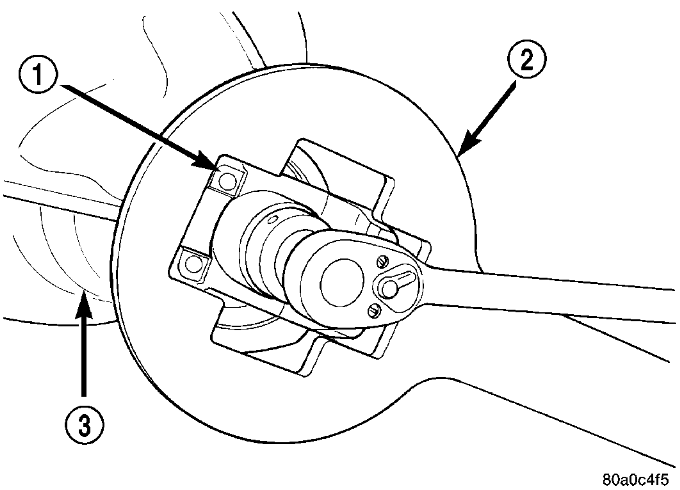


Fig. 40 PINION SHAFT NUT

1 - PINION FLANGE
2 - HOLDING TOOL
3 - DIFFERENTIAL HOUSING

DIFFERENTIAL COVER

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove drain plug.

(3) Disconnect indicator switch harness and remove connector from differential cover (Fig. 41).

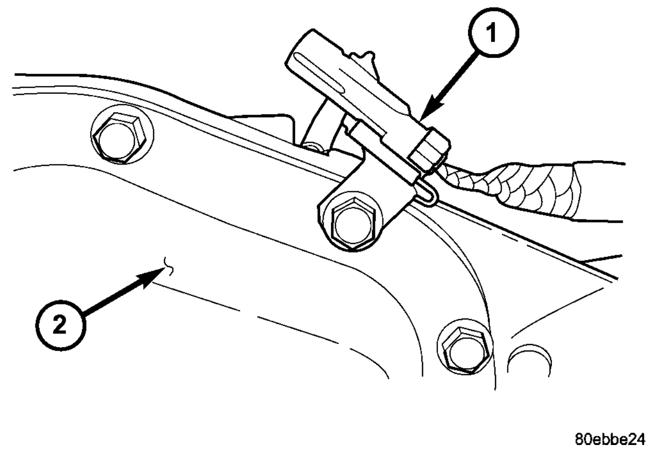


Fig. 41 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(4) Remove cover bolts.

(5) Remove cover and drain lubricant.

INSTALLATION

(1) Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 42).

CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.

(2) Install cover, identification tag and indicator switch connector (Fig. 43). Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).

(3) Connect indicator switch harness.

(4) Fill differential to specifications.

(5) Install fill plug and tighten to 34 N·m (25 ft. lbs.).

DIFFERENTIAL COVER (Continued)

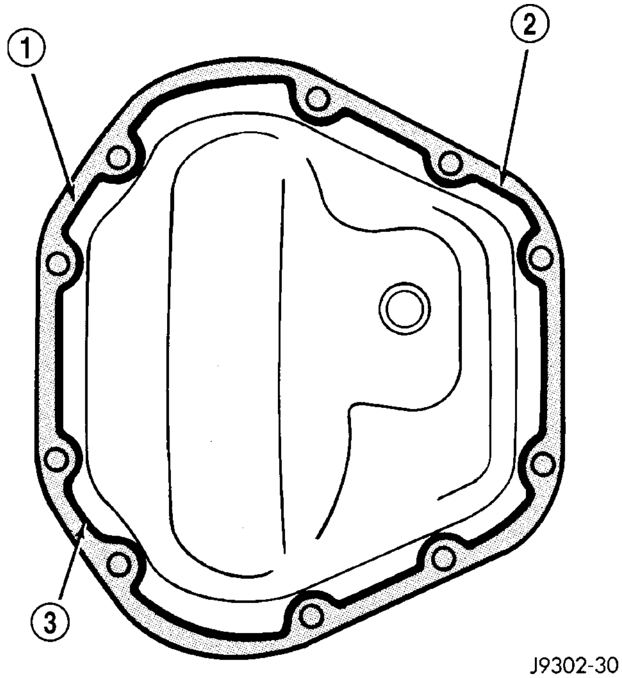


Fig. 42 HOUSING COVER - TYPICAL

1 - SEALANT SURFACE
2 - SEALANT
3 - SEALANT THICKESS

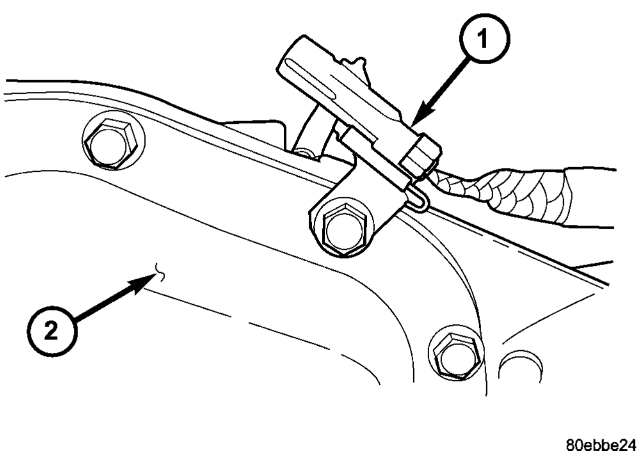


Fig. 43 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

DIFFERENTIAL - TRU-LOK

DESCRIPTION

The differential is a locking differential, that provides a positive mechanical connection between the right and left axle when engauged. The differential uses a dog clutch to connection the right and left axle.

OPERATION

The Tru-lok differential is activated by the axle lock switch located on the dash panel. When the switch is activated, an air pump with a built-in pressure regulator sends 5 PSI of air pressure to a accuator diaphragm in the differential housing. The diaphragm then engages a dog clutch and a position switch. The dog clutch has one gear attached to the differential case and another gear attached to a differential side gear. When the dog clutch is engaged the right and left wheels turn at the same speed. The position switch lights a lamp on the dash to indicate the system has been engaged. The differential works as standard differential when not engaged.

NOTE: The differential is serviced as an assembly, the diaphragm and indicator switch are serviced separately. The differential case must be removed to service the diaphragm actuator and indicator switch.

DIAGNOSIS AND TESTING

UNLOCKED

(1) Block tires opposite the axle to be tested to prevent the vehicle from rolling.

(2) Place transfer case in 4WD Low and automantic transmission in Park (1st gear if manual transmission).

(3) Raise both wheels of the axle to be tested off the ground.

(4) Turn ignition to the ON position and dash switch to the OFF position.

(5) Rotate one tire by hand. The other tire should spin in the opposite direction.

NOTE: If wheel cannot be rotated the differential must be repaired/replaced.

DIFFERENTIAL - TRU-LOK (Continued)

LOCKED

(1) Block tires opposite the axle to be tested to prevent the vehicle from rolling.

(2) Place transfer case in 4WD Low and automantic transmission in Park (1st gear if manual transmission).

(3) Raise both wheels of the axle to be tested off the ground.

(4) Turn ignition to the ON position and dash switch to the ON position.

(5) Try to rotate one tire by hand. You should not be able to rotate the tire.

NOTE: If wheel does rotate verify locker pump operation. If the pump is operating properly the differential must be repaired/replaced.

TRU-LOK INDICATOR SWITCH

(1) Turn ignition switch off.

(2) Disconnect indicator switch harness (Fig. 44) from the differential housing.

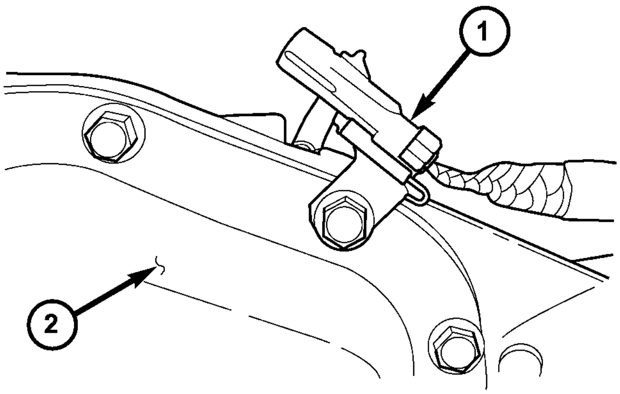


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Fig. 44 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(3) Measure electrical continuity across the switch terminals. Circuit should be closed (zero resistance).

NOTE: If circuit is not closed remove differential and replace locker indicator switch.

TRU-LOK PUMPS

(1) Connect a pressure gauge to the front pump.

(2) Place transfer case in 4WD Low and automatic transmission in Park (1st gear if manual transmission).

(3) Turn ignition to the ON position and push the dash switch twice to activate the front pump.

NOTE: If pump is not running, verify pump has (Fig. 45) 12 volts and a ground.

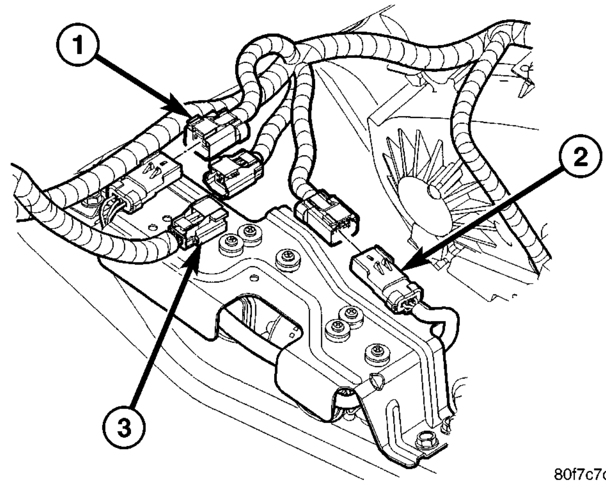

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Fig. 45 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

(4) With the pump running the pressure gauge should show 5 psi..

NOTE: If pump does not produce 5 psi. replace the pump.

REMOVAL

(1) Remove drain plug from the differential housing.

(2) Disconnect indicator switch harness and remove connector from differential cover (Fig. 46).

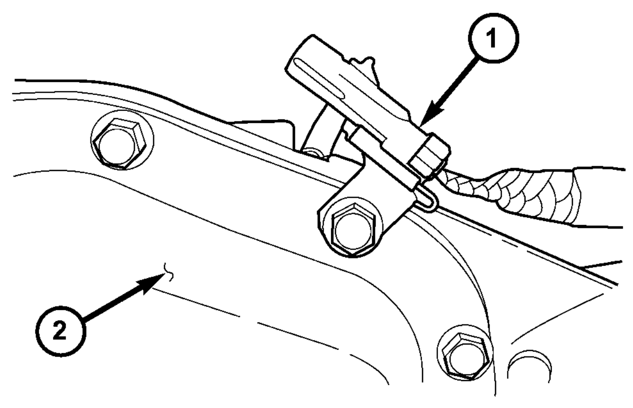

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Fig. 46 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(3) Remove differential housing cover.

DIFFERENTIAL - TRU-LOK (Continued)

(4) Remove axle shafts.

(5) Remove pressure hose from actuator assembly (Fig. 47).

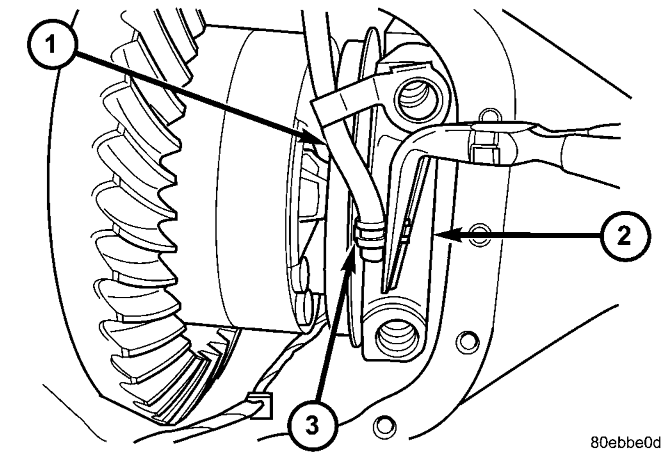


Fig. 47 PRESSURE HOSE

1 - PRESSURE HOSE
2 - BEARING CAP
3 - PRESSURE HOSE CLAMP

(6) Note the reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 48).

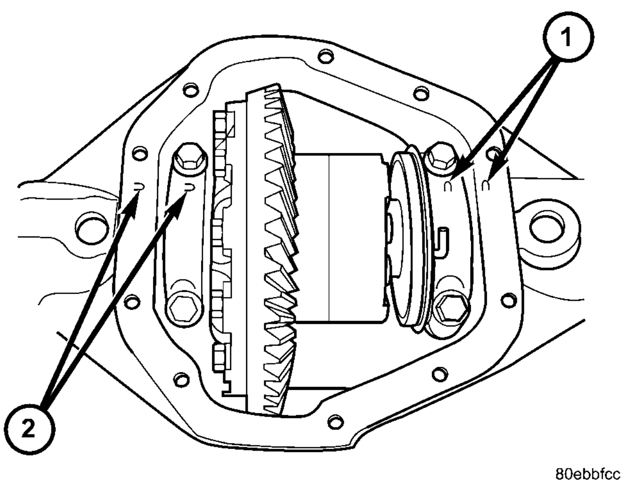


Fig. 48 BEARING CAP REFERENCE MARKS

1 - REFERENCE MARKS
2 - REFERENCE MARKS

(7) Loosen differential bearing cap bolts.

(8) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 49). Install hold-down clamps and tighten the turnbuckle finger-tight.

(9) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud (Fig. 50). Load indicator plunger against the opposite side of the housing and zero the indicator.

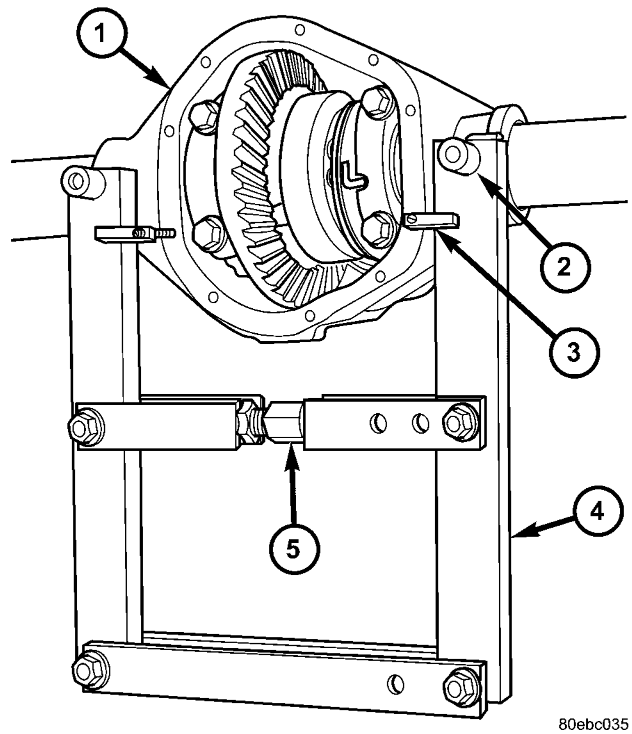


Fig. 49 SPREADER LOCATION

1 - DIFFERENTIAL CASE
2 - ADAPTER
3 - HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

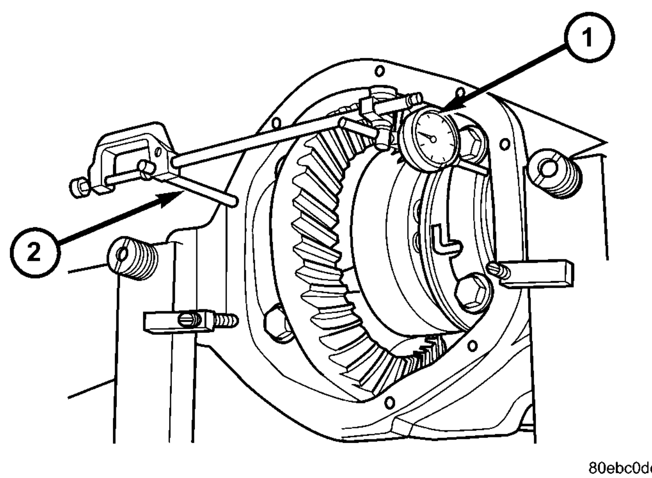


Fig. 50 DIAL INDICATOR LOCATION

1 - DIAL INDICATOR
2 - PILOT STUD

CAUTION: Never spread the housing over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

(10) Spread housing while measuring the distance with the dial indicator (Fig. 51).

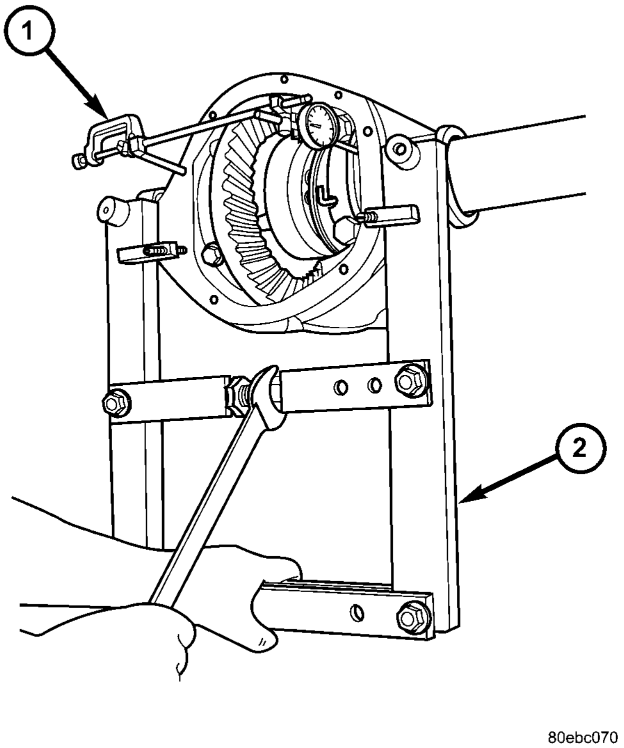


Fig. 51 SPREAD DIFFERENTIAL CASE

1 - DIAL INDICATOR
2 - SPREADER

(11) Remove dial indicator.

(12) Remove differential bearing cap bolts and ring gear side bearing cap.

(13) Remove differential from housing with pinion gear side bearing cap (Fig. 52) and tag differential bearing cups and preload shims to indicate location.

CAUTION: Do not bend actuator mounting tabs, during differential removal. Failure to heed caution may result in damage.

(14) Remove spreader from housing.

(15) Remove indicator switch (Fig. 53) from differential housing.

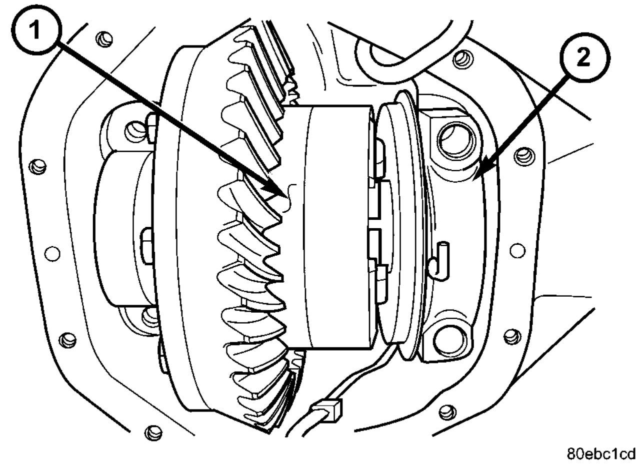


Fig. 52 DIFFERENTIAL

1 - DIFFERENTIAL
2 - BEARING CAP

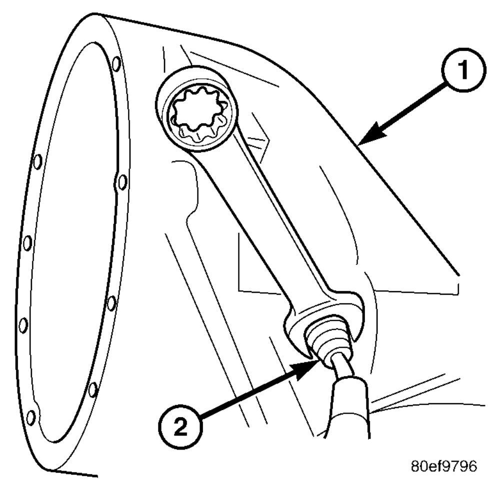


Fig. 53 LOCKER INDICATOR SWITCH

1 - DIFFERENTIAL CASE
2 - SWITCH

(16) Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

DIFFERENTIAL - TRU-LOK (Continued)

DISASSEMBLY

(1) Install Plug C-293-3 into the differential axle shaft hole.

(2) Remove differential case bearings with Puller 6444, Puller Rods 6444-3 and Puller Flange 6444-1. Position puller (Fig. 54) on the differential.

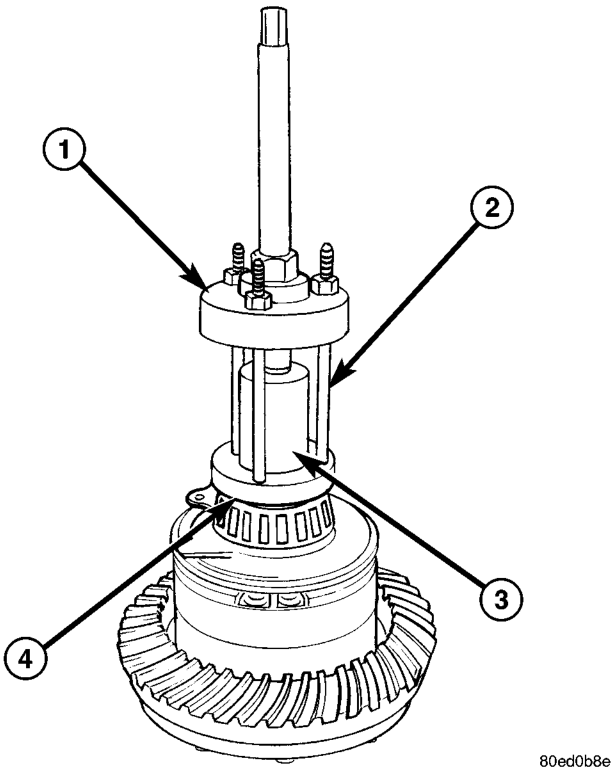


Fig. 54 PULLER AND FLANGE

1 - PULLER
2 - ROD
3 - PLUG
4 - FLANGE

(3) Position Puller Jaws 6444-7 (Fig. 55) around the case bearing and puller flange.

(4) Position Puller Collar 6444-8 (Fig. 56) around the puller jaws.

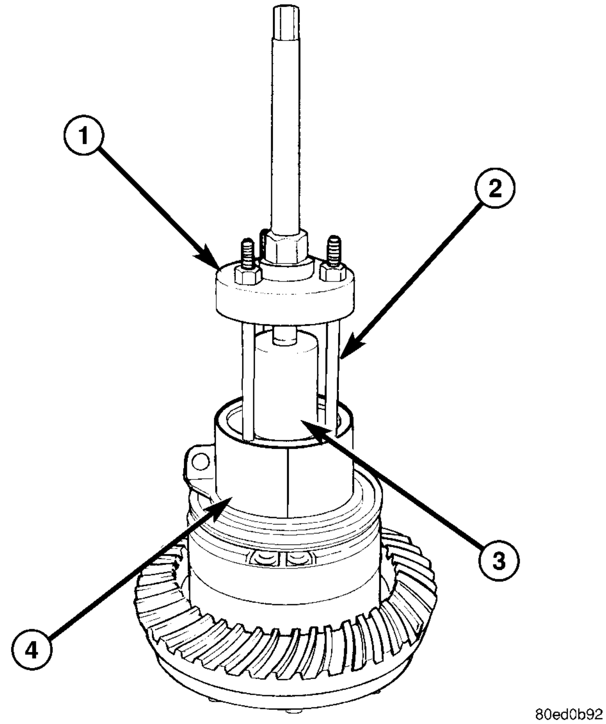


Fig. 55 PULLER AND JAWS

1 - PULLER
2 - ROD
3 - PLUG
4 - JAW

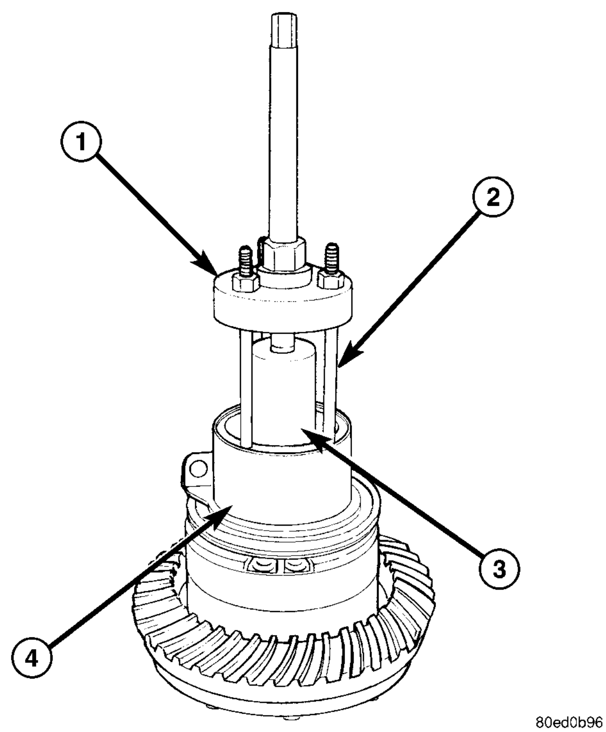


Fig. 56 PULLER AND COLLAR

1 - PULLER
2 - ROD
3 - PLUG
4 - COLLAR

DIFFERENTIAL - TRU-LOK (Continued)

(5) Tighten the puller nut and remove differential case bearing.

(6) Remove actuator (Fig. 57).

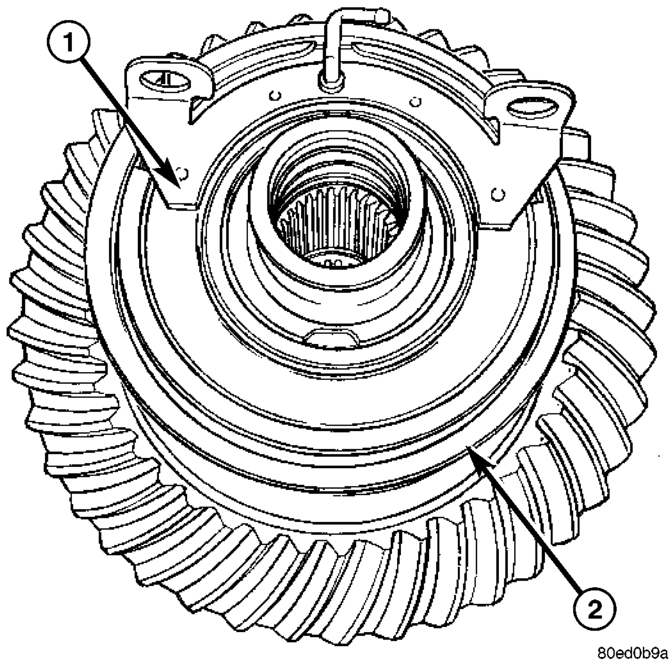


Fig. 57 LOCKING ACTUATOR

1 - ACTUATOR
2 - PRESSURE PLATE

ASSEMBLY

(1) Verify pressure plate tabs (Fig. 58) are seated on the dog clutch slots.

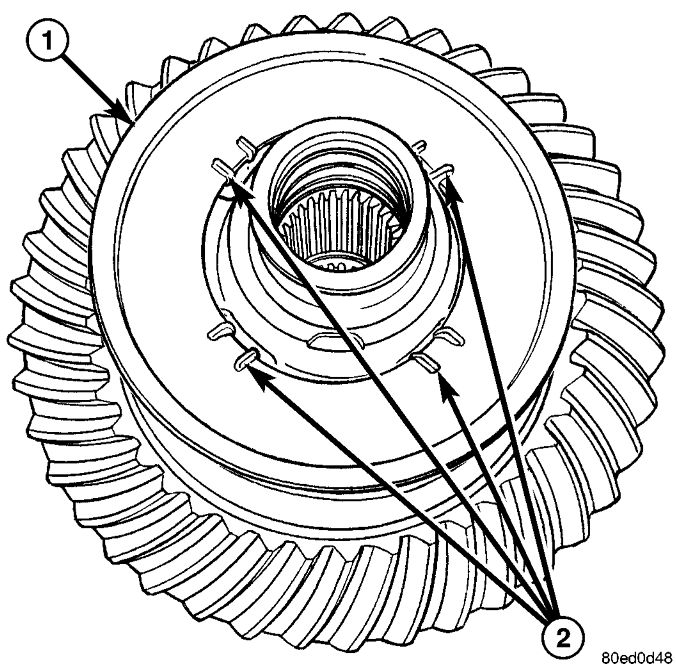


Fig. 58 PRESSURE PLATE

1 - PLATE
2 - PLATE TABS

(2) Place actuator on the pressure plate and case bearing on the case (Fig. 59).

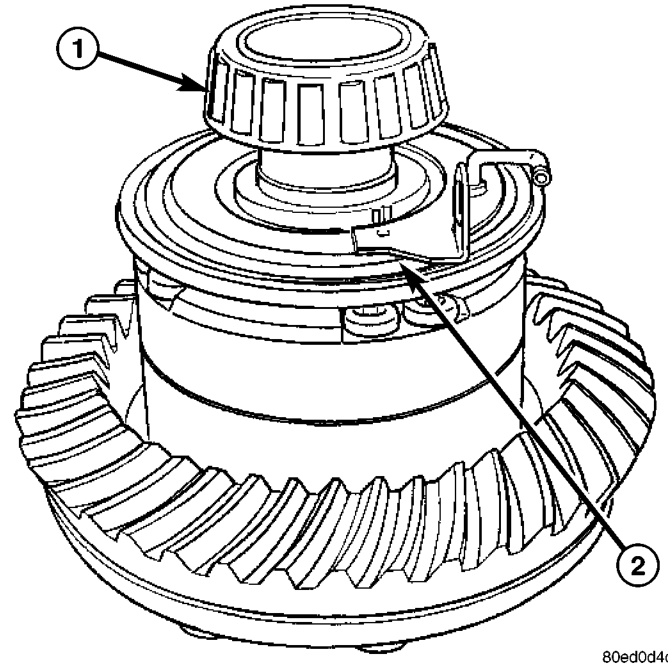


Fig. 59 ACTUATOR AND CASE BEARING

1 - CASE BEARING
2 - ACTUATOR

(3) Install differential case bearings with Installer D-156 and Handle C-4171.

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Install indicator switch into the housing.

(2) Position Spreader W-129-B and adapters from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 60). Install hold-down clamps and tighten the tool turnbuckle finger-tight.

(3) Install Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing and zero indicator.

(4) Spread housing while measuring the distance with the dial indicator.

CAUTION: Never spread over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

(5) Remove dial indicator.

(6) Install differential case with pinion gear side bearing cap and differential preload shims in the

DIFFERENTIAL - TRU-LOK (Continued)

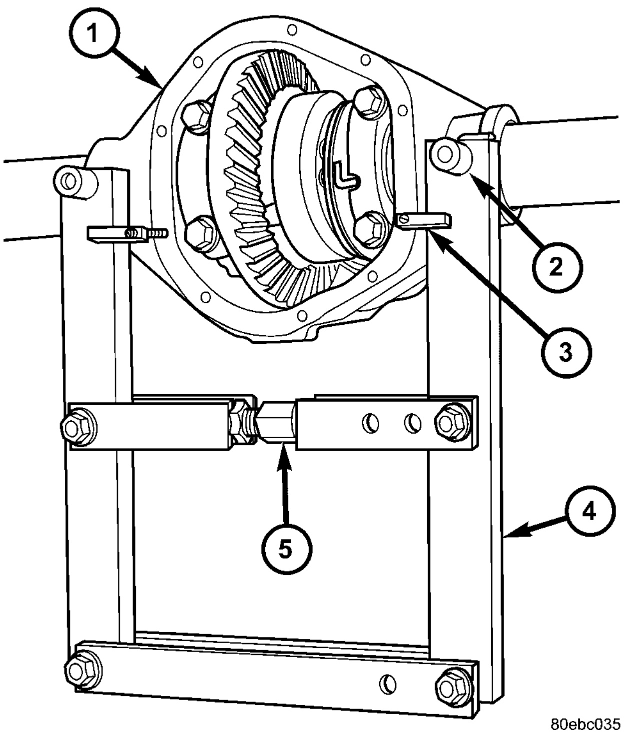


Fig. 60 SPREADER LOCATION

1 - DIFFERENTIAL CASE
2 - ADAPTER
3 - HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

housing. Tap differential case to seat bearings cups in the housing.

CAUTION: Ensure indicator switch plunger head is positioned under the actuator. Failure to heed caution may result in damage.

(7) Install ring gear side bearing cap with reference marks aligned (Fig. 61).
(8) Loosely install differential bearing cap bolts.
(9) Remove axle housing spreader.
(10) Tighten bearing cap bolts to 108 N·m (80 ft. lbs.).
(11) With a 1/4 inch drill bit check the clearance between the actuator and actuator pressure plate at the top and the bottom.

CAUTION: If clearance is not correct, indicator switch plunger may be on top of the actuator or actuator mounting tabs may be bent. Failure to heed caution may result in damage.

(12) Install pressure hose on the actuator assembly.
(13) Install axle shafts.

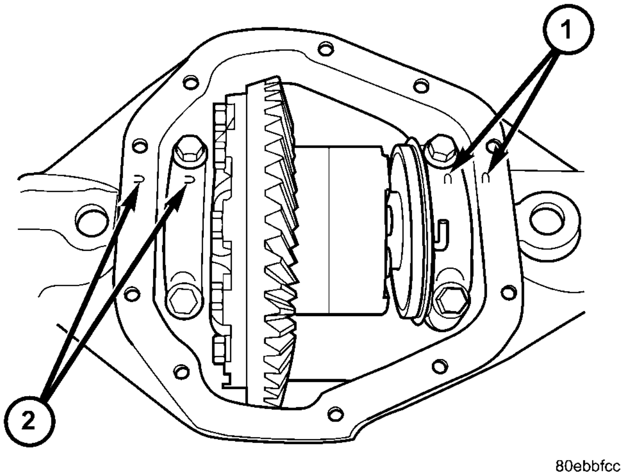


Fig. 61 BEARING CAP REFERENCE MARKS

1 - REFERENCE MARKS
2 - REFERENCE MARKS

(14) Install differential cover, identification tag and indicator switch connector (Fig. 62).

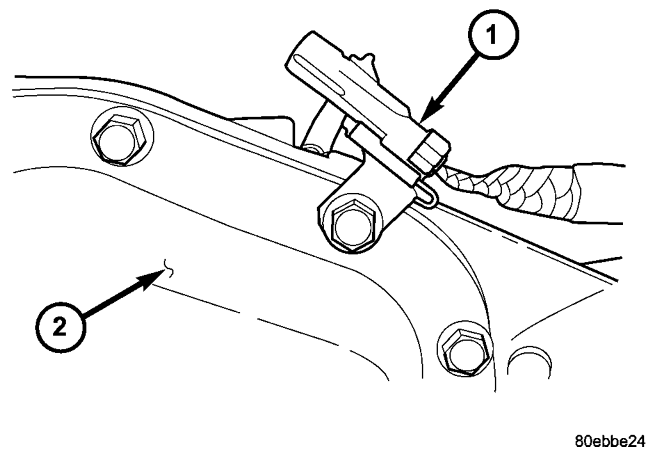


Fig. 62 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

DIFFERENTIAL - TRU-LOK PUMP

REMOVAL

(1) Disconnect pumps and axle harness connectors (Fig. 63).
(2) Remove pressure hoses from the front and rear pumps.
(3) Remove pump mounting bracket bolts (Fig. 64).
(4) Remove pumps and bracket assembly from the vehicle.
(5) Remove pump connectors from the mounting bracket.

DIFFERENTIAL - TRU-LOK PUMP (Continued)

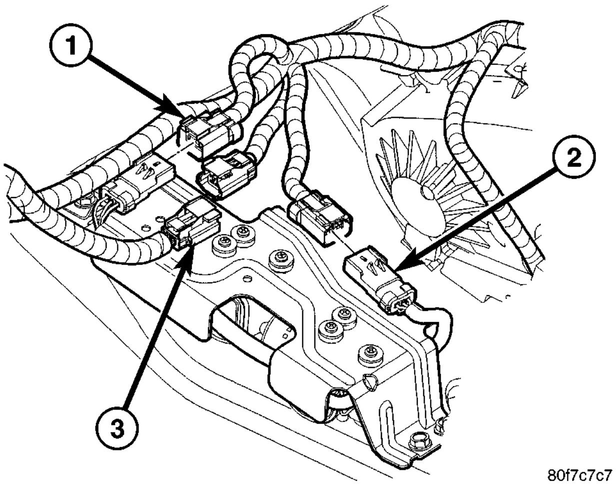


Fig. 63 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

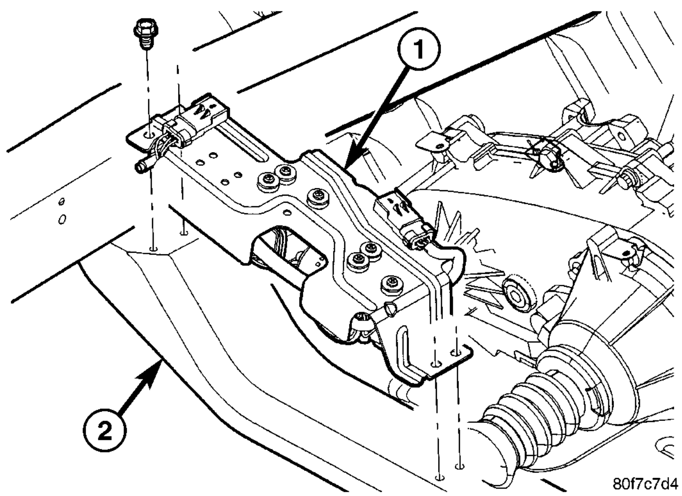


Fig. 64 PUMP BRACKET

1 - PUMP BRACKET
2 - CROSSMEMBER/SKID PLATE

(6) Remove pump mounting screws (Fig. 65) from the bracket and remove pump/pumps.

INSTALLATION

(1) Align pump with screw holes in pump bracket.
(2) Install and tighten pump mounting screws (Fig. 66).
(3) Install pump bracket assembly on the cross-member/skid plate and install pump bracket mounting bolts (Fig. 67).
(4) Tighten pump bracket bolts to 14 N·m (125 in. lbs.).

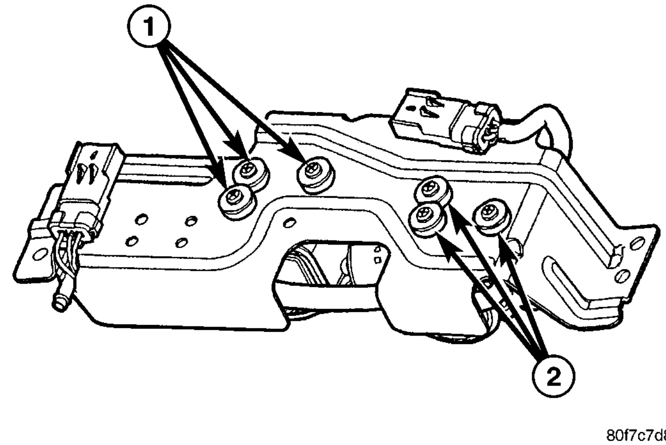


Fig. 65 PUMP SCREWS

1 - REAR PUMP SCREWS
2 - FRONT PUMP SCREWS

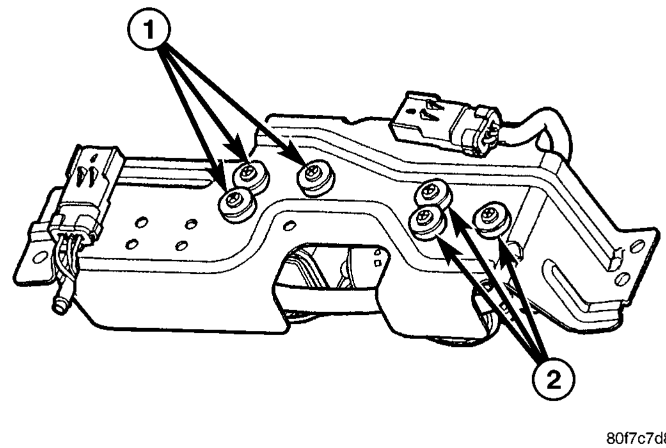


Fig. 66 PUMP SCREWS

1 - REAR PUMP SCREWS
2 - FRONT PUMP SCREWS

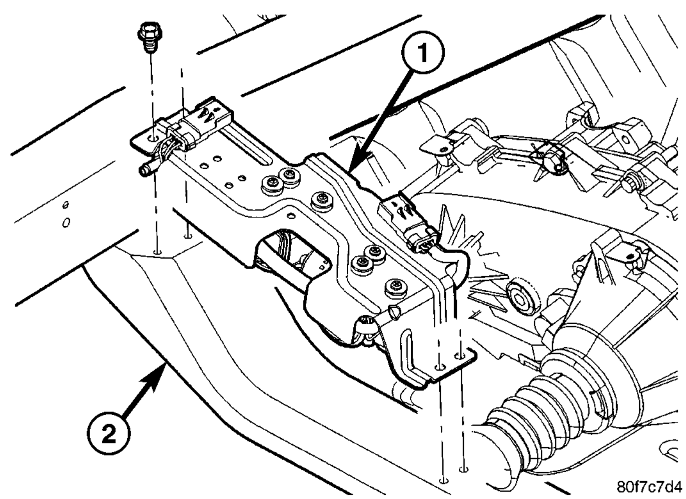


Fig. 67 PUMP BRACKET

1 - PUMP BRACKET
2 - CROSSMEMBER/SKID PLATE

DIFFERENTIAL - TRU-LOK PUMP (Continued)

(5) Connector pump and axle harness connectors (Fig. 68).

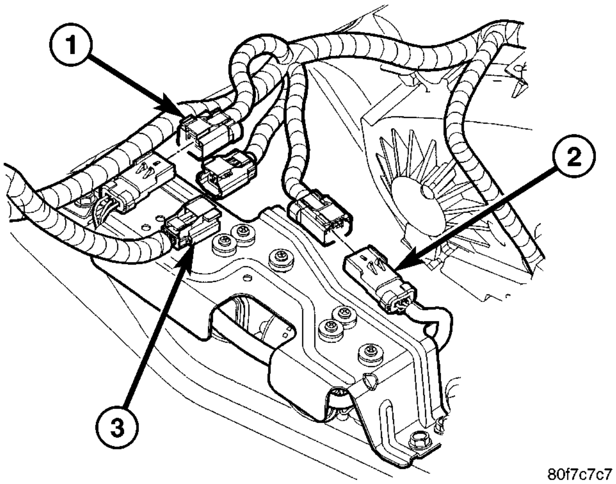


Fig. 68 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

(6) Install pressure hoses on the pumps.
(7) Verify pump operation.

PINION GEAR/RING GEAR

REMOVAL

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

(1) Remove differential from housing.
(2) Secure differential case in a vise with soft metal jaw.
(3) Remove ring gear bolts from the differential case.
(4) Drive ring gear off the differential case with a dead-blow hammer (Fig. 69).
(5) Hold yoke with Holder 6719A and remove pinion nut and washer.
(6) Remove pinion yoke from the pinion shaft with Puller C-452 and Flange Wrench C-3281 (Fig. 70).

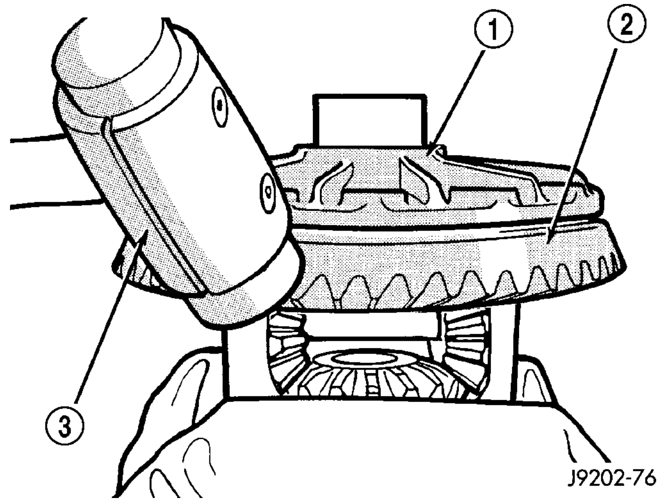


Fig. 69 RING GEAR REMOVAL

1 - CASE
2 - RING GEAR
3- HAMMER

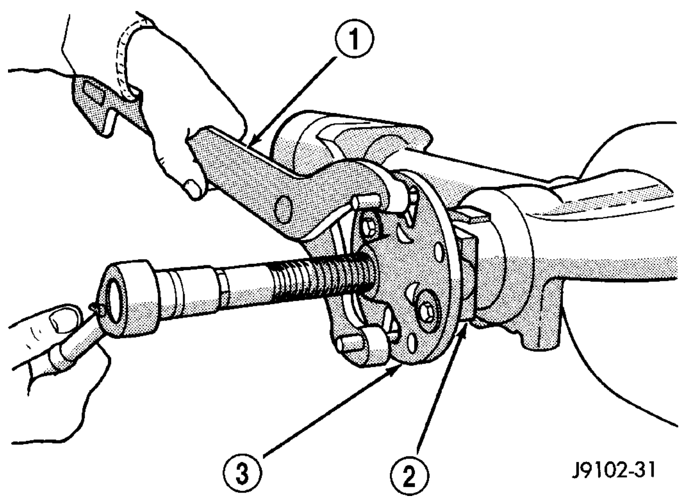


Fig. 70 PINION YOKE REMOVAL

1 - FLANGER WRENCH
2 - YOKE
3 - PULLER

PINION GEAR/RING GEAR (Continued)

(7) Remove pinion gear and preload shims from housing (Fig. 71).

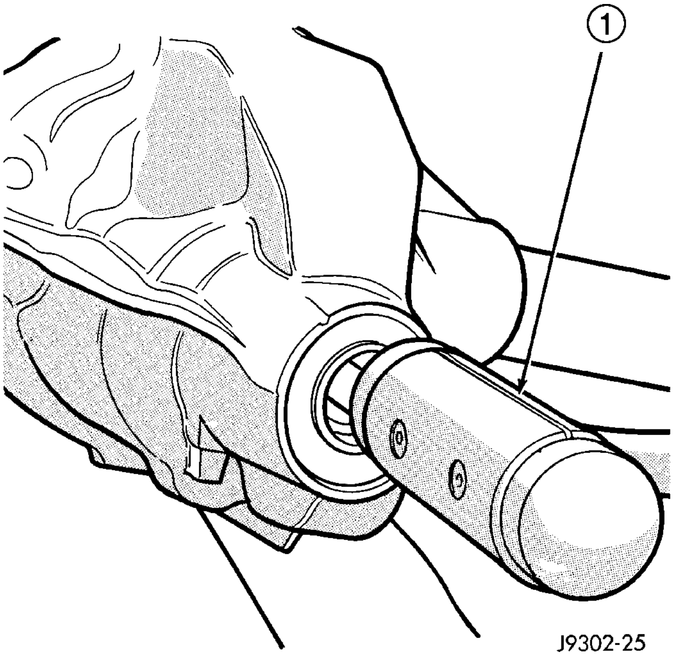


Fig. 71 REMOVE PINION GEAR

1 - DEAD-BLOW HAMMER

(8) Remove pinion seal with a pry bar or slide hammer mounted screw.

(9) Remove front pinion bearing cup with Remover D-147 and Handle C-4171 (Fig. 72).

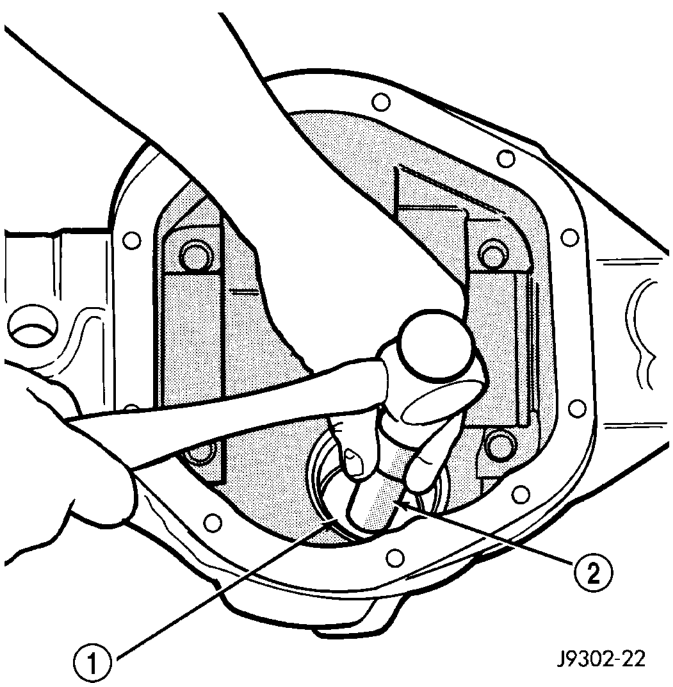


Fig. 72 FRONT BEARING CUP REMOVAL

1 - REMOVER
2 - HANDLE

(10) Remove rear bearing cup (Fig. 73) with Remover D-148 and Handle C-4171.

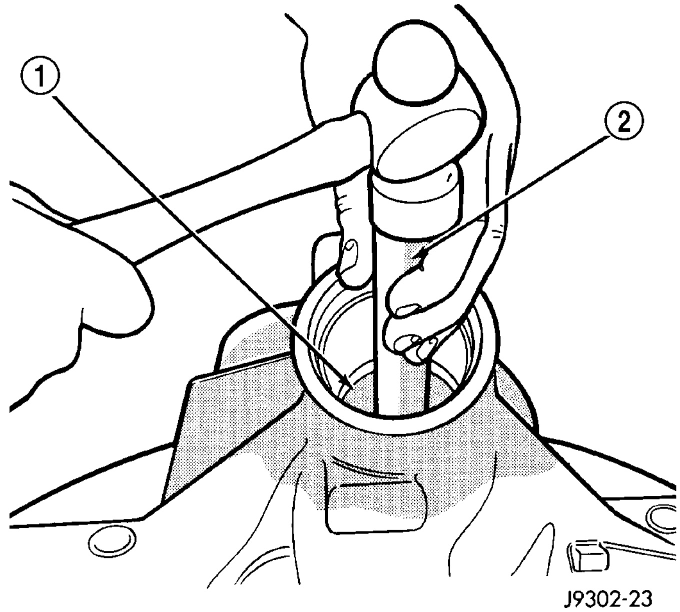


Fig. 73 REAR BEARING CUP REMOVAL

1 - DRIVER
2 - HANDLE

(11) Remove rear pinion bearing with Puller C-293-PA and Adapters C-293-39 (Fig. 74).

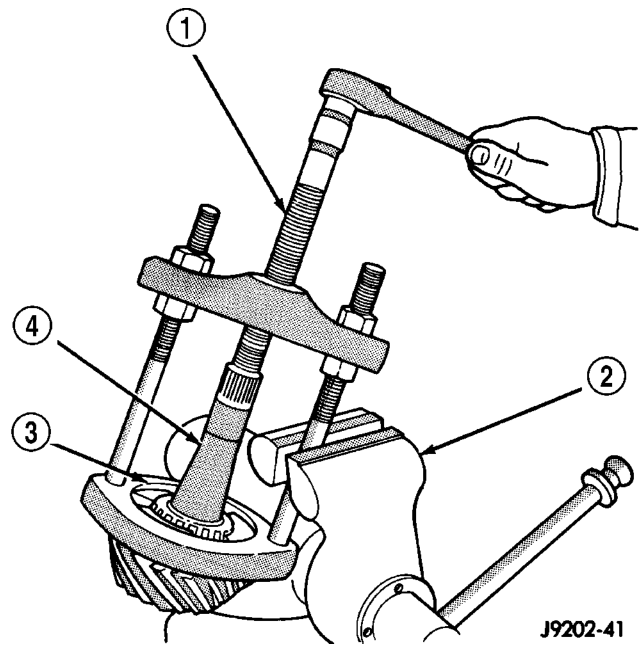


Fig. 74 REAR BEARING REMOVAL

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION SHAFT

PINION GEAR/RING GEAR (Continued)

(12) Remove pinion depth shim/oil slinger from pinion shaft and record thickness.

INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear to achieve proper ring and pinion gear mesh. If ring and pinion gears are reused, the original pinion depth shim can be used. Refer to Adjustments (Pinion Gear Depth) to select the proper shim thickness if ring and pinion gears are replaced.

(1) Apply Mopar Door Ease stick or equivalent lubricant to outside surface of bearing cups.

(2) Install rear pinion bearing cup with Installer D-146 and Handle C-4171 (Fig. 75).

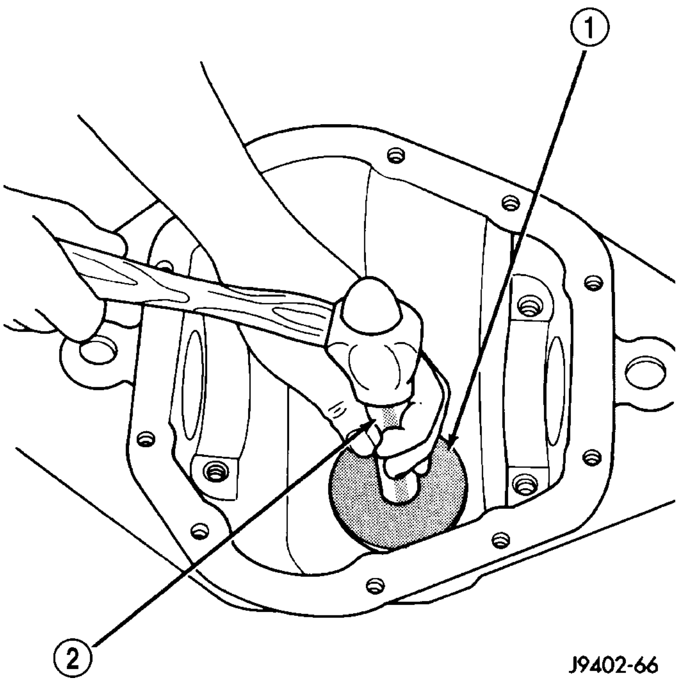


Fig. 75 REAR PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

(3) Install front pinion bearing cup with Installer D-144 and Handle C-4171 (Fig. 76).

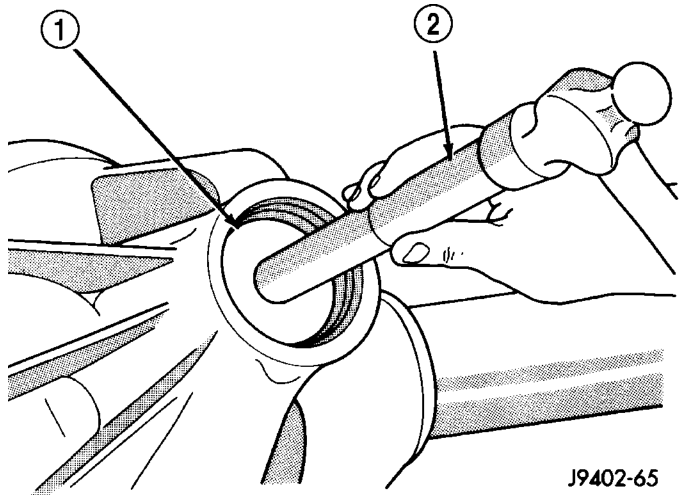


Fig. 76 FRONT PINION BEARING CUP INSTALLER

1 - INSTALLER
2 - HANDLE

(4) Install pinion front bearing, oil slinger. Apply a light coating of gear lubricant on the lip of pinion seal.

(5) Install pinion seal with an appropriate installer (Fig. 77).

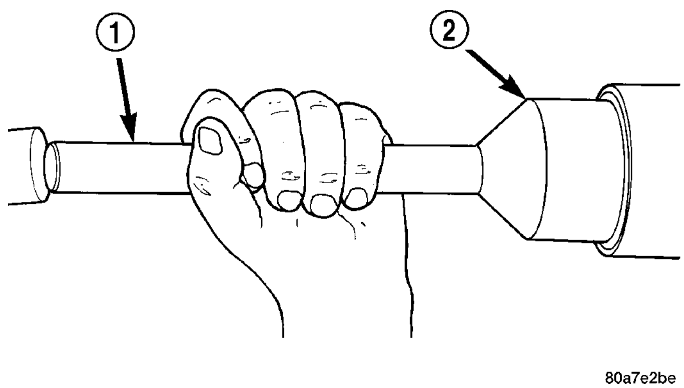


Fig. 77 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(6) Install proper thickness depth shim on the pinion gear.

PINION GEAR/RING GEAR (Continued)

(7) Install rear bearing and oil slinger, if equipped on pinion gear with Installer W-262 (Fig. 78).

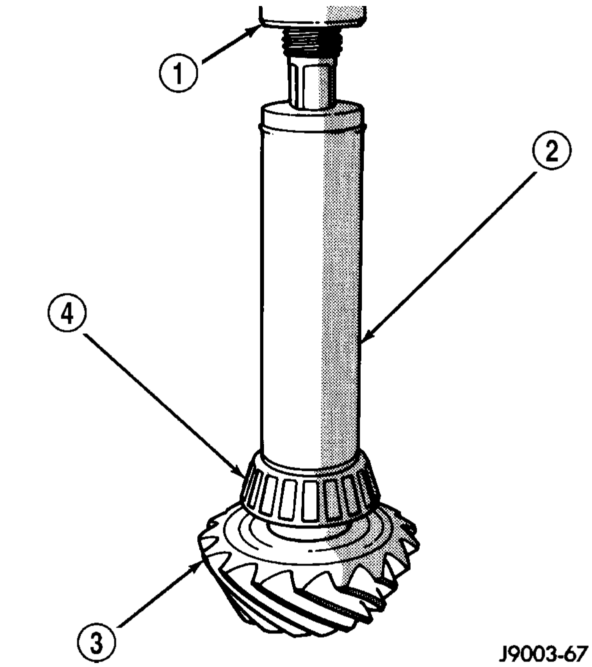


Fig. 78 REAR PINION BEARING

1 - PRESS
2 - INSTALLER
3 - PINION GEAR
4 - PINION BEARING

(8) Install pinion gear in housing.

(9) Install pinion preload shims (Fig. 79)

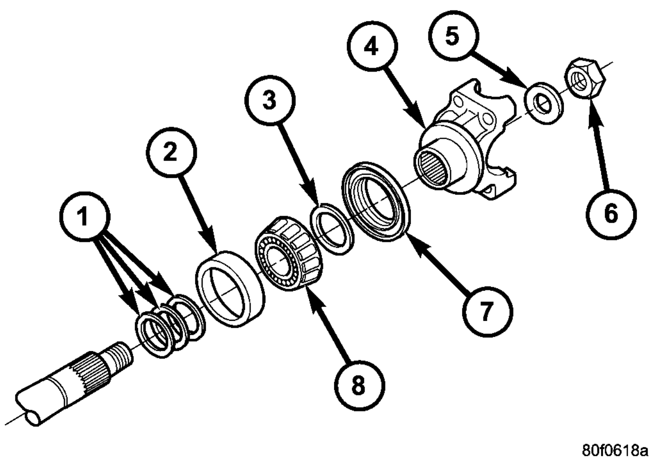


Fig. 79 PINION PRELOAD SHIMS

1 - PRELOAD SHIMS
2 - FRONT BEARING CUP
3 - SLINGER
4 - PINION YOKE
5 - WASHER
6 - PINION NUT
7 - PINION OIL SEAL
8 - FRONT PINION BEARING

(10) Install yoke with Installer W-162-D and Yoke Holder 6719A (Fig. 80).

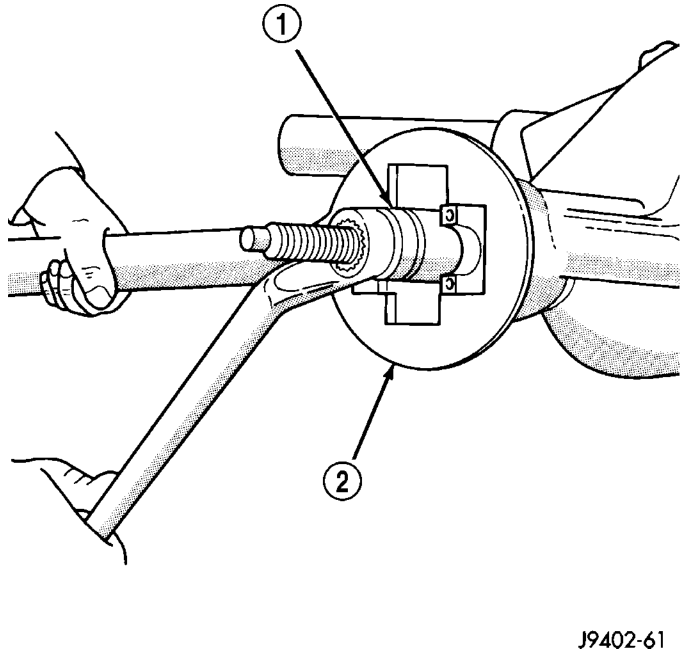


Fig. 80 PINION YOKE INSTALLER

1 - INSTALLER
2 - YOKE HOLDER

(11) Install yoke washer and a **new** nut on the pinion gear. Tighten the nut to specification (Fig. 81).

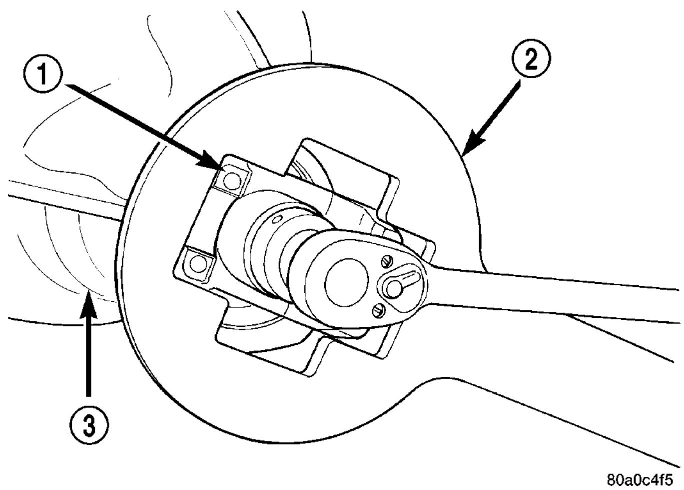


Fig. 81 TIGHTENING PINION NUT

1 - PINION YOKE
2 - YOKE HOLDING
3 - DIFFERENTIAL HOUSING

PINION GEAR/RING GEAR (Continued)

(12) Check bearing preload torque with an inch pound torque wrench (Fig. 82). The torque to rotate the pinion gear should be:

- Original Bearings: 1 to 2 N·m (10 to 20 in. lbs.).
- New Bearings: 2.3 to 4.5 N·m (20 to 40 in. lbs.).

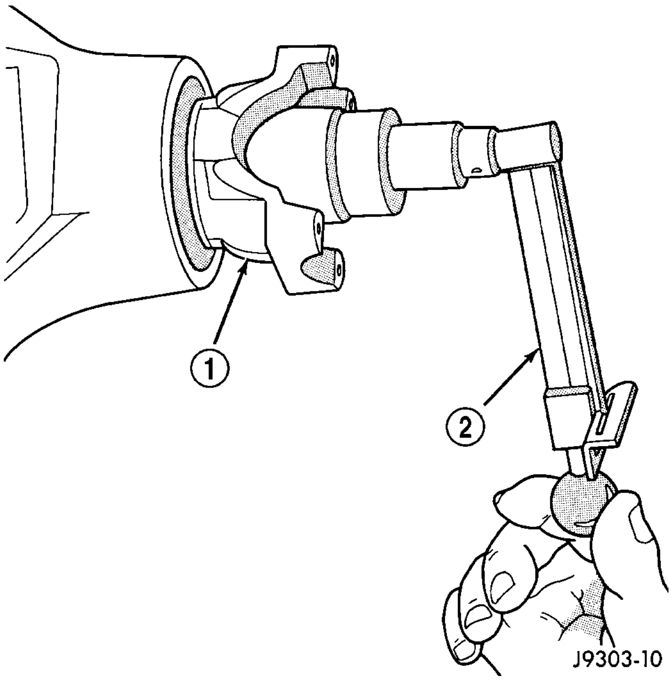


Fig. 82 PINION ROTATION TORQUE

1 - PINION YOKE
2 - INCH POUND TORQUE WRENCH

(13) Invert differential case in a vise and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(14) Install **new** ring gear bolts and alternately tighten to 136 N·m (100 ft. lbs.). (Fig. 83).

CAUTION: Never reuse the ring gear bolts. Failure to heed caution may result in damage.

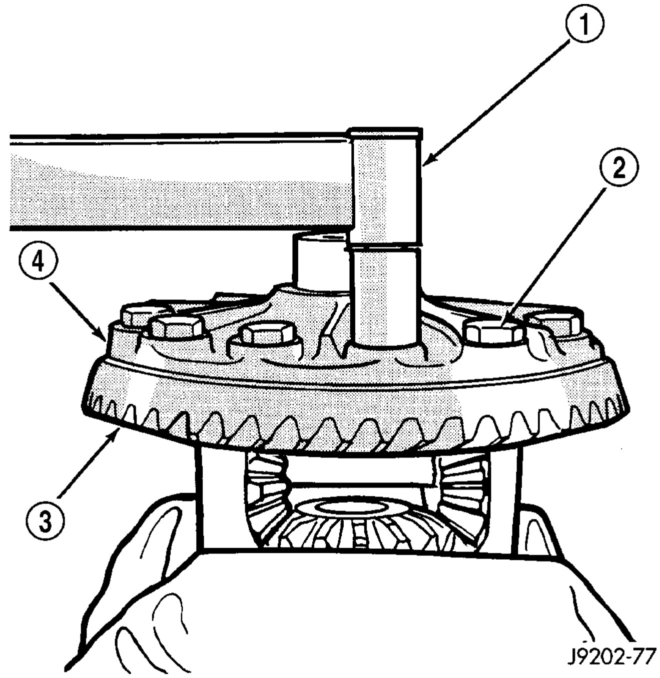


Fig. 83 RING GEAR INSTALLATION

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

(15) Install differential in axle housing and verify gear mesh and contact pattern. Refer to Adjustments (Gear Contact Pattern).

REAR AXLE - 194RBI

TABLE OF CONTENTS

REAR AXLE - 194RBI

DIAGNOSIS AND TESTING

GEAR NOISE

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

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

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

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

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

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise

REAR AXLE - 194RBI (Continued)

level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

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

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

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rearend vibration. Do not overlook engine accessories, brackets and drive belts.

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

DRIVELINE SNAP

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

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

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.

REAR AXLE - 194RBI (Continued)

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

REAR AXLE - 194RBI (Continued)

Condition	Possible Causes	Correction
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern. Adjust backlash or pinion depth.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

REAR AXLE - 194RBI (Continued)

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Position a lift device under the axle and secure axle to device.

(3) Remove brake components.

(4) Disconnect the vent hose from the axle shaft tube.

(5) Remove propeller shaft.

(6) Disconnect stabilizer bar links (Fig. 1).

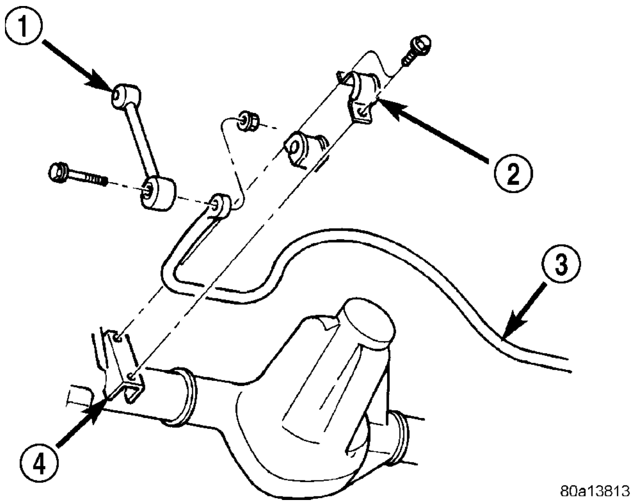


Fig. 1 STABILIZER BAR

1 - LINK
2 - RETAINER
3 - STABILIZER BAR
4 - AXLE MOUNT

(7) Remove shock absorbers from axle bracket (Fig. 2).

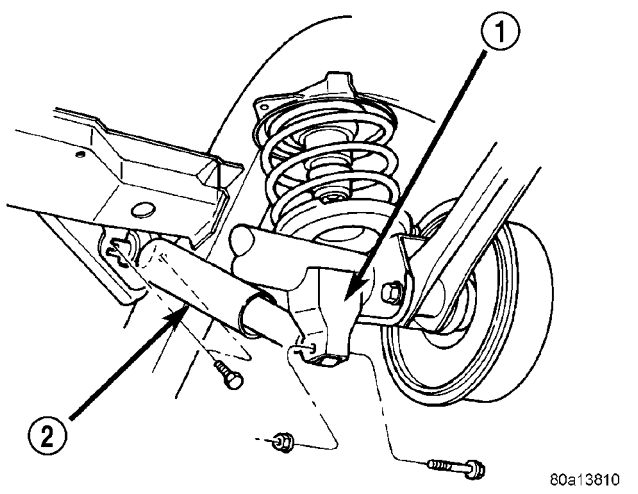


Fig. 2 SHOCK ABSORBER

1 - AXLE BRACKET
2 - SHOCK

(8) Remove track bar from axle bracket (Fig. 3).

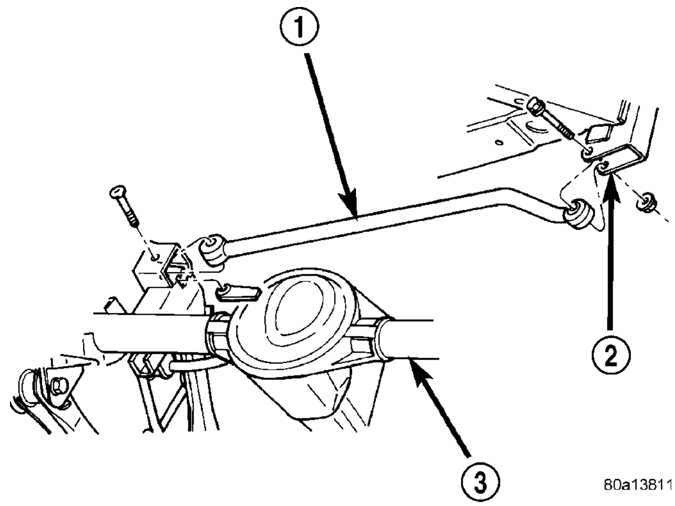


Fig. 3 REAR TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - REAR AXLE

(9) Remove upper and lower control arms from axle brackets.

(10) Lower axle and remove springs.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. Failure to heed caution may result in damage.

(1) Raise axle and align the spring centering bolts with mating holes in the axle spring perch.

(2) Install upper and lower control arms in the axle brackets (Fig. 4) and loosely install the mounting bolts.

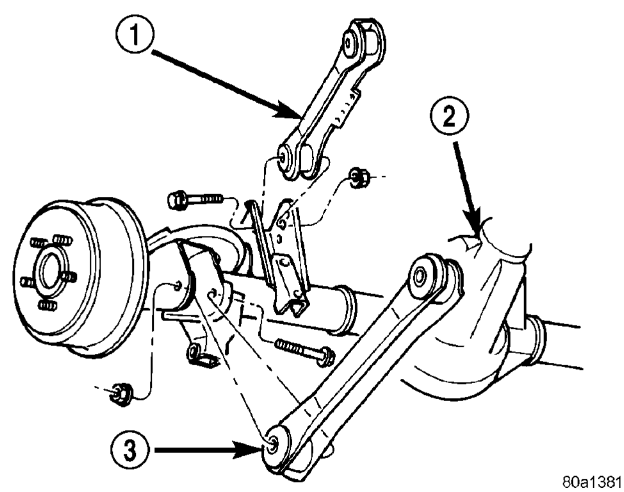


Fig. 4 UPPER AND LOWER SUSPENSION ARMS

1 - UPPER SUSPENSION ARM
2 - REAR AXLE
3 - LOWER SUSPENSION ARM

REAR AXLE - 194RBI (Continued)

(3) Install shock absorbers and tighten nuts to torque specification.

(4) Install stabilizer bar links and tighten nuts to torque specification.

(5) Install brake components.

(6) Install axle vent hose.

(7) Install propeller shaft (Fig. 5).

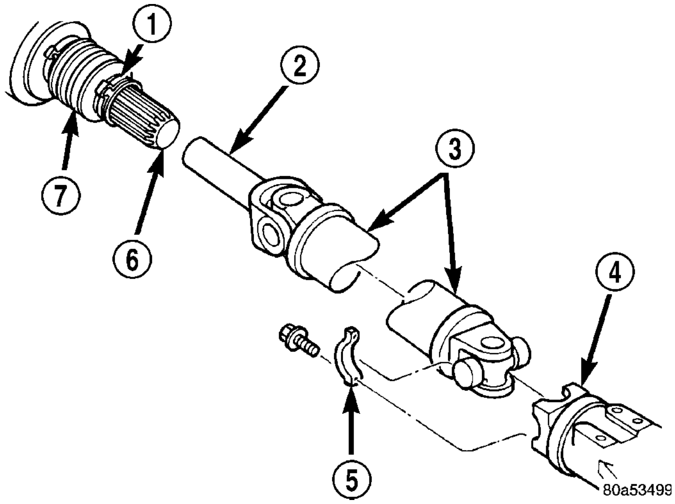


Fig. 5 REAR PROPELLER SHAFT

1 - CLAMP
2 - YOKE
3 - PROPELLER SHAFT
4 - AXLE YOKE
5 - CLAMP
6 - OUTPUT SHAFT
7 - BOOT

(8) Tighten upper and lower control arms nuts to torque specification.

ADJUSTMENTS

RING AND PINION GEAR

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 6). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing cone (Fig. 7).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

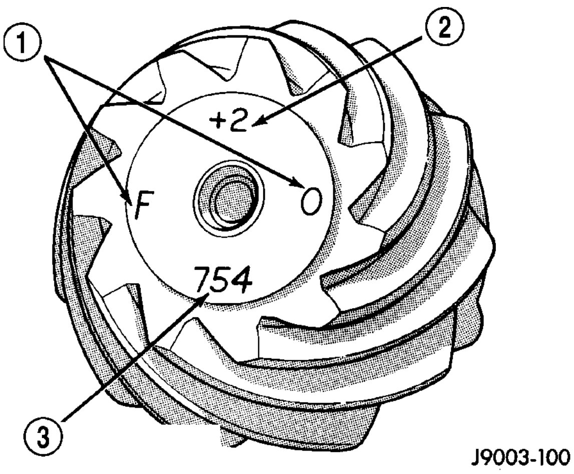


Fig. 6 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - DRIVE PINION GEAR DEPTH VARIANCE
3 - GEAR MATCHING NUMBER

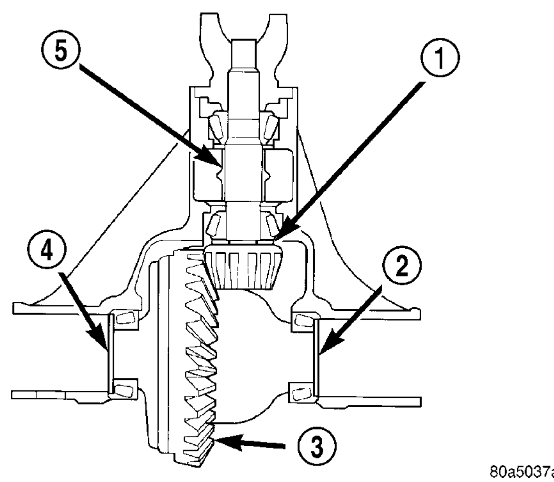


Fig. 7 ADJUSTMENT SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL SHIM-PINION GEAR SIDE
3 - RING GEAR
4 - DIFFERENTIAL SHIM-RING GEAR SIDE
5 - COLLAPSIBLE SPACER

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus amount needed.

Note the etched number on the face of the drive pinion gear (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

REAR AXLE - 194RBI (Continued)

PINION GEAR DEPTH VARIANCE

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

PINION DEPTH MEASUREMENT

Measurements are taken with pinion cups and pinion bearings installed in the housing. Take measurements with a Pinion Gauge Set, Pinion Block 6735, Arbor Discs 6732 and Dial Indicator C-3339 (Fig. 8).

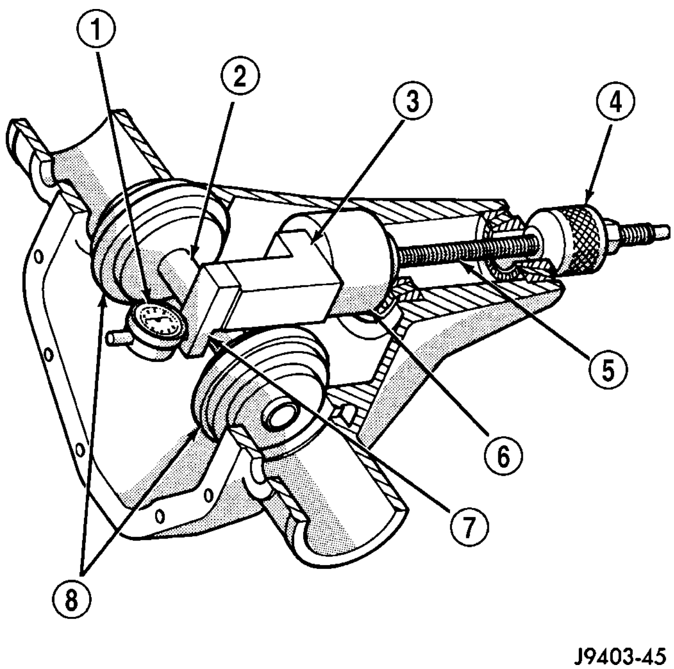


Fig. 8 PINION GEAR DEPTH TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 6735 and rear pinion bearing onto Screw 6741 (Fig. 8).

(2) Insert assembled height gauge components, rear bearing and screw into the housing through pinion bearing cups (Fig. 9).

(3) Install front pinion bearing and Cone 6740 hand tight.

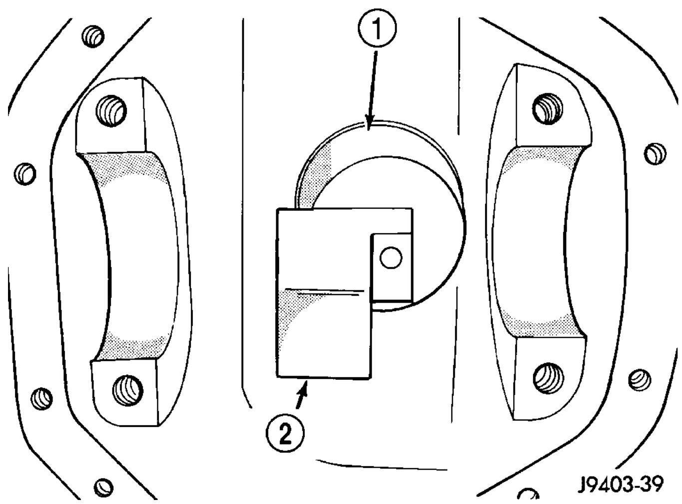


Fig. 9 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

REAR AXLE - 194RBI (Continued)

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in the housing side bearing cradles (Fig. 10). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

NOTE: Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

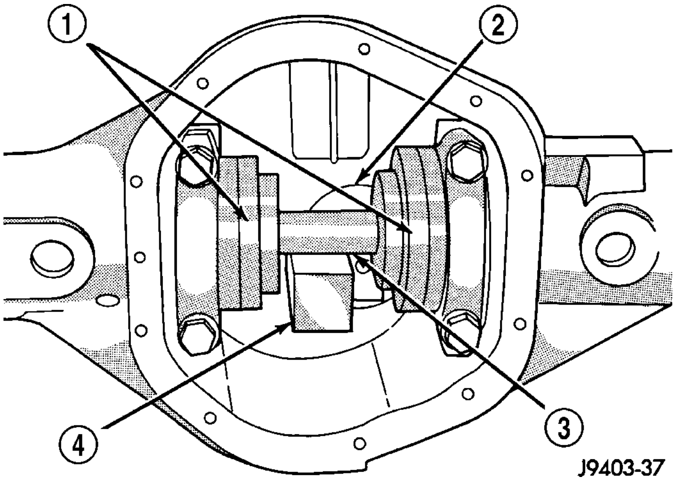


Fig. 10 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

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

(6) Position Scooter Block/Dial Indicator flush on the pinion height block. Hold scooter block and zero the dial indicator.

(7) Slowly slide the scooter block across the pinion height block over to the arbor (Fig. 11). Move the scooter block till the dial indicator probe crests the arbor, then record the highest reading.

(8) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 6) using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

(9) Remove the pinion depth gauge components from the housing

DIFFERENTIAL BEARING PRELOAD

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the housing. The proper shim thickness can be determined using slip-fit Dummy Bearings D-348 in place of the differential side bearings and a Dial Indicator C-3339. Before proceeding with the differential bearing preload and gear backlash

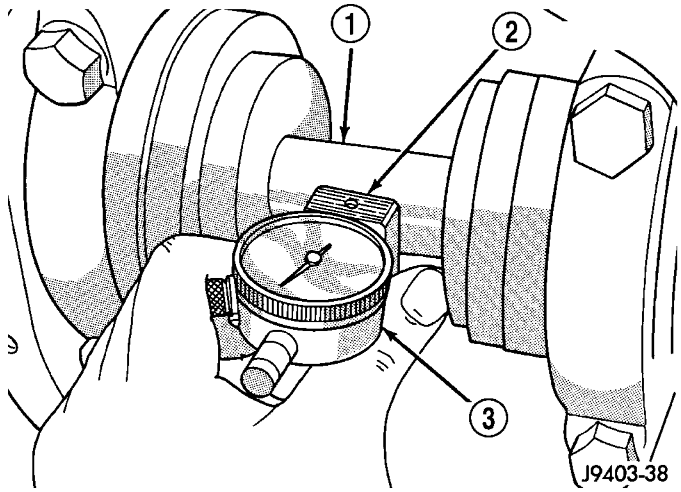


Fig. 11 PINION GEAR DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

measurements, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thickness and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 12).

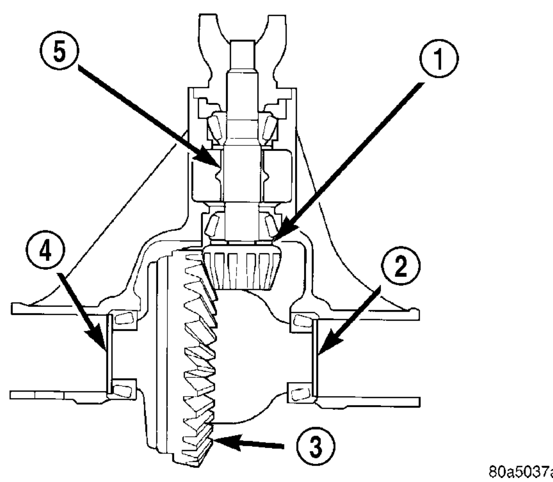


Fig. 12 SHIM LOCATIONS

1 - PINION GEAR DEPTH SHIM
2 - DIFFERENTIAL SHIM-PINION GEAR SIDE
3 - RING GEAR
4 - DIFFERENTIAL SHIM-RING GEAR SIDE
5 - COLLAPSIBLE SPACER

REAR AXLE - 194RBI (Continued)

PRELOAD SHIM SELECTION

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

(1) Remove side bearings from differential case.

(2) Install ring gear, if necessary, on differential case and tighten bolts to specification.

(3) Install Dummy Bearings D-348 on differential case.

(4) Install differential case in the housing.

(5) Insert Dummy Shims 8107 (3.0 mm / 0.118 in.) starting point shims between the dummy bearing and the housing (Fig. 13).

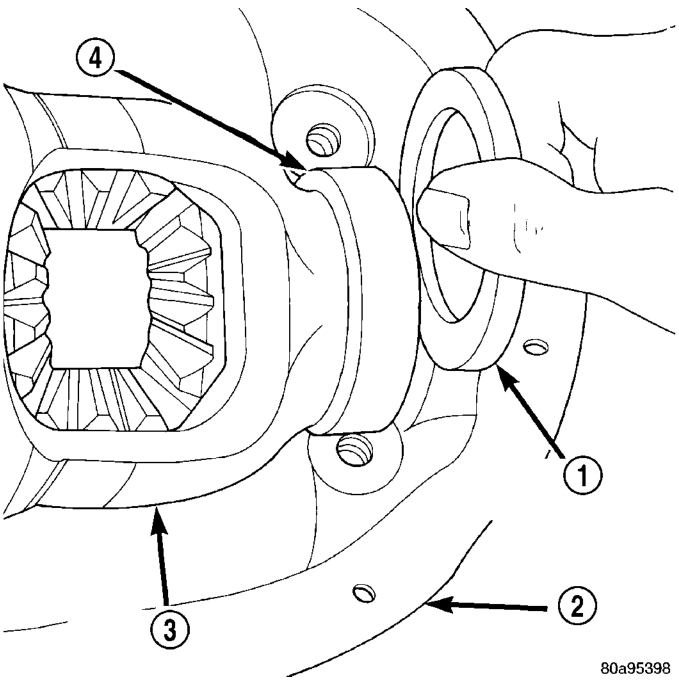


Fig. 13 DUMMY SHIM LOCATION

1 - DUMMY SHIM
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE
4 - DUMMY BEARING

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

(7) Using a dead-blow hammer to seat the differential dummy bearings to each side of the housing (Fig. 14) and (Fig. 15).

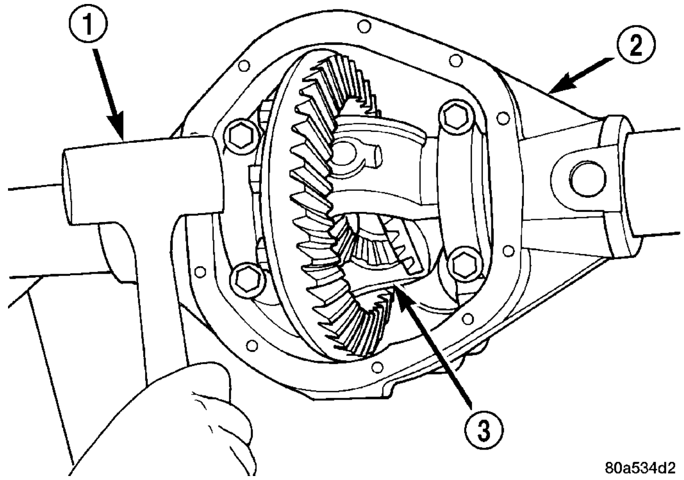


Fig. 14 SEAT DUMMY BEARING PINION GEAR SIDE

1 - MALLET
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

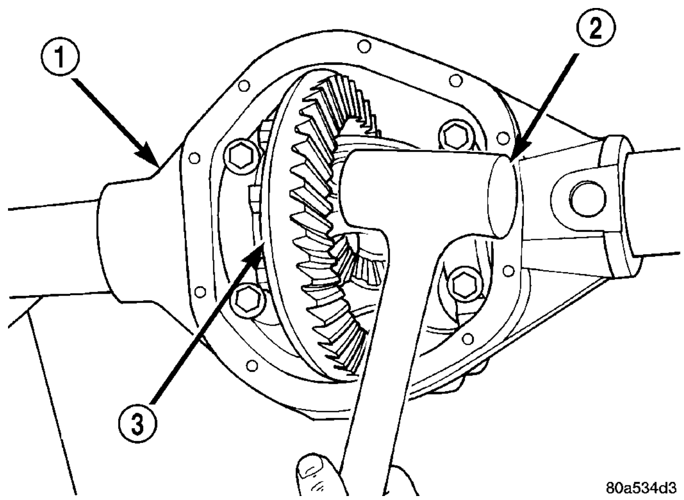


Fig. 15 SEAT DUMMY BEARING RING GEAR SIDE

1 - DIFFERENTIAL HOUSING
2 - MALLET
3 - DIFFERENTIAL CASE

REAR AXLE - 194RBI (Continued)

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 16).

(9) Attach Dial Indicator C-3339 to the pilot stud and position indicator plunger on a flat surface of the ring gear bolt head (Fig. 16).

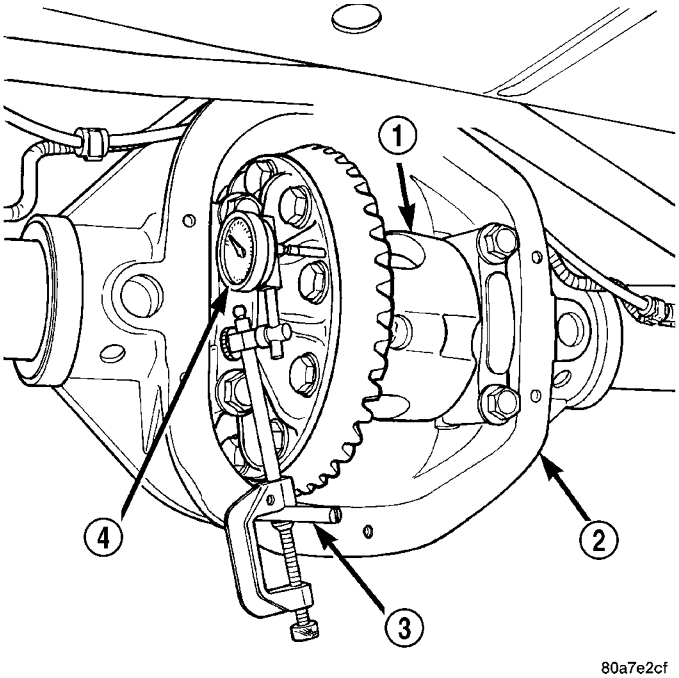


Fig. 16 DIFFERENTIAL SIDE PLAY MEASUREMENT

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

(10) Push differential case to the pinion gear side of the housing (Fig. 17) and zero dial indicator.

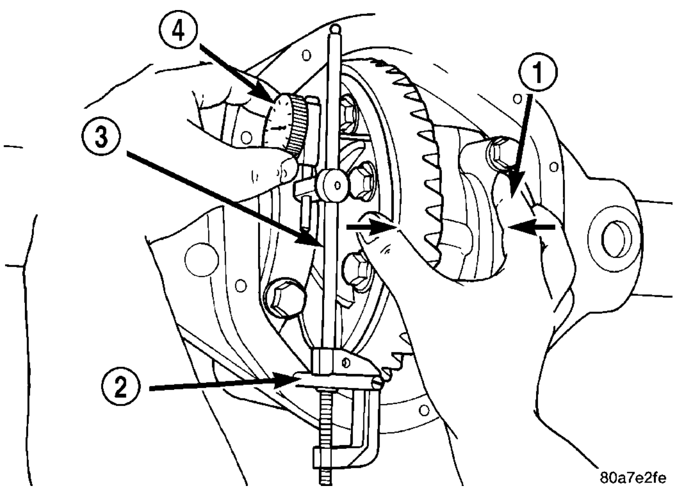


Fig. 17 ZERO DIAL INDICATOR

1 - DIFFERENTIAL CASE TO PINION GEAR SIDE
2 - PILOT STUD
3 - DIAL INDICATOR EXTENSION
4 - ZERO DIAL INDICATOR FACE

(11) Push differential case to the ring gear side and record dial indicator reading (Fig. 18).

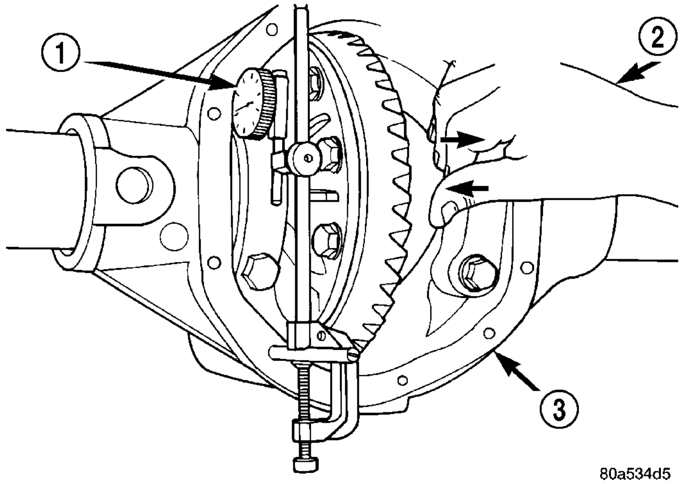


Fig. 18 RECORD DIAL INDICATOR READING

1 - READ DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(12) Add the dial indicator reading to the starting point shim thickness to determine total shim thickness to achieve zero differential end play.

(13) Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims to compress or preload the new bearings when the differential is installed.

(14) Rotate dial indicator out of the way.

(15) Remove differential case, dummy bearings and starting point shims from the housing.

(16) Install pinion gear in the housing. Install the yoke and establish the correct pinion rotating torque.

(17) Install differential case and dummy bearings in the housing (without shims) and tighten retaining cap bolts.

(18) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 16).

(19) Push and hold differential case toward pinion gear.

(20) Zero dial indicator face to pointer.

(21) Push and hold differential case to ring gear side of the housing and record dial indicator reading.

(22) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness of shim required to achieve proper backlash.

(23) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.

(24) Rotate dial indicator out of the way on pilot stud.

(25) Remove differential case and dummy bearings from the housing.

REAR AXLE - 194RBI (Continued)

(26) Install new side bearing cones and cups on differential case.

(27) Install spreader W-129-B and some components of Adapter Set 6987 on differential housing and spread axle opening enough to receive differential case.

(28) Place side bearing shims into the housing against the differential bearing bore.

(29) Install differential case in the housing.

(30) Rotate the differential case several times to seat the side bearings.

(31) Position the indicator plunger against a ring gear tooth (Fig. 19).

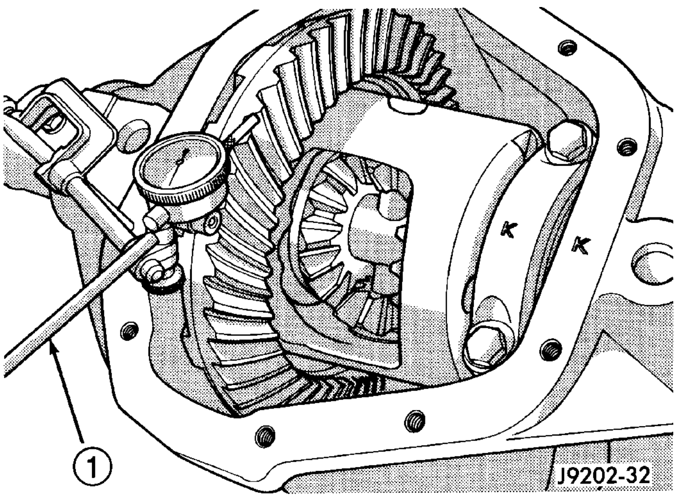


Fig. 19 RING GEAR BACKLASH

1 - DIAL INDICATOR

(32) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(33) Zero dial indicator face to pointer.

(34) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in. - 0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other (Fig. 20).

(35) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

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

GEAR CONTACT PATTERN

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

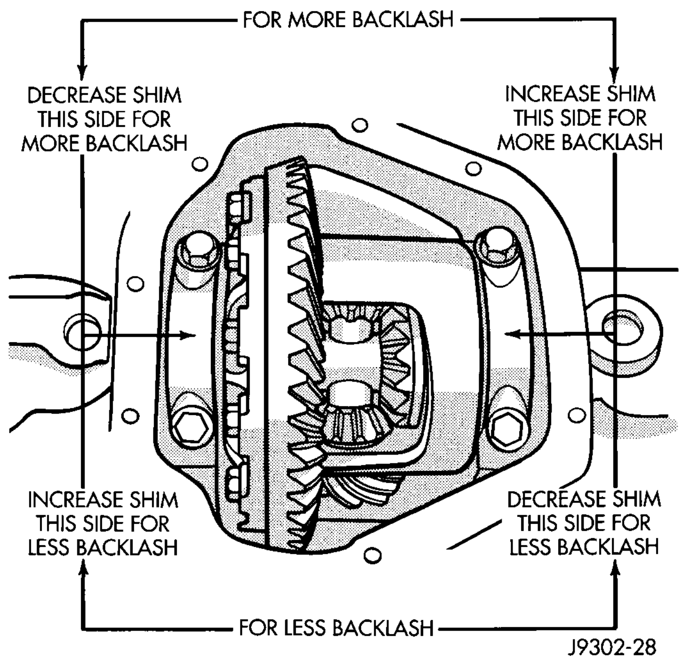


Fig. 20 BACKLASH SHIM ADJUSTMENT

within specifications to achieve desired tooth contact patterns.

The TOP LAND of the gear tooth is the top surface of the tooth. The PROFILE of the gear tooth is the depth of the tooth. The TOE of the gear is the portion of the tooth surface at the end towards the center. The HEEL of the gear is the portion of the tooth at the outer-end. The ROOT of the gear tooth is the lowest portion of the tooth (Fig. 21).

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

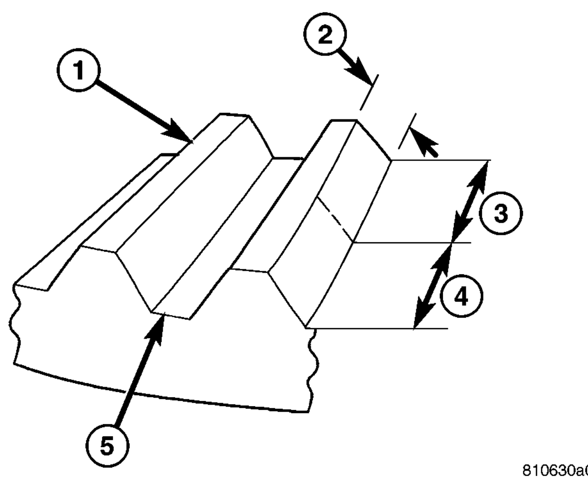


Fig. 21 GEAR DESCRIPTION

1 - TOP LAND
2 - PROFILE
3 - TOE
4 - HEEL
5 - ROOT

REAR AXLE - 194RBI (Continued)

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

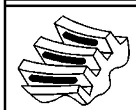
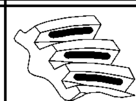
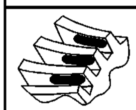
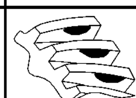
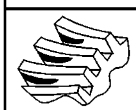
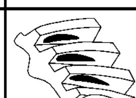
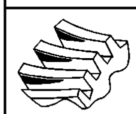
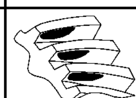
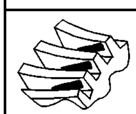
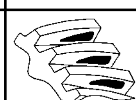
(3) With a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeeze the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns charts (Fig. 22) and (Fig. 23) and adjust pinion depth and gear backlash as necessary.

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

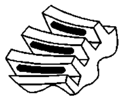
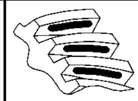
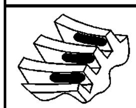
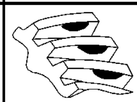
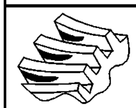
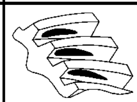
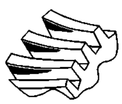
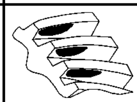
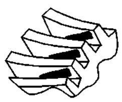
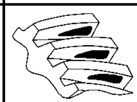
Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

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

8106312d

Fig. 22 PATTERN INTERPRETATION (GEAR CUT 2 AXIS)

REAR AXLE - 194RBI (Continued)

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

8106361d

Fig. 23 PATTERN INTERPRETATION (GEAR CUT 3 AXIS)

SPECIFICATIONS

REAR AXLE

AXLE SPECIFICATIONS

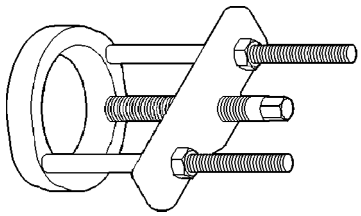
DESCRIPTION	SPECIFICATION
Axle Ratio	3.07, 3.73, 4.10, 4.56
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	2-4 N·m (20-35 in. lbs.)

TORQUE SPECIFICATIONS

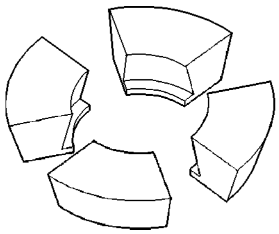
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	77	57	-
Ring Gear Bolts	136	100	-
Pinion Nut Min / Max	271-475	200-350	-
Pinion Mate Shaft Screw	16.25	12	-

REAR AXLE - 194RBI (Continued)

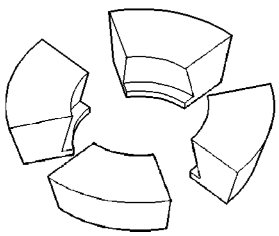
SPECIAL TOOLS



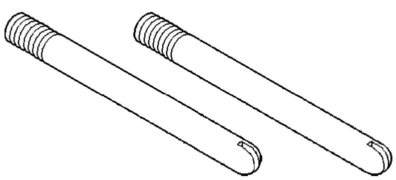
PULLER C-293-PA



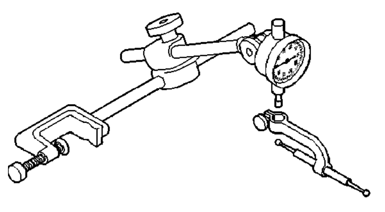
ADAPTER C-293-39



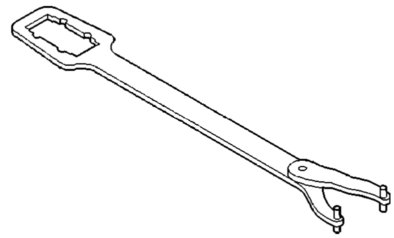
ADAPTER C-293-40



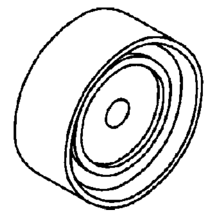
PILOT STUDS C-3288-B



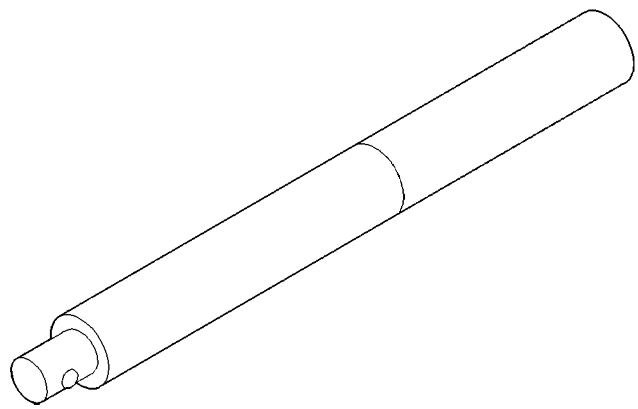
DIAL INDICATOR C-3339



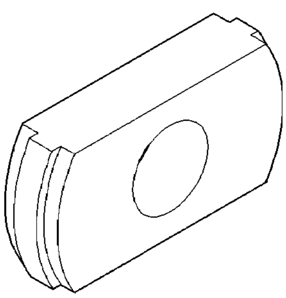
WRENCH C-3281



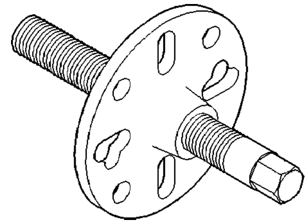
INSTALLER C-3716-A



HANDLE C-4171

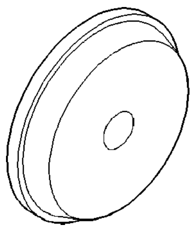


REMOVER C-4345

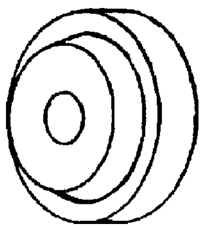


PULLER C-452

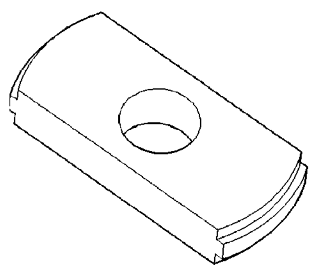
REAR AXLE - 194RBI (Continued)



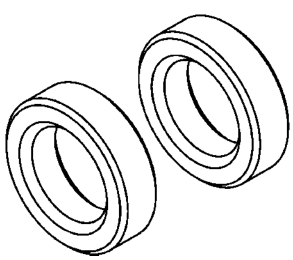
INSTALLER D-130



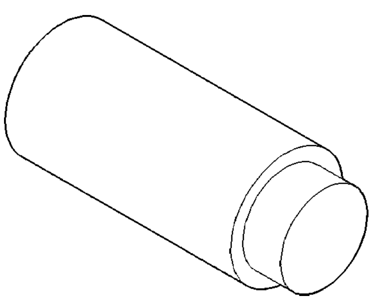
INSTALLER D-146



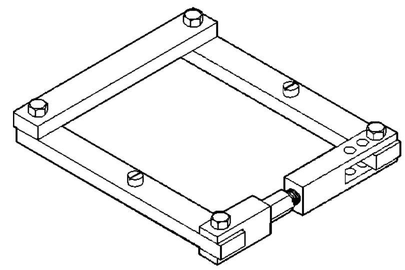
REMOVER D-149



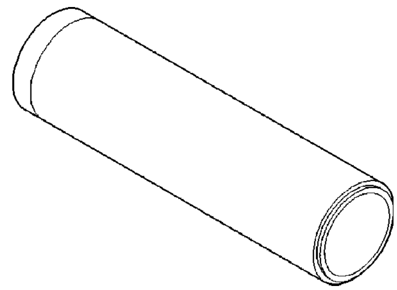
DUMMY BEARINGS D-348



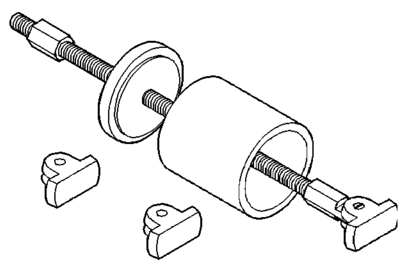
ADAPTER PLUG SP-3289



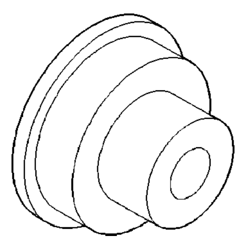
SPREADER W-129-B



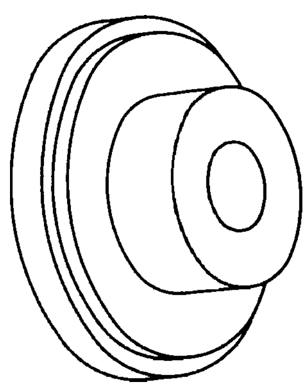
INSTALLER W-262



BEARING REMOVER 6310

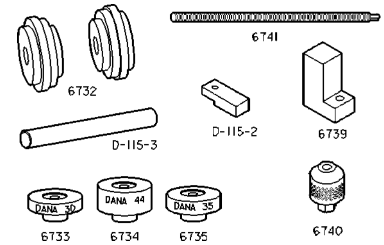


INSTALLER 6436

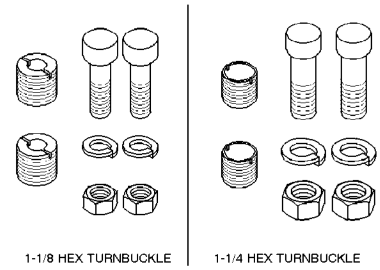


INSTALLER 6437

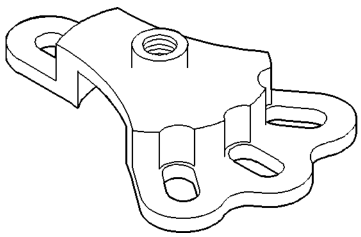
REAR AXLE - 194RBI (Continued)



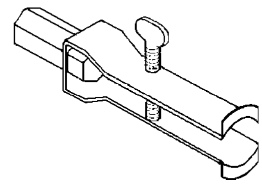
PINION DEPTH 6774



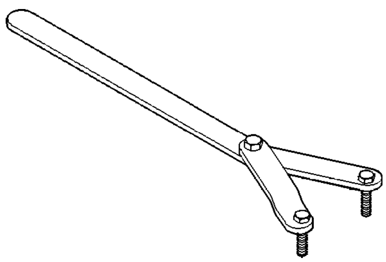
ADAPTER KIT 6987



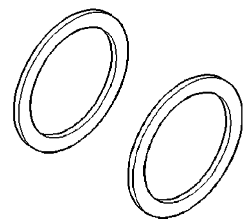
HUB PULLER 6790



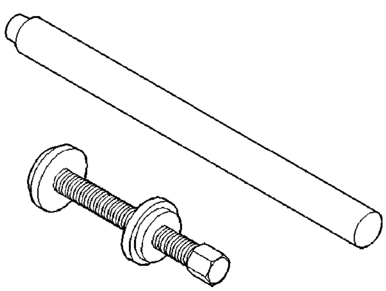
PULLER 7794-A



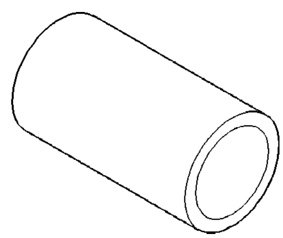
WRENCH SPANNER 6958



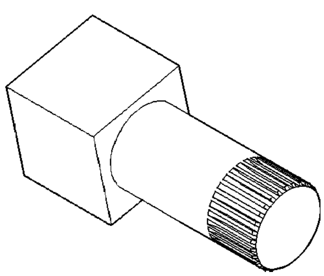
SHIM DUMMY 8107



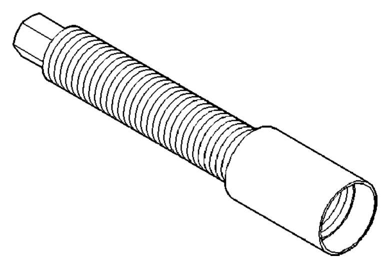
TRAC-LOK TOOLS 6960



CUP 8109



HOLDER FIXTURE 6965



INSTALLER SCREW 8112

AXLE SHAFTS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake drum.

(3) Remove differential cover and drain fluid.

(4) Rotate differential case to access pinion mate gear shaft lock screw. Remove lock screw and shaft from differential case (Fig. 24).

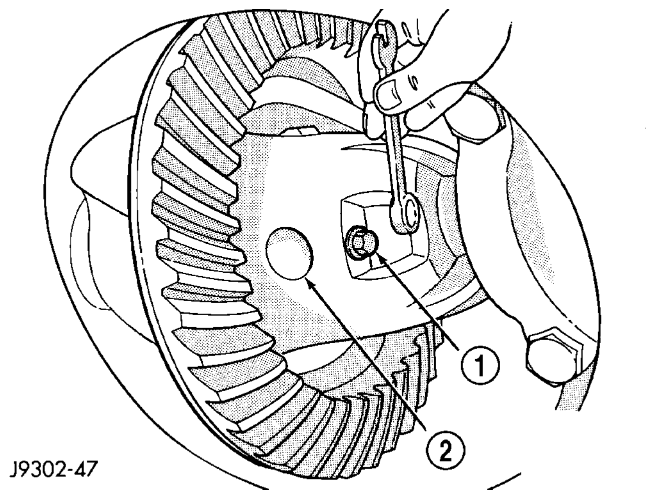


Fig. 24 MATE SHAFT LOCK SCREW

1 - LOCK SCREW
2 - PINION GEAR MATE SHAFT

(5) Push axle shaft inward and remove axle C-clip lock (Fig. 25).

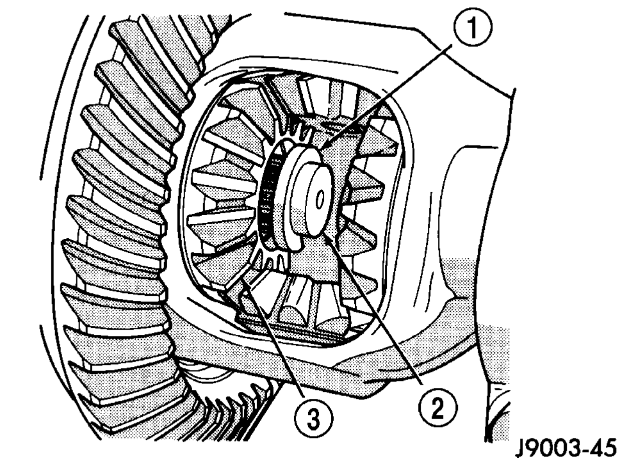


Fig. 25 AXLE SHAFT C-CLIP

1 - C-CLIP LOCK
2 - AXLE SHAFT
3 - SIDE GEAR

(6) Remove axle shaft.

INSTALLATION

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

(2) Install C-clip lock on the axle shaft, then push axle outward to seat C-clip lock in side gear.

(3) Insert pinion mate shaft into differential case and through thrust washers and pinion gears.

(4) Align hole in shaft with hole in the differential case and install lock screw with Loctite® on the threads. Tighten lock screw to 19 N·m (14 ft. lbs.).

(5) Install differential cover.

AXLE SHAFT SEALS

REMOVAL

(1) Remove the axle shaft.

(2) Remove axle shaft seal from the end of the axle shaft tube with a small pry bar.

(3) Inspect the axle shaft tube bore for roughness and burrs and remove as necessary.

INSTALLATION

(1) Wipe the axle shaft tube bore clean.

(2) Install **new** axle shaft seal with Installer 6437 and Handle C-4171 (Fig. 26).

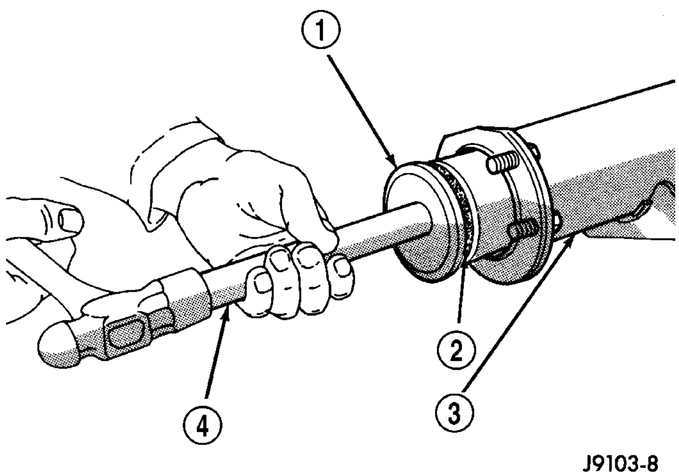


Fig. 26 AXLE SHAFT SEAL

1 - INSTALLER
2 - SEAL
3 - AXLE SHAFT TUBE
4 - HANDLE

(3) Install the axle shaft.

AXLE BEARINGS

REMOVAL

(1) Remove axle shaft.

(2) Remove axle shaft seal from axle shaft tube with a small pry bar.

(3) Remove axle shaft bearing from the axle tube with Bearing Removal Tool Set 6310 and Adapter Foot 6310-5 (Fig. 27).

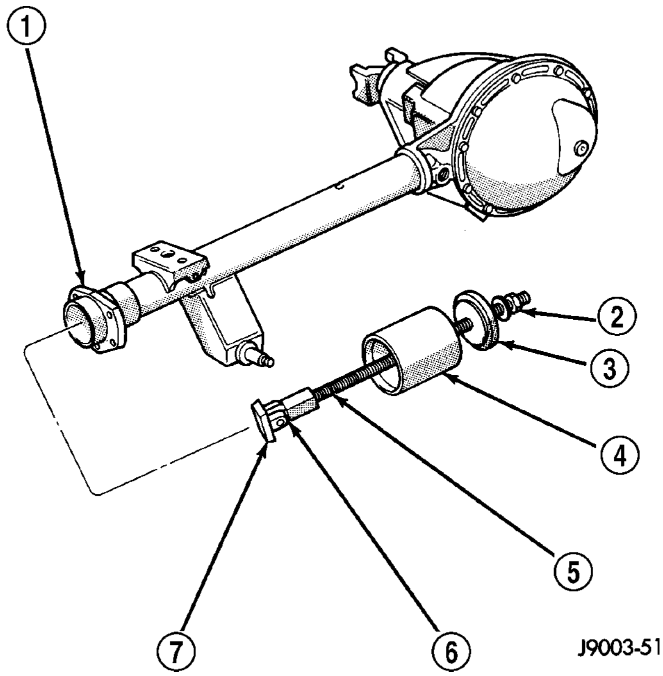


Fig. 27 AXLE SHAFT BEARING TOOLS

1 - AXLE SHAFT TUBE
2 - NUT
3 - GUIDE PLATE
4 - GUIDE
5 - THREADED ROD
6 - ADAPTER
7 - FOOT

INSTALLATION

(1) Wipe axle shaft tube bore clean.

(2) Install axle shaft bearing with Installer 6436 and Handle C-4171.

NOTE: Part number on the bearing must be against the installer.

(3) Install **new** axle shaft seal with Installer 6437 and Handle C-4171 (Fig. 28).

(4) Install axle shaft.

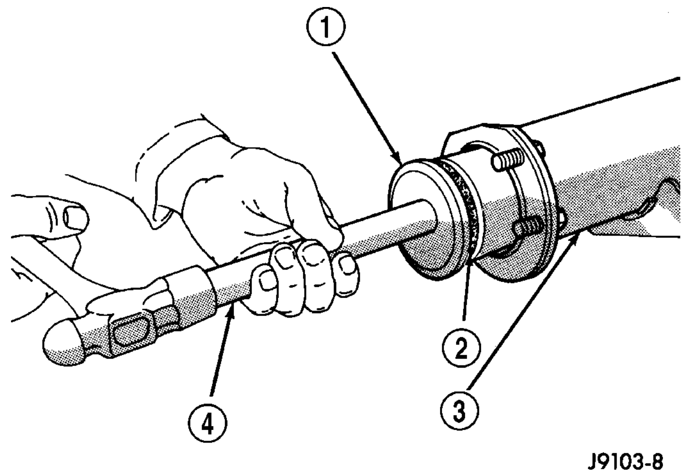


Fig. 28 AXLE SHAFT SEAL INSTALLER

1 - INSTALLER
2 - SEAL
3 - AXLE SHAFT TUBE
4 - HANDLE

PINION SEAL

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake drums.

(3) Remove propeller shaft from the yoke.

(4) Rotate pinion gear three or four times.

(5) Record torque necessary to rotate the pinion gear with an inch pound dial-type torque wrench.

(6) Hold the yoke with Wrench 6958 and remove pinion nut and washer.

(7) Remove pinion yoke with Remover C-452 and Wrench C-3281 (Fig. 29).

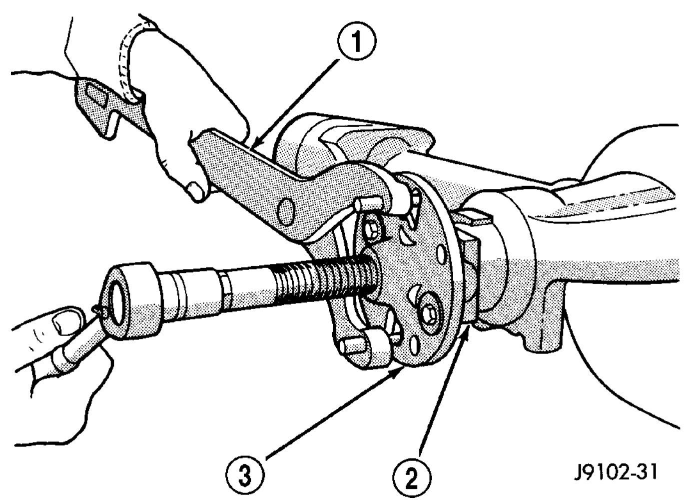


Fig. 29 PINION YOKE REMOVER

1 - WRENCH
2 - YOKE
3 - REMOVER

(8) Remove pinion seal with a pry tool or slide hammer mounted screw.

PINION SEAL (Continued)

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 30).

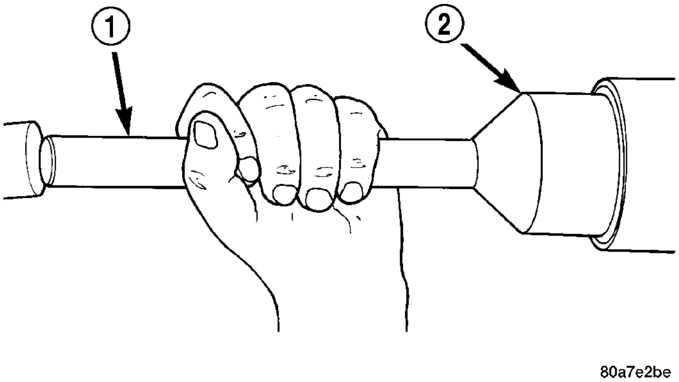


Fig. 30 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(2) Install pinion yoke Screw 8112, Cup 8109 and Spanner Wrench 6958 (Fig. 31).

CAUTION: Do not exceed the minimum tightening torque 271 N·m (200 ft. lbs.) when installing the pinion yoke at this point. Failure to heed caution may result in damage.

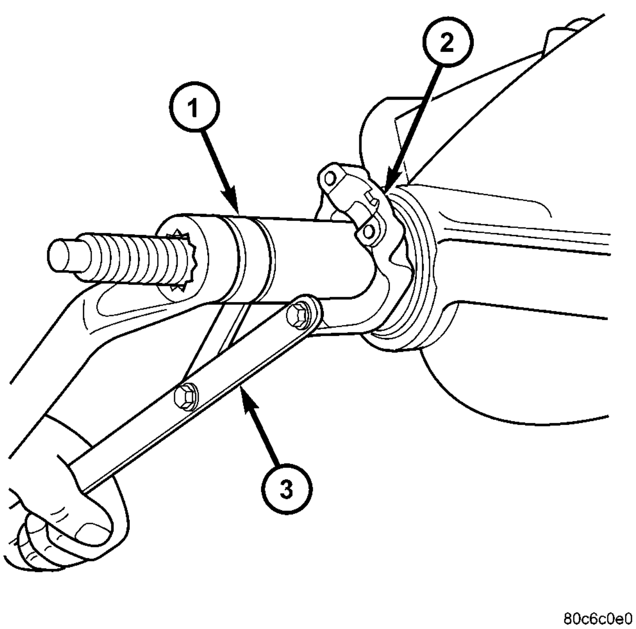


Fig. 31 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

(3) Install yoke washer and **new** nut on pinion gear and tighten nut until there is zero bearing end-play.

(4) Tighten pinion nut to 271 N·m (200 ft. lbs.).

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

(5) Rotate pinion shaft using an inch pound torque wrench. Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.) (Fig. 32).

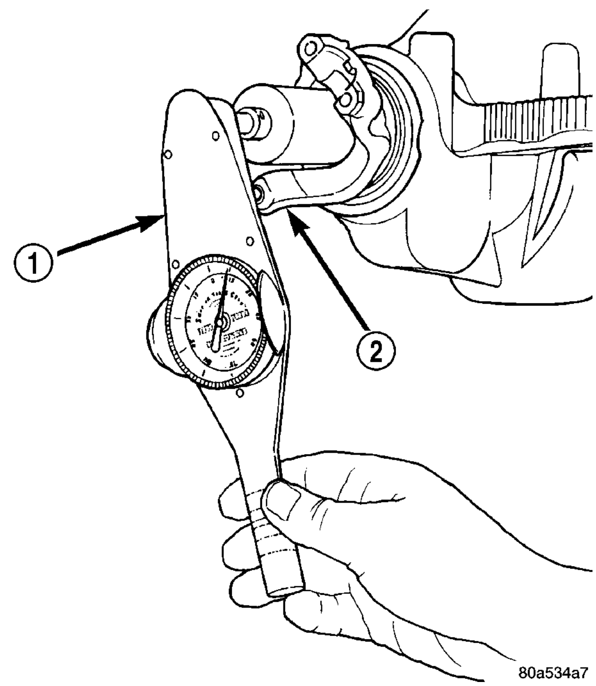


Fig. 32 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

PINION SEAL (Continued)

(6) If rotating torque is low, use Wrench 6958 to hold pinion yoke (Fig. 33), and tighten pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

CAUTION: If maximum tightening torque 475 N·m (350 ft. lbs.) is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Failure to heed caution may result in damage.

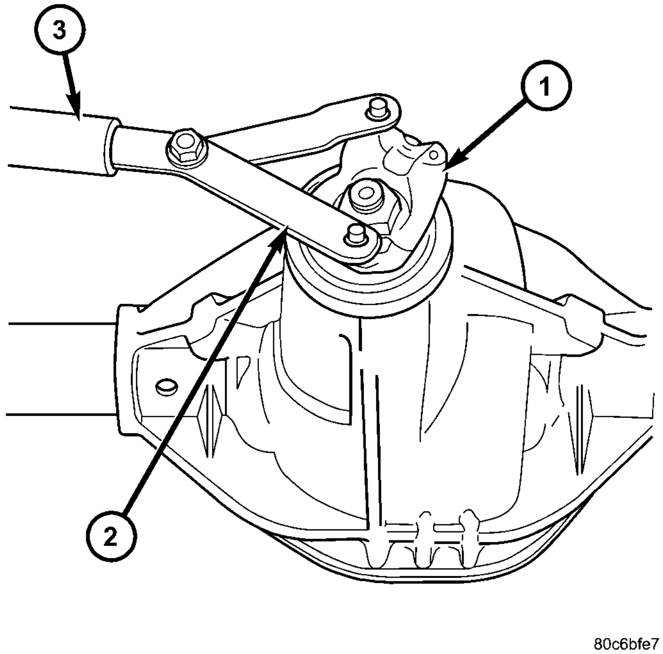


Fig. 33 YOKE HOLDER

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

(7) Install propeller shaft.
(8) Install the brake drums.

COLLAPSIBLE SPACER

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.
(2) Remove rear brake drums.
(3) Remove propeller shaft.
(4) Rotate pinion gear three or four times.
(5) Record torque to rotate the pinion gear with an inch pound dial-type torque wrench.
(6) Hold pinion yoke with Spanner Wrench 6958 and remove pinion nut and washer.
(7) Remove pinion yoke with Remover C-452 and Flange Wrench C-3281 (Fig. 34).
(8) Remove pinion shaft seal with a pry tool or a slide hammer mounted screw.

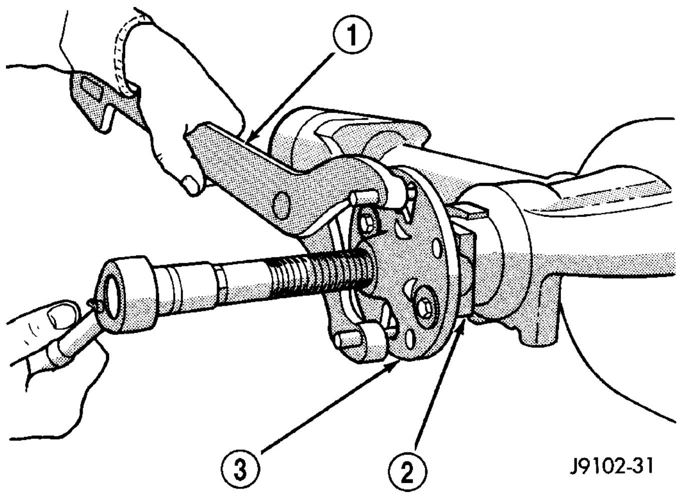


Fig. 34 PINION YOKE REMOVER

1 - WRENCH
2 - YOKE
3 - REMOVER

(9) Remove front pinion bearing using a pair of pick tools to pull the bearing straight off the pinion gear shaft.

NOTE: If bearing becomes bound on pinion shaft, lightly tap the pinion shaft with a rawhide/rubber hammer.

(10) Remove collapsible spacer.

INSTALLATION

(1) Install a **new** collapsible preload spacer on pinion shaft.
(2) Install pinion front bearing.
(3) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 35).

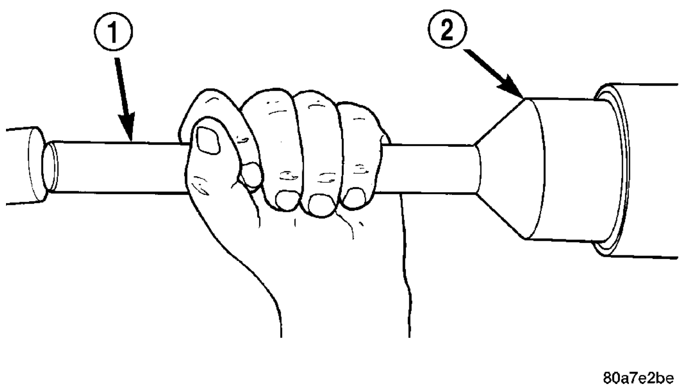


Fig. 35 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

COLLAPSIBLE SPACER (Continued)

(4) Install yoke with Screw 8112, Cup 8109 and Spanner Wrench 6958 (Fig. 36).

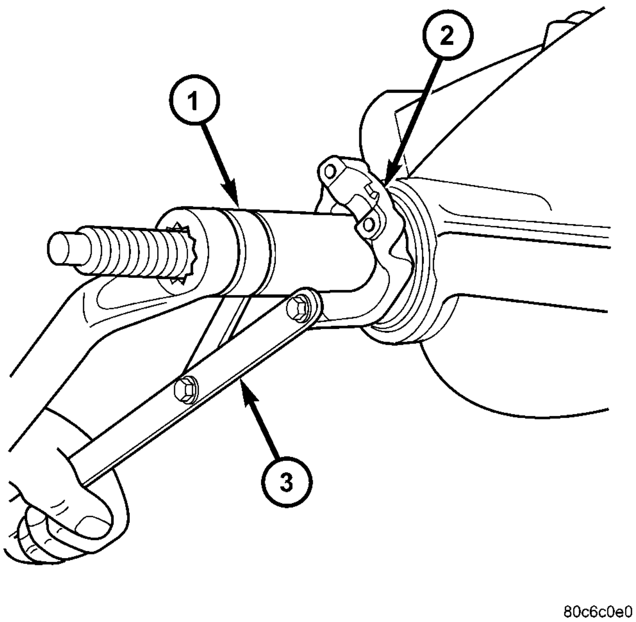


Fig. 36 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

(5) Install yoke washer and **new** nut on the pinion gear. Tighten the nut to 271 N·m (200 ft. lbs.).

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

(6) Using yoke with Spanner Wrench 6958 and a torque wrench set at 475 N·m (350 ft. lbs.), (Fig. 37) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 38).

CAUTION: If more than 475 N·m (350 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced. Failure to heed caution may result in damage.

(7) Check rotating torque with an inch pound torque wrench (Fig. 38). The rotating torque of the pinion should be, the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.).

(8) Install propeller shaft.

(9) Install rear brake drums.

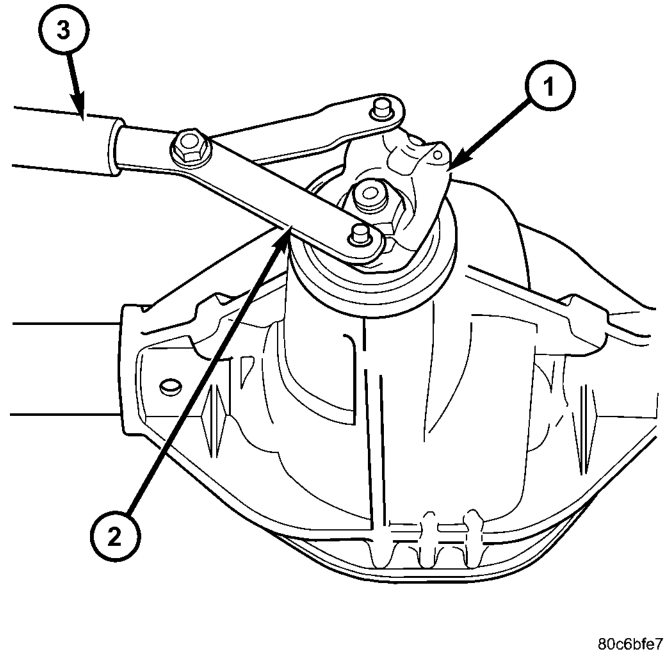


Fig. 37 YOKE HOLDER

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

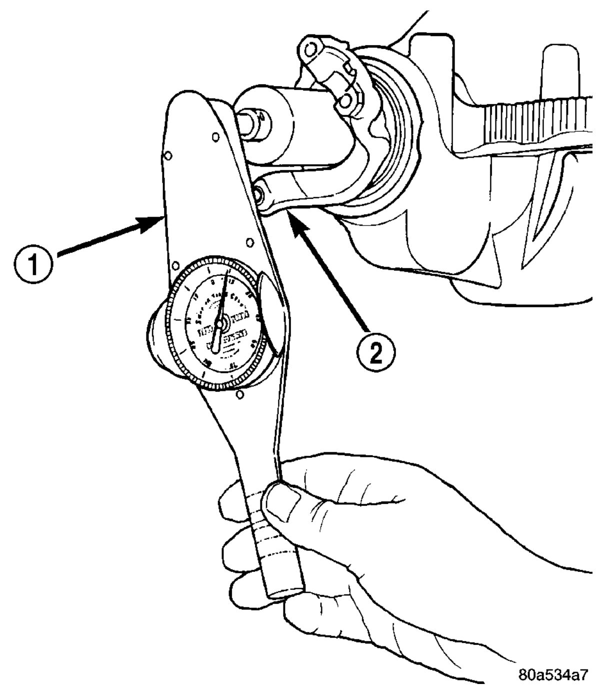


Fig. 38 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

DIFFERENTIAL COVER

REMOVAL

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

INSTALLATION

(1) Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 39).

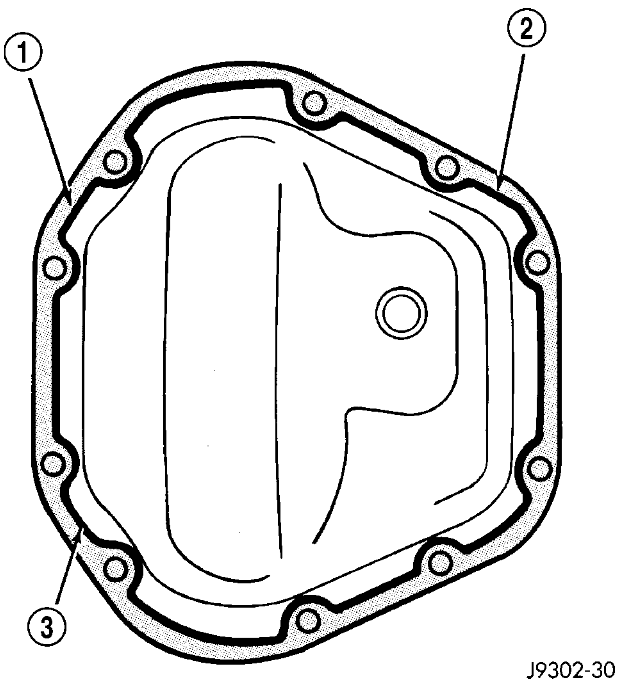


Fig. 39 HOUSING COVER - TYPICAL

1 - SEALANT SURFACE
2 - SEALANT
3 - SEALANT THICKESS

CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.

(2) Install cover and identification tag. Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).
(3) Fill differential to specifications.
(4) Install fill plug and tighten to 34 N·m (25 ft. lbs.).

DIFFERENTIAL

REMOVAL

(1) Remove differential fill plug.
(2) Remove differential cover and drain fluid.
(3) Remove axle shafts.
(4) Note reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 40).

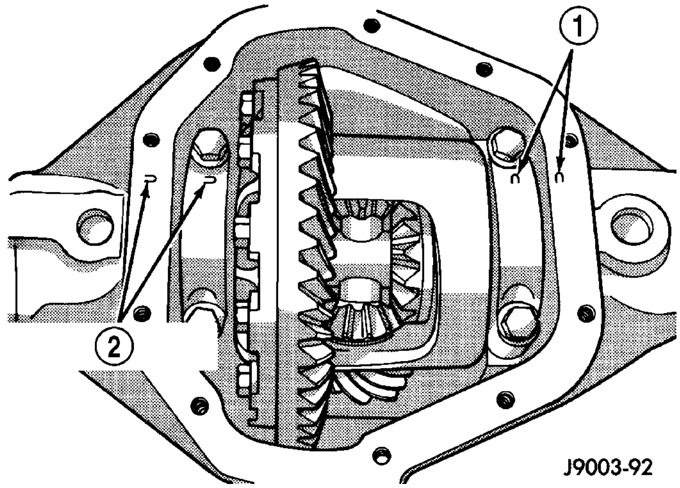


Fig. 40 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(5) Loosen differential bearing cap bolts.
(6) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 41). Install hold-down clamps and tighten the turnbuckle finger-tight.

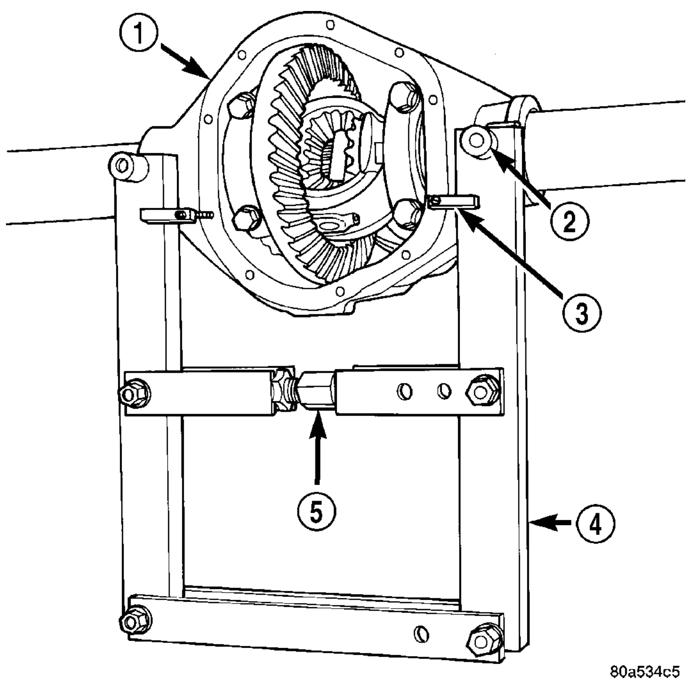


Fig. 41 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL (Continued)

(7) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing (Fig. 42) and zero the indicator.

CAUTION: Never spread the housing over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

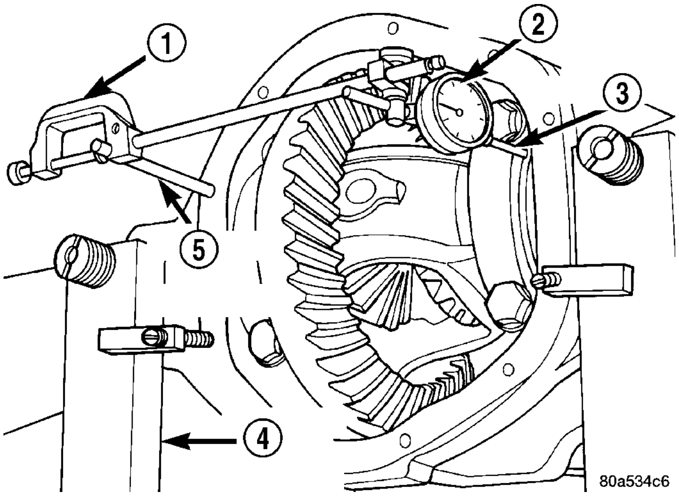


Fig. 42 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

(8) Spread housing while measuring the distance with the dial indicator (Fig. 43).

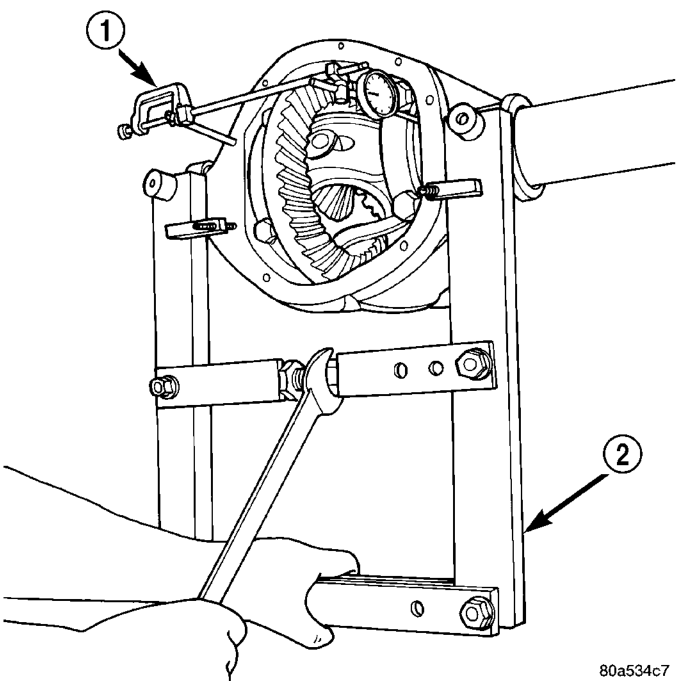


Fig. 43 SPREAD DIFFERENTIAL HOUSING

1 - DIAL INDICATOR
2 - SPREADER

(9) Remove dial indicator.

(10) While holding differential case in position, remove differential bearing caps.

(11) Remove differential from housing and tag differential bearing cups to indicate location (Fig. 44).

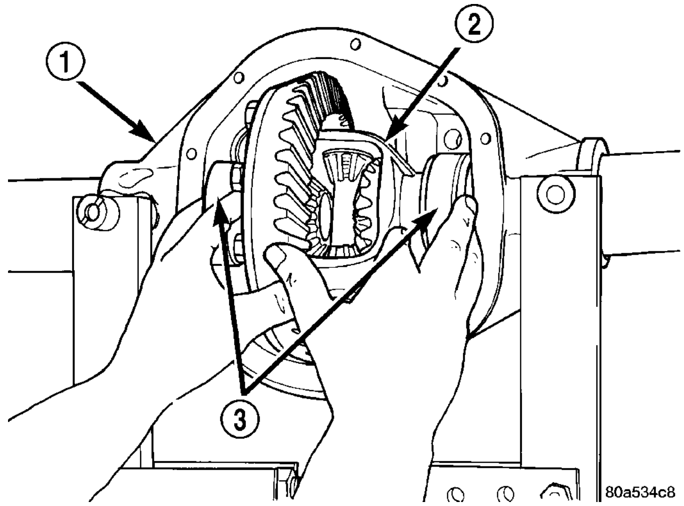


Fig. 44 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

(12) Remove spreader from housing.

(13) Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

DISASSEMBLY

(1) Remove pinion shaft.

(2) Rotate differential side gears and remove differential pinions and thrust washers (Fig. 45).

(3) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Lubricate all differential components with hypoid gear lubricant.

(2) Install differential side gears and thrust washers.

(3) Install differential pinion gears and thrust washers.

(4) Install the pinion mate shaft.

(5) Align hole in the pinion mate shaft with the hole in the differential case and install pinion mate shaft lock screw finger tight.

DIFFERENTIAL (Continued)

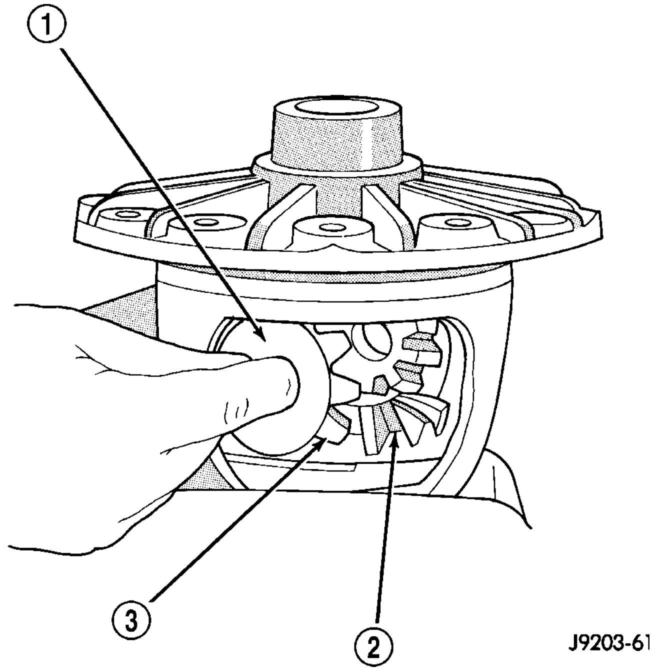


Fig. 45 DIFFERENTIAL GEARS

1 - THRUST WASHER
2 - SIDE GEAR
3 - DIFFERENTIAL PINION

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B and adapters from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 46). Install hold-down clamps and tighten turnbuckle finger-tight.

(2) Install Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Never spread over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator.

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings. Tap the differential case to ensure the bearings cups are seated in the housing.

(6) Install bearing caps in their original locations (Fig. 47).

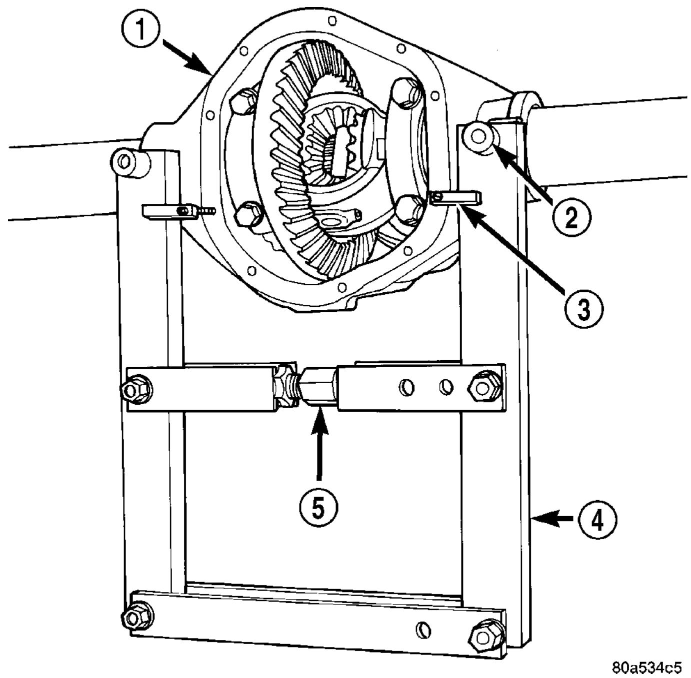


Fig. 46 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

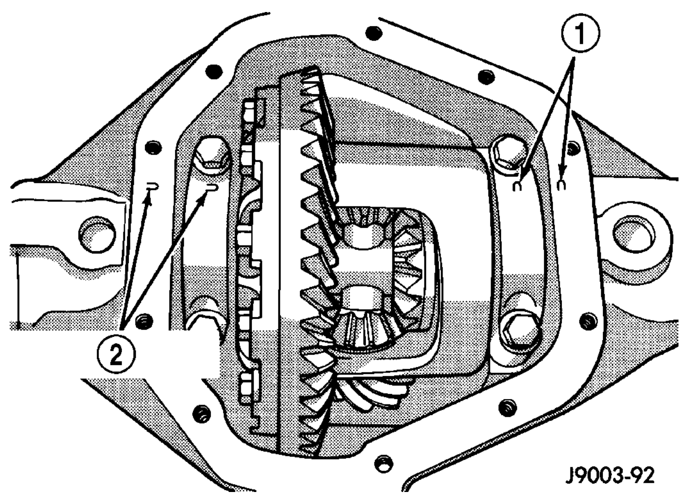


Fig. 47 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten bearing cap bolts to 77 N·m (57 ft. lbs.).

(10) Install axle shafts.

(11) Install cover and identification tag.

DIFFERENTIAL - TRAC-LOK

DESCRIPTION

The Trac-Lok® differential has a one-piece differential case, and similar internal components as a standard differential, plus two clutch disc packs. Differential bearing preload and ring gear backlash are adjusted with shims located between the differential case bearing cups and housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

OPERATION

This differentials clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 48).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok® operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

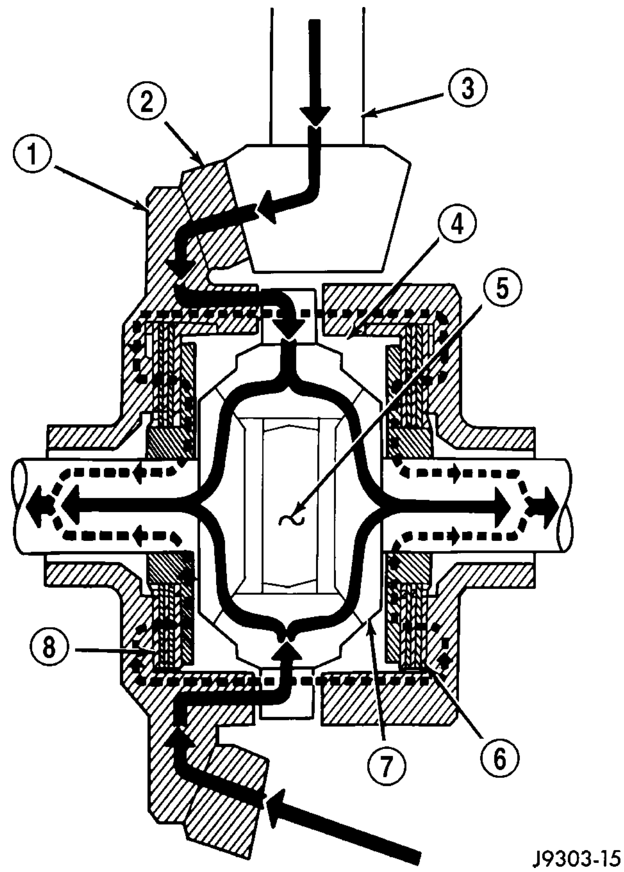


Fig. 48 TRAC-LOK LIMITED SLIP DIFFERENTIAL

1 - CASE
2 - RING GEAR
3 - DRIVE PINION
4 - PINION GEAR
5 - MATE SHAFT
6 - CLUTCH PACK
7 - SIDE GEAR
8 - CLUTCH PACK

DIAGNOSIS AND TESTING

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. A container of Mopar Trac-lok® Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If chatter persists, clutch damage could have occurred.

DIFFERENTIAL TEST

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 or equivalent tool to studs.

DIFFERENTIAL - TRAC-LOK (Continued)

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 49).

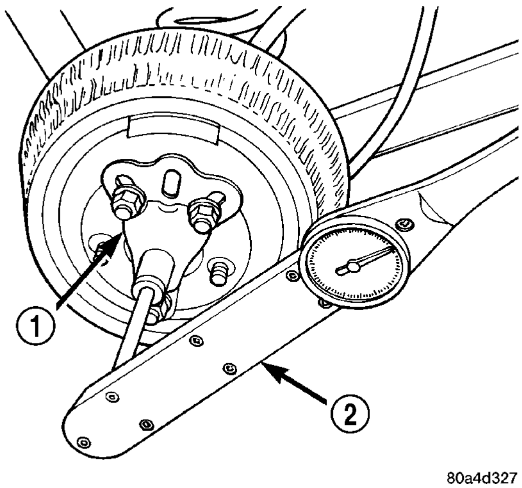


Fig. 49 ROTATING TORQUE TEST

1 - SPECIAL TOOL WITH BOLT IN CENTER HOLE
2 - TORQUE WRENCH

(6) If rotating torque is less than 41 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

DISASSEMBLY

(1) Clamp Holding Fixture 6965 in vise and set differential case on fixture (Fig. 50).

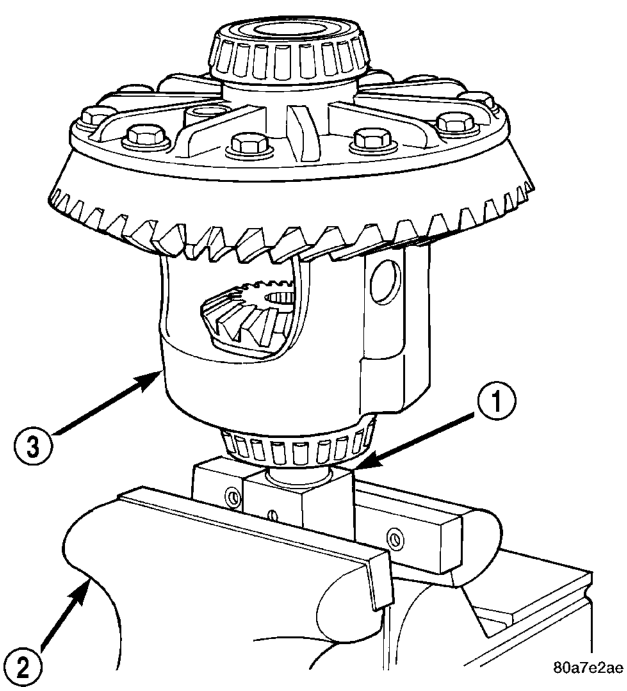


Fig. 50 DIFFERENTIAL CASE FIXTURE

1 - FIXTURE
2 - VISE
3 - DIFFERENTIAL

(2) Remove pinion gear mate shaft lock screw.

(3) Remove pinion gear mate shaft.

(4) Lubricate and install disc without threaded hole from Trac-Lok® Tool Kit 6960 into lower side gear (Fig. 51).

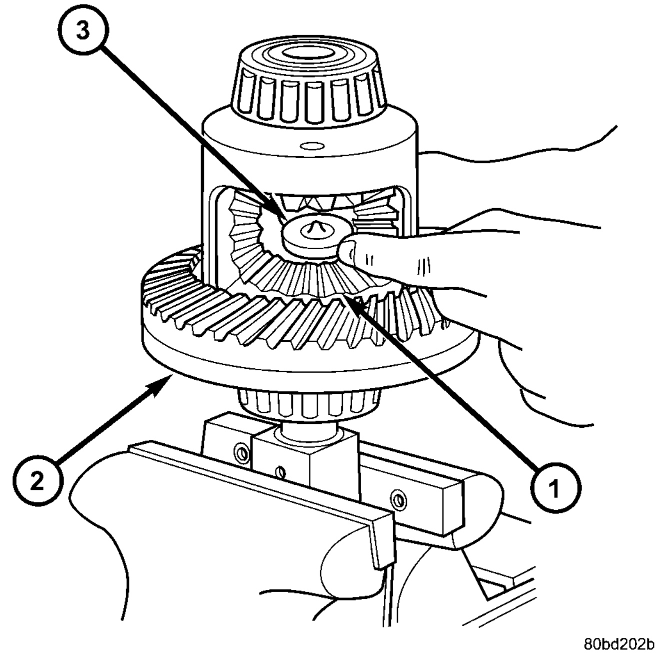


Fig. 51 DISC PLATE

1 - LOWER SIDE GEAR
2 - DIFFERENTIAL CASE
3 - DISC

(5) Install disc with threaded hole in the upper side gear. Thread forcing screw from Trac-Lok® Tool Kit 6960 through the upper disc until it comes in contact with lower disc.

DIFFERENTIAL - TRAC-LOK (Continued)

(6) Insert a screw driver in slot of upper disc (Fig. 52) to prevent disc from turning.

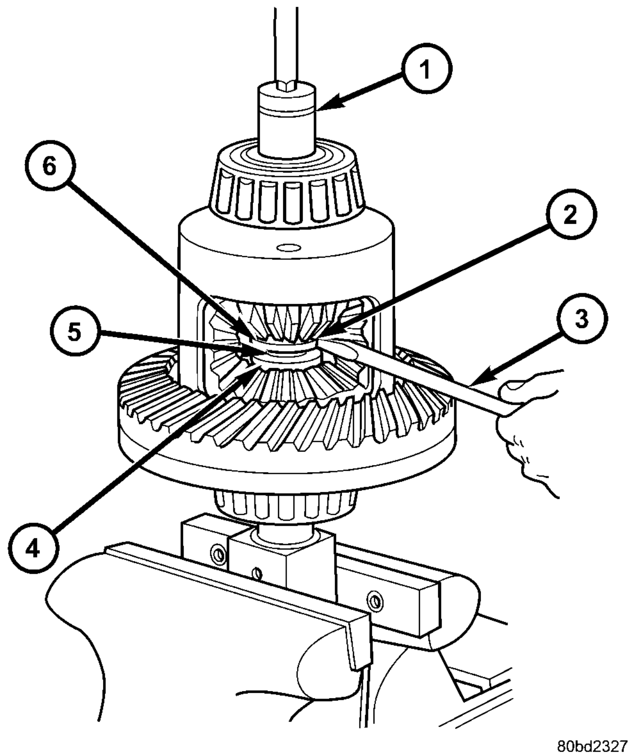


Fig. 52 THREAD ADAPTER DISC

1 - SOCKET
2 - SLOT IN DISC
3 - SCREWDRIVER
4 - LOWER DISC
5 - FORCING SCREW
6 - UPPER DISC

(7) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 53).

(8) With a feeler gauge remove thrust washers from behind the pinion gears (Fig. 54).

(9) Insert turning bar from tool kit into the pinion mate shaft hole in the case (Fig. 55).

(10) Loosen forcing screw in small increments until clutch pack tension is relieved and the differential case can be rotated with turning bar.

(11) Rotate differential case until pinion gears can be removed.

(12) Remove pinion gears from differential case.

(13) Remove forcing screw and discs.

(14) Remove top side gear, clutch pack retainers and clutch pack (Fig. 56).

NOTE: Keep plates in order during removal.

(15) Remove differential case from the fixture.

(16) Remove side gear, clutch pack retainer and clutch pack.

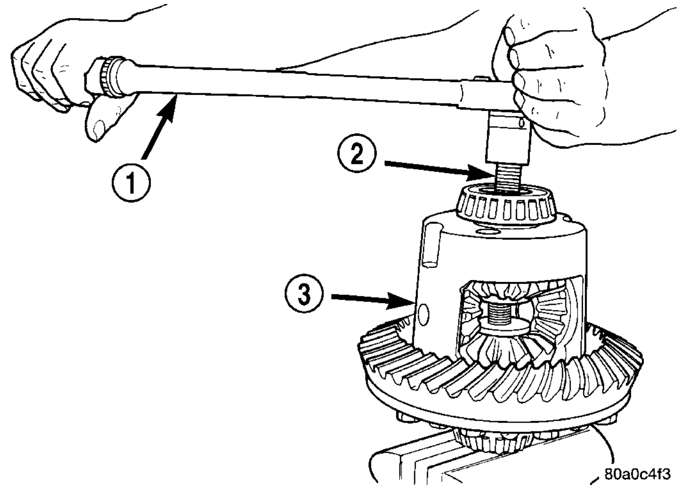


Fig. 53 TIGHTEN FORCING SCREW

1 - TORQUE WRENCH
2 - FORCING SCREW
3 - DIFFERENTIAL CASE

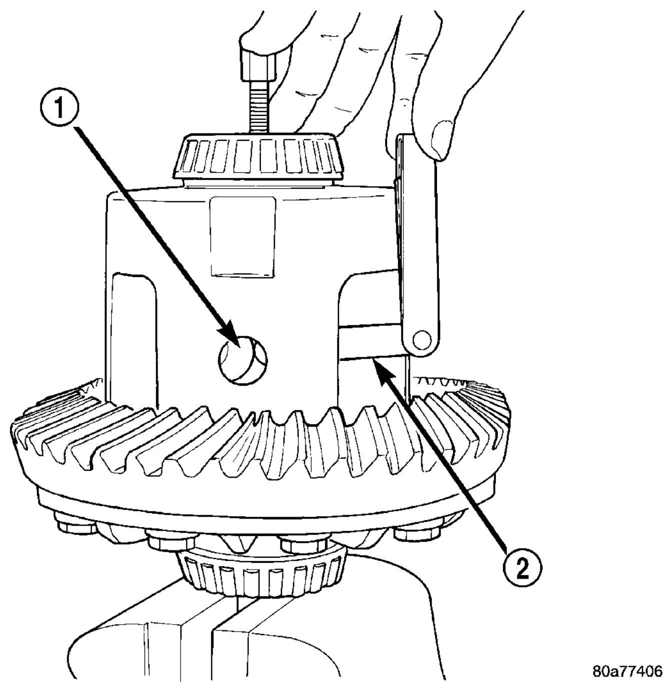


Fig. 54 PINION GEAR THRUST WASHER

1 - THRUST WASHER
2 - FEELER GAUGE

NOTE: Keep plates in order during removal.

ASSEMBLY

NOTE: New Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

DIFFERENTIAL - TRAC-LOK (Continued)

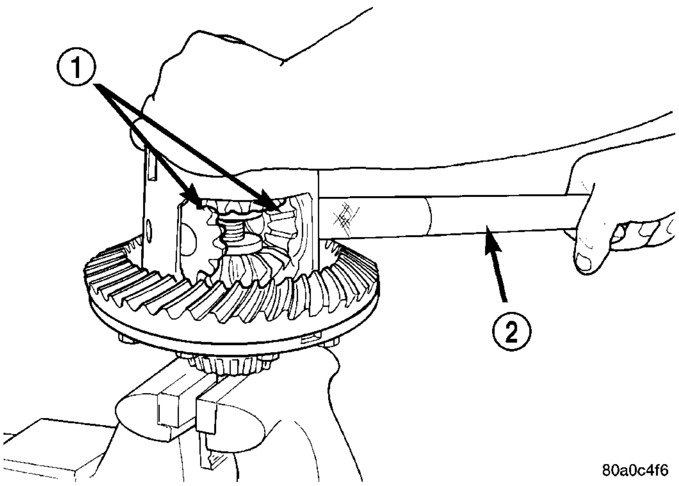


Fig. 55 TURNING BAR

1 - PINION GEARS
2 - TURNING BAR

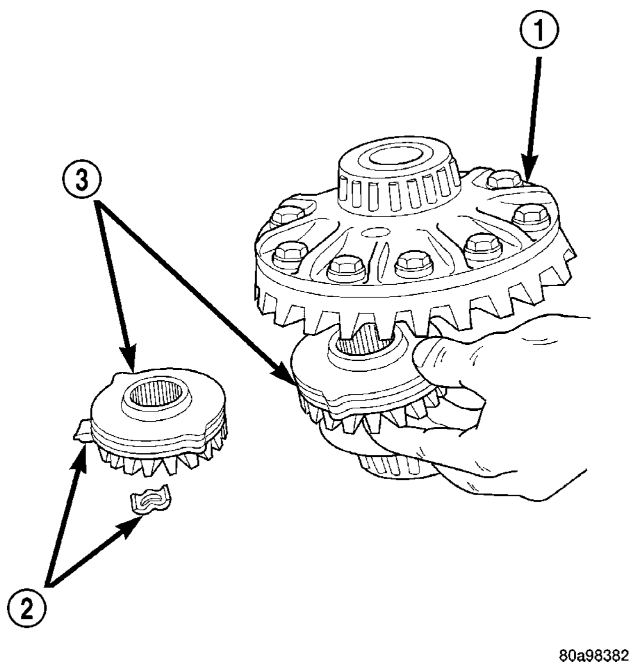


Fig. 56 SIDE GEAR & CLUTCH DISC

1 - DIFFERENTIAL CASE
2 - RETAINER
3 - SIDE GEAR AND CLUTCH DISC PACK

(1) Assemble clutch discs into packs and secure disc packs with retaining clips (Fig. 57).

(2) Install assembled clutch disc packs on side gear hubs.

(3) Install clutch pack and lower side gear in differential case (Fig. 58).

NOTE: Verify clutch pack retaining clips are in position and seated in case pockets.

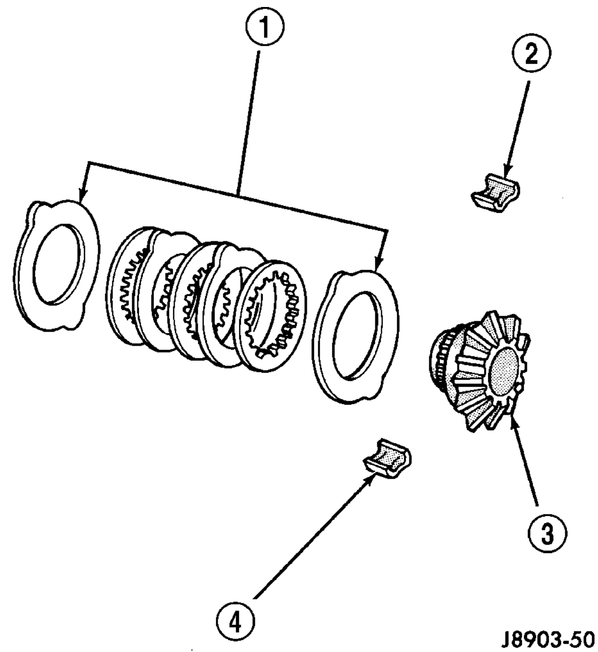


Fig. 57 CLUTCH DISC PACK

1 - CLUTCH PACK
2 - RETAINER
3 - SIDE GEAR
4 - RETAINER

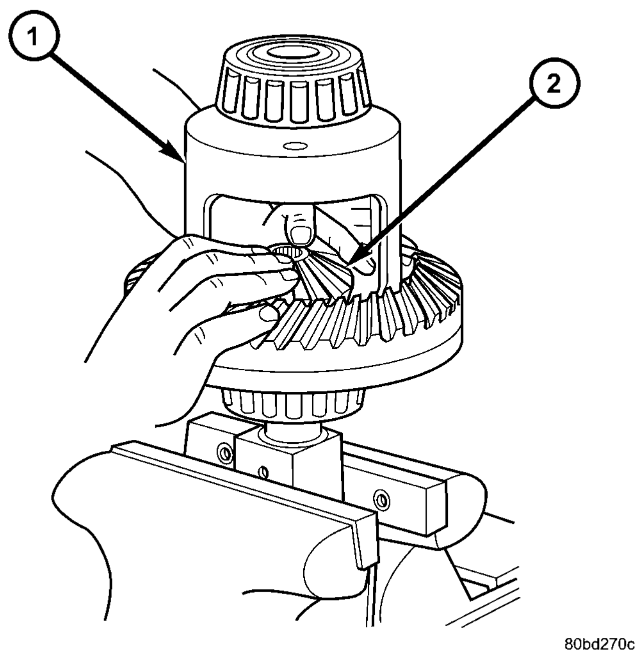


Fig. 58 CLUTCH PACK AND LOWER SIDE GEAR

1 - DIFFERENTIAL CASE
2 - LOWER SIDE GEAR AND CLUTCH PACK

DIFFERENTIAL - TRAC-LOK (Continued)

(4) Lubricated and install disc without the hole from Trac-Lok® Tool Kit 6960 into lower side gear.

(5) Install upper side gear and clutch disc pack (Fig. 59).

NOTE: Verify clutch pack retaining clips are in position and seated in case pockets.

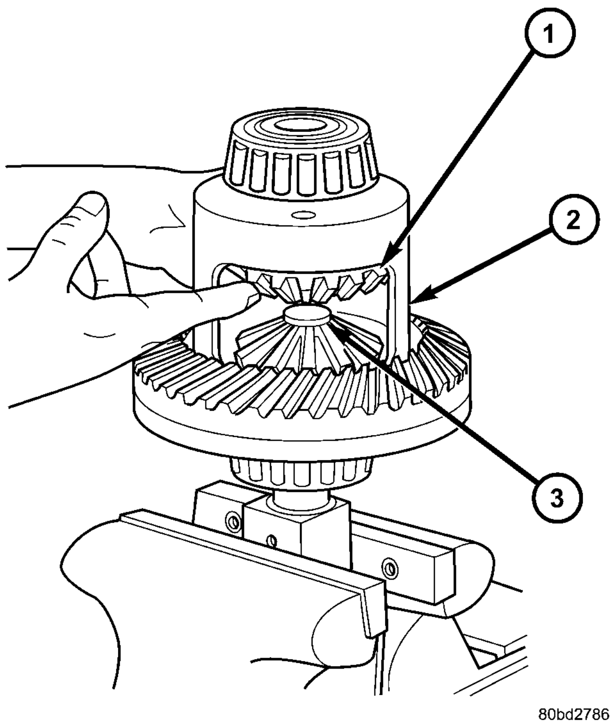


Fig. 59 CLUTCH PACK AND UPPER SIDE GEAR

1 - SIDE GEAR AND CLUTCH PACK
2 - DIFFERENTIAL CASE
3 - LOWER DISC

(6) Lubricate and install disc with threaded hole into top side gear.

(7) Thread forcing screw from tool kit through the top disc and until screw slightly compress clutch disc.

(8) Place pinion gears in position in side gears and verify pinion mate shaft hole is aligned.

(9) Rotate case with turning bar until pinion mate shaft holes in pinion gears align with holes in case.

NOTE: It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(10) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(11) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(12) Remove forcing screw and discs.

(13) Install pinion gear mate shaft and align holes in shaft and case.

(14) Install pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(15) Lubricate all differential components with hypoid gear lubricant.

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Remove differential from housing.

(2) Remove bearings from differential case with Puller/Press C-293-PA , Adapters C-293-39 and Plug SP-3289 (Fig. 60).

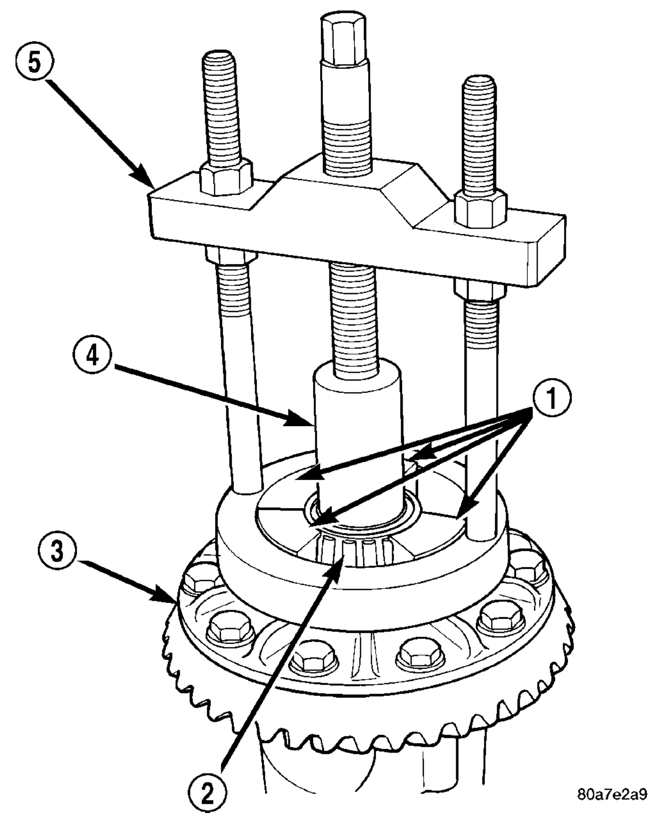


Fig. 60 BEARING REMOVAL

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

DIFFERENTIAL CASE BEARINGS (Continued)

INSTALLATION

(1) Install differential side bearings with Installer C-3716-A with Handle C-4171 (Fig. 61).

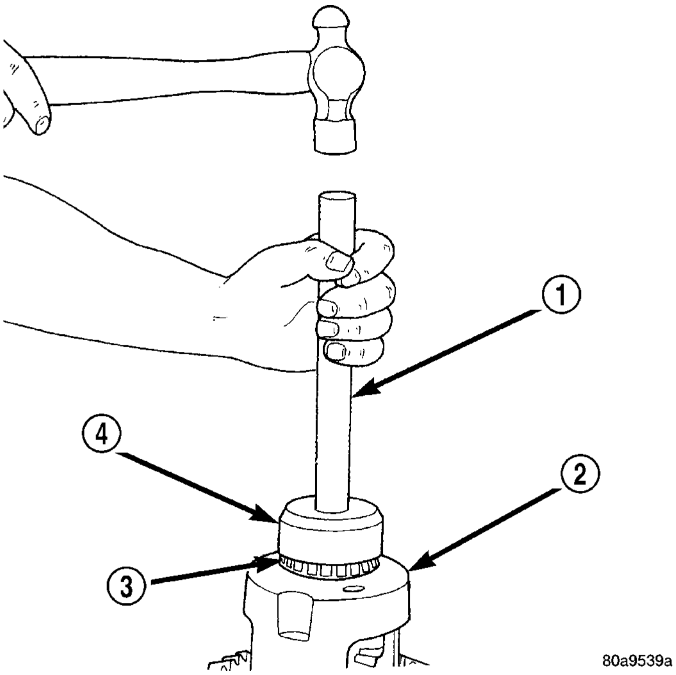


Fig. 61 DIFFERENTIAL CASE BEARINGS

1 - HANDLE
2 - DIFFERENTIAL
3 - BEARING
4 - INSTALLER

(2) Install differential in the housing.

PINION GEAR/RING GEAR

REMOVAL

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

(1) Remove differential from housing.

(2) Place differential case in a vise with soft metal jaw.

(3) Remove ring gear bolts from the differential case.

(4) Drive ring gear off the differential case with a dead-blow hammer (Fig. 62).

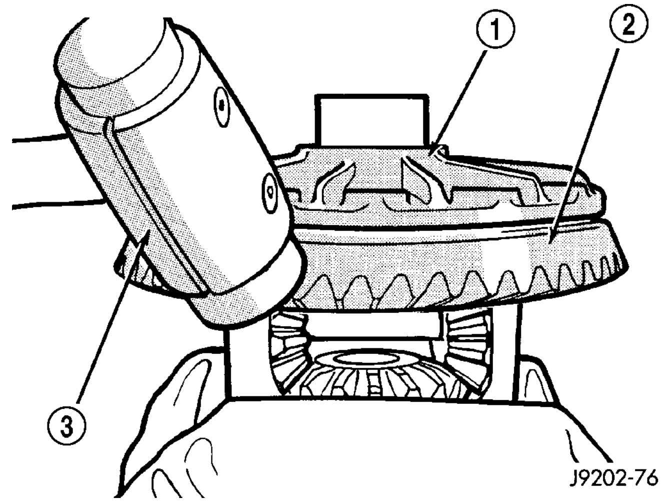


Fig. 62 RING GEAR

1 - CASE
2 - RING GEAR
3 - DEAD-BLOW HAMMER

(5) Hold pinion yoke with Wrench 6958 and remove pinion yoke nut and washer.

(6) Remove pinion yoke from pinion shaft with Remover C-452 and Wrench C-3281 (Fig. 63).

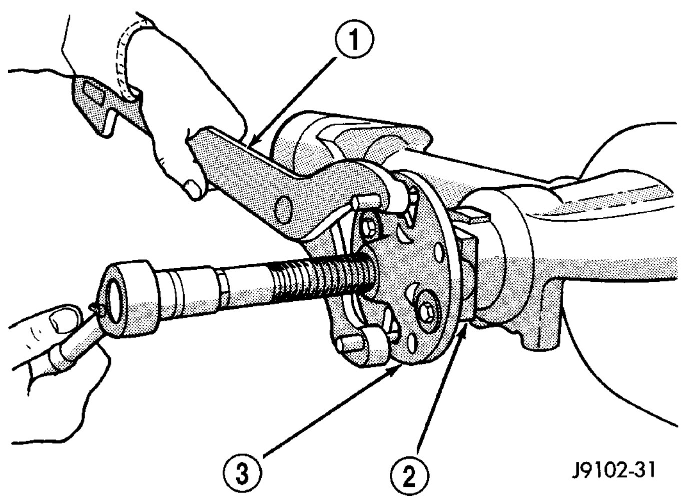


Fig. 63 PINION YOKE REMOVER

1 - WRENCH
2 - YOKE
3 - PULLER

PINION GEAR/RING GEAR (Continued)

(7) Remove pinion gear from housing with a dead-blow hammer (Fig. 64).

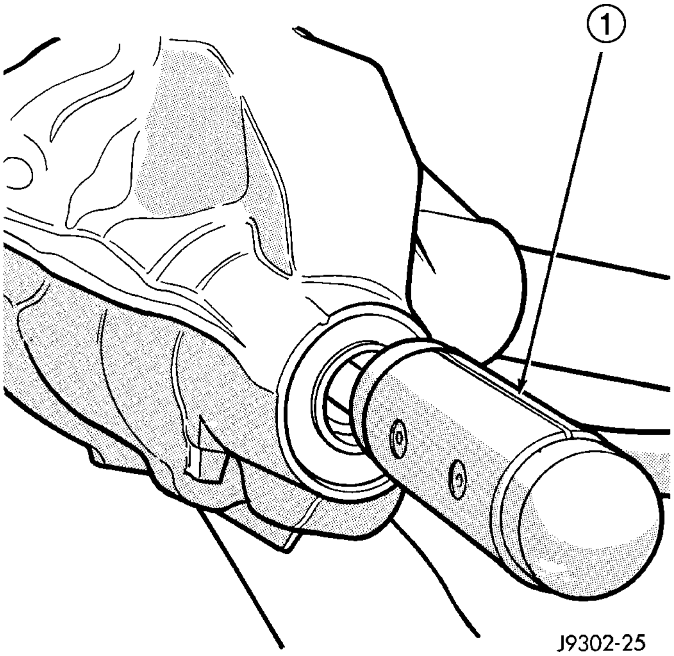


Fig. 64 REMOVE PINION GEAR

1 - DEAD-BLOW HAMMER

(8) Remove pinion shaft seal with a pry tool or a slide hammer mounted screw.

(9) Remove oil slinger, if equipped, and front pinion bearing.

(10) Remove front pinion bearing cup with Remover C-4345 and Handle C-4171 (Fig. 65).

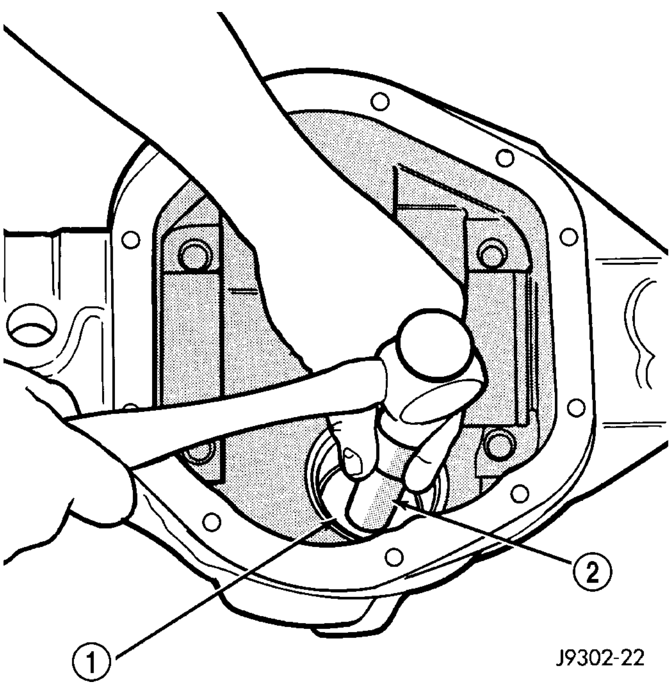


Fig. 65 FRONT PINION BEARING CUP

1 - REMOVER
2 - HANDLE

(11) Remove rear bearing cup from housing (Fig. 66) with Remover D-149 and Handle C-4171.

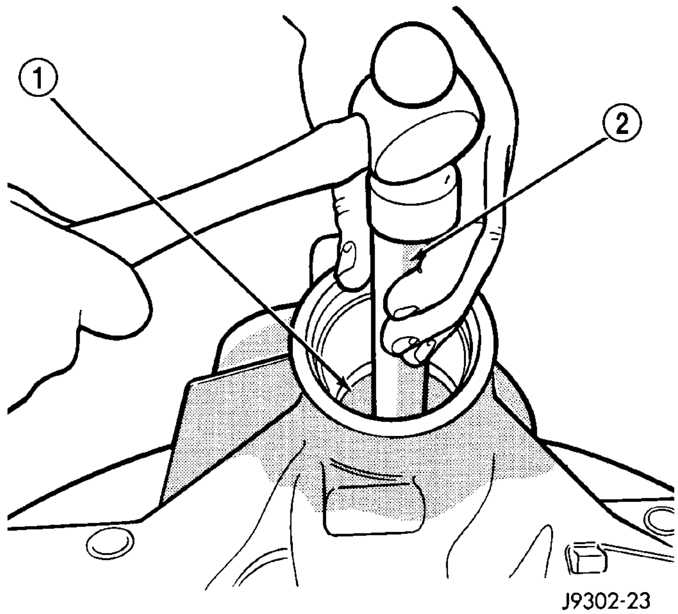


Fig. 66 REAR PINION BEARING CUP

1 - DRIVER
2 - HANDLE

(12) Remove collapsible preload spacer (Fig. 67).

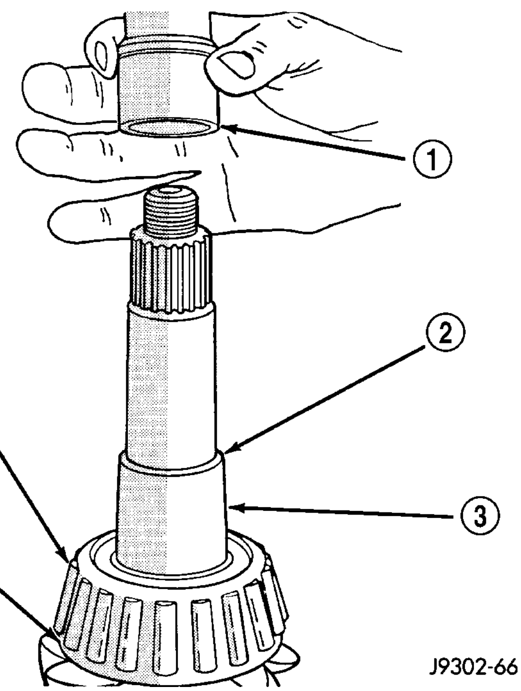


Fig. 67 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - SHIM
5 - REAR BEARING

PINION GEAR/RING GEAR (Continued)

(13) Remove rear bearing from the pinion shaft with Puller/Press C-293-PA and Adapters C-293-40 (Fig. 68).

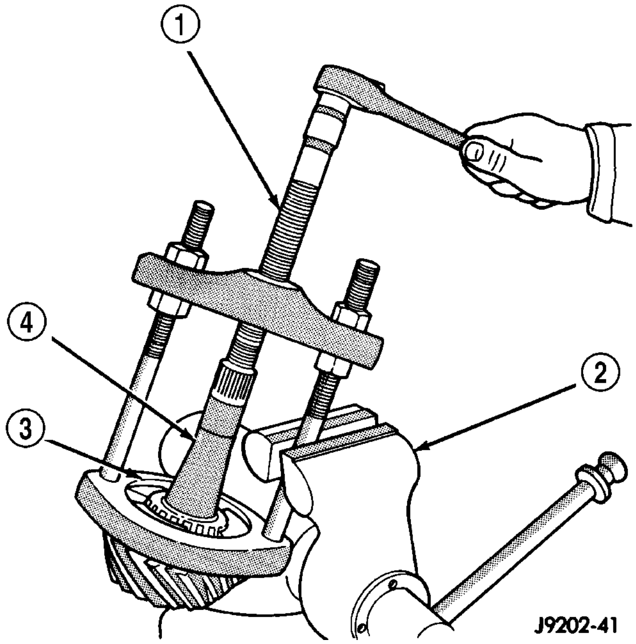


Fig. 68 REAR PINION BEARING

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - DRIVE PINION GEAR SHAFT

(14) Remove depth shims from the pinion shaft and record the shims thickness.

INSTALLATION

NOTE: A pinion depth shim/oil slinger is placed between the rear pinion bearing cone and the pinion head to achieve proper ring gear and pinion mesh. If ring gear and pinion are reused, the pinion depth shim/oil slinger should not require replacement. Refer to Adjustment (Pinion Gear Depth) to select the proper thickness shim/oil slinger if ring and pinion gears are replaced.

(1) Apply Mopar Door Ease or equivalent lubricant to outside surface of bearing cups.
(2) Install pinion rear bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 69) and verify cup is seated.
(3) Install pinion front bearing cup with Installer D-130 and Handle C-4171 (Fig. 70) and verify cup is seated.
(4) Install pinion front bearing and shim.

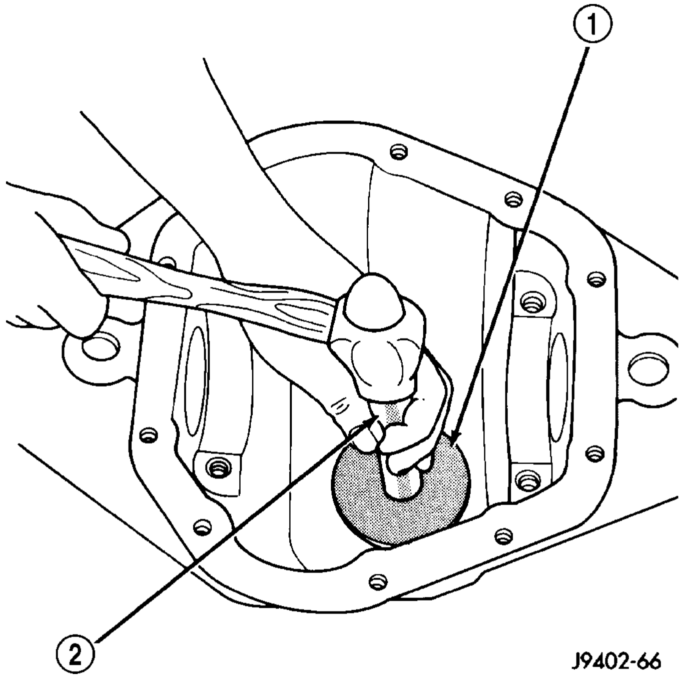


Fig. 69 REAR PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

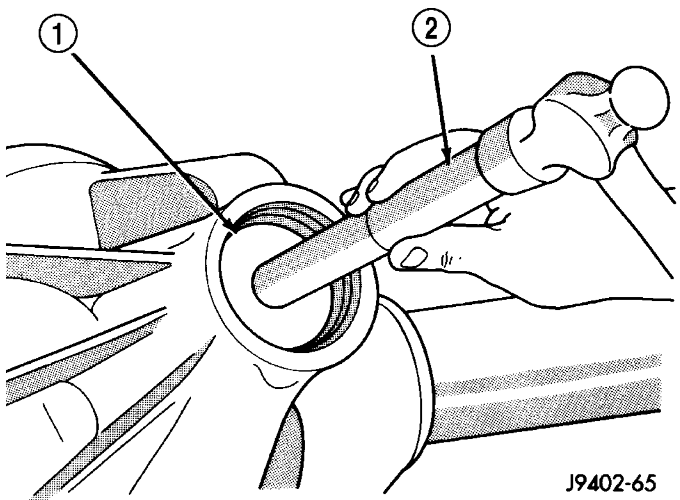


Fig. 70 FRONT PINION BEARING CUP

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR (Continued)

(5) Apply a light coating of gear lubricant on the lip of pinion seal and install seal with an appropriate installer (Fig. 71).

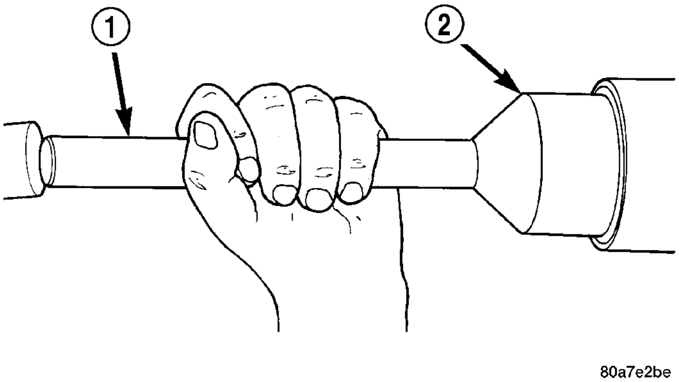


Fig. 71 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(6) Install depth shim on the pinion gear.

(7) Install rear bearing and shim on the pinion gear with Installer W-262 and a press (Fig. 72).

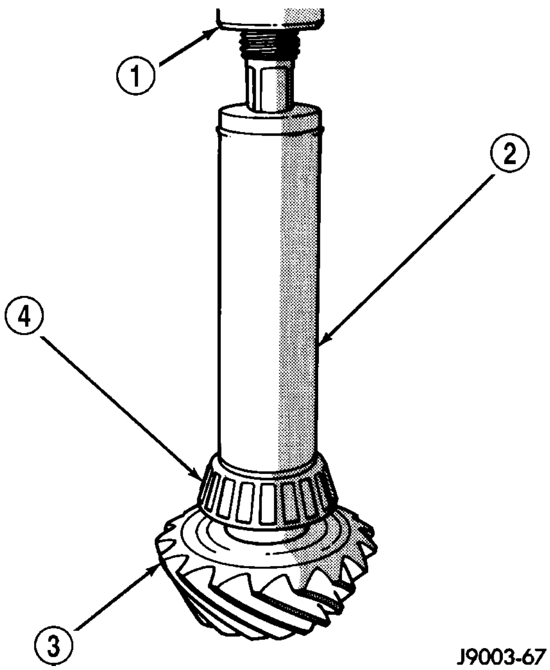


Fig. 72 REAR PINION BEARING

1 - PRESS
2 - INSTALLER
3 - DRIVE PINION GEAR
4 - REAR PINION BEARING

(8) Install a **new** collapsible preload spacer on pinion shaft and install pinion gear in the housing (Fig. 73).

(9) Install yoke with Installer Screw 8112, Cup 8109 and Wrench 6958 (Fig. 74).

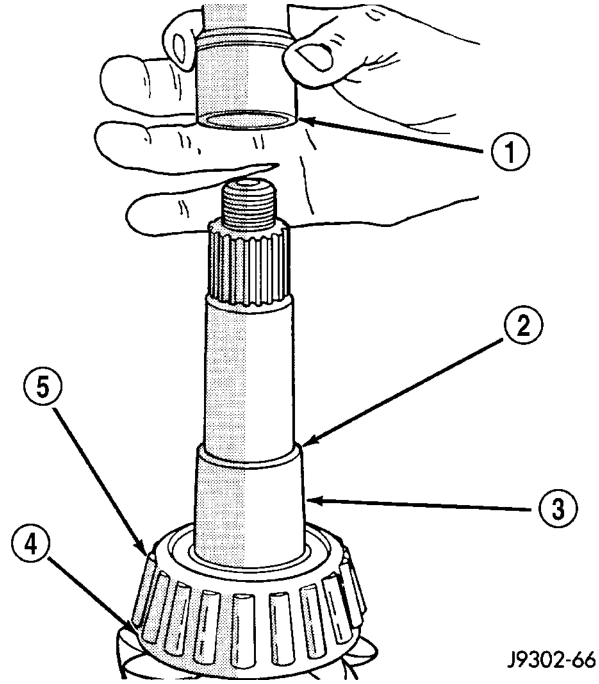


Fig. 73 COLLAPSIBLE SPACER

1 - COLLAPSIBLE SPACER
2 - SHOULDER
3 - PINION GEAR
4 - SHIM
5 - REAR BEARING

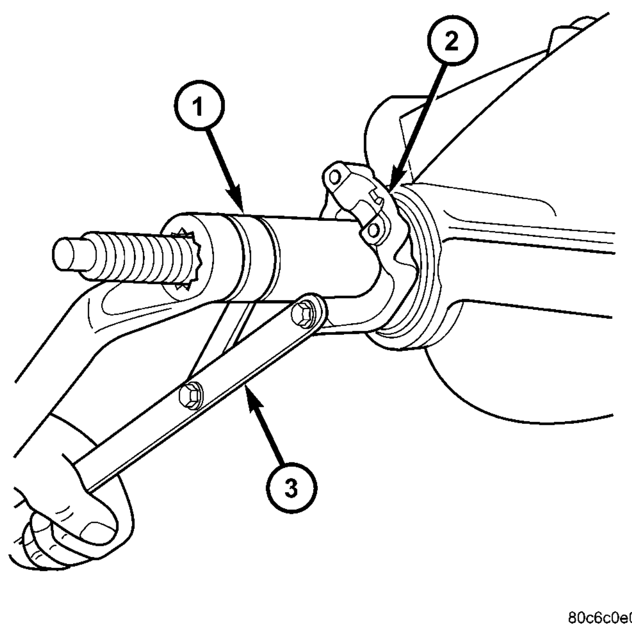


Fig. 74 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

PINION GEAR/RING GEAR (Continued)

(10) Install yoke washer and a **new** nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.

(11) Tighten the nut to 271 N·m (200 ft. lbs.).

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

(12) Using Spanner Wrench 6958 and a torque wrench set at 475 N·m (350 ft. lbs.), (Fig. 75) slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 76).

CAUTION: If more than 475 N·m (350 ft. lbs.) torque is required to crush the collapsible spacer, the spacer is defective and must be replaced. Failure to heed caution may result in damage.

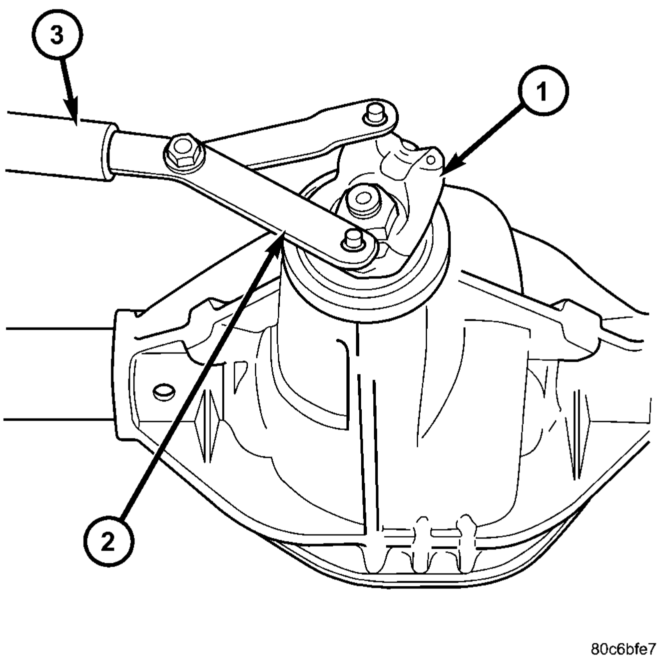


Fig. 75 PINION YOKE WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

(13) Check bearing rotating torque with a inch pound torque wrench (Fig. 76). The pinion gear rotating torque should be:

- Original Bearings: 1 to 2 N·m (10 to 20 in. lbs.).
- New Bearings: 2 to 4 N·m (20 to 35 in. lbs.).

(14) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(15) Invert the differential case in the vise.

(16) Install new ring gear bolts and alternately tighten to 136 N·m (100 ft. lbs.) (Fig. 77).

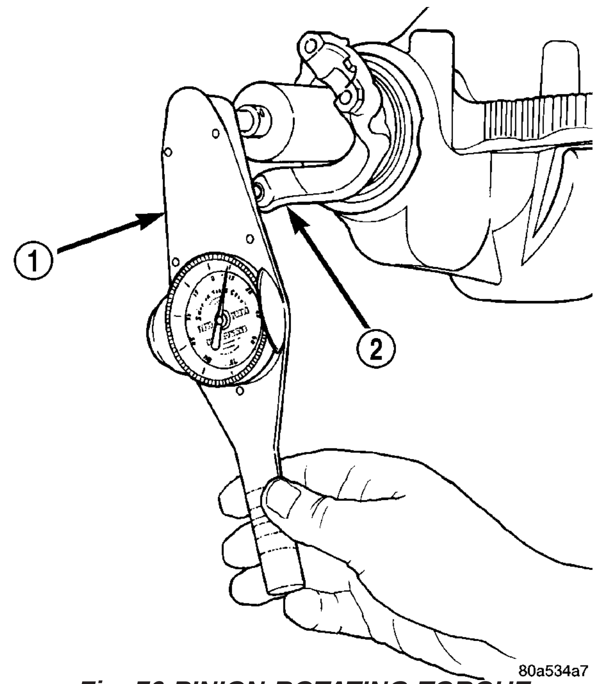


Fig. 76 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

CAUTION: Do not reuse ring gear bolts, the bolts can fracture causing extensive damage. Failure to heed caution may result in damage.

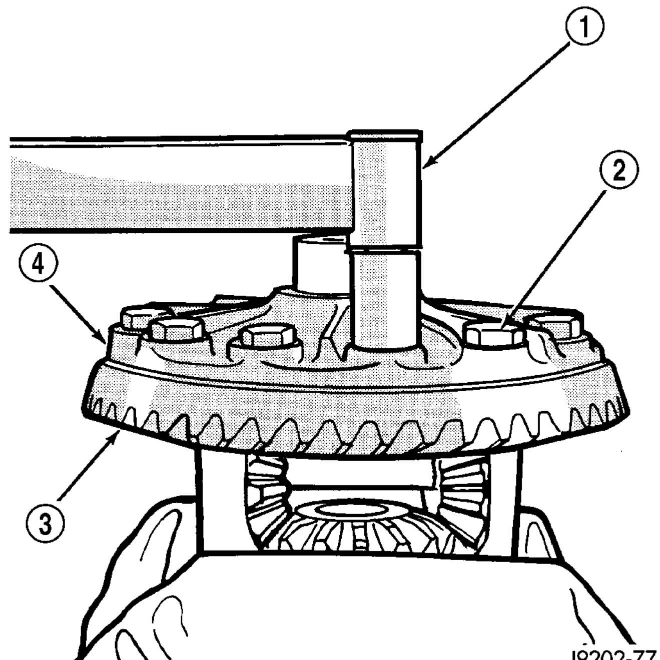


Fig. 77 RING GEAR BOLTS

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

(17) Install differential in axle housing and verify gear mesh and contact pattern. Refer to Adjustments (Gear Contact Pattern) for procedure.

REAR AXLE - 216RBI

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REAR AXLE - 216RBI

DIAGNOSIS AND TESTING

GEAR NOISE

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

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

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

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

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

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

REAR AXLE - 216RBI (Continued)

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

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

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

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rearend vibration. Do not overlook engine accessories, brackets and drive belts.

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

DRIVELINE SNAP

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

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

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube. 2. Bent or sprung axle shaft.	1. Inspect axle tube alignment. Correct as necessary. 2. Inspect and correct as necessary.
Axle Shaft Broke	1. Misaligned axle tube. 2 Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.	1. Replace the broken shaft after correcting tube mis-alignment. 2. Replace broken shaft and avoid excessive weight on vehicle. 3. Replace broken shaft and avoid or correct erratic clutch operation. 4. Replace broken shaft and inspect and repair clutch as necessary.

REAR AXLE - 216RBI (Continued)

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

REAR AXLE - 216RBI (Continued)

Condition	Possible Causes	Correction
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern. Adjust backlash or pinion depth.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

REAR AXLE - 216RBI (Continued)

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.
(2) Position a suitable lifting device under the axle.
(3) Secure axle to device.
(4) Remove brake components.
(5) Remove brake hose at the axle junction block.
(6) Remove vent hose from axle tube.
(7) If equipped with Locker differential disconnect pressure hose from differential housing and locker indicator connector (Fig. 1).

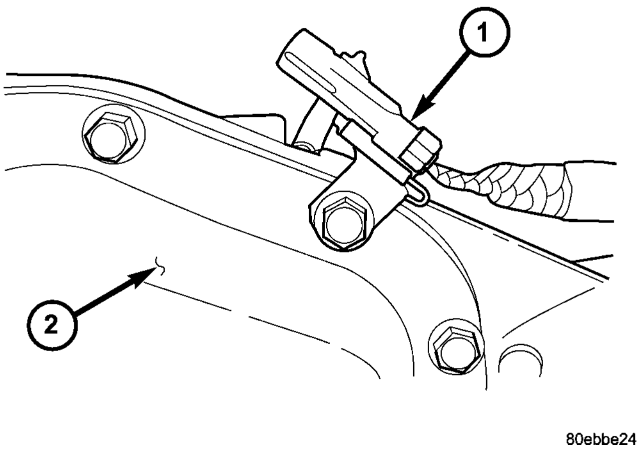


Fig. 1 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(8) Remove propeller shaft.
(9) Remove stabilizer bar links from axle.
(10) Remove shock absorbers from axle (Fig. 2).

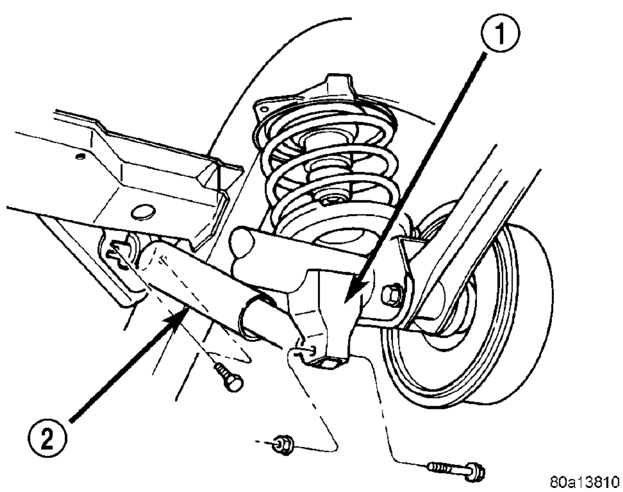


Fig. 2 SHOCK ABSORBER

1 - AXLE BRACKET
2 - SHOCK

(11) Remove track bar from axle (Fig. 3).

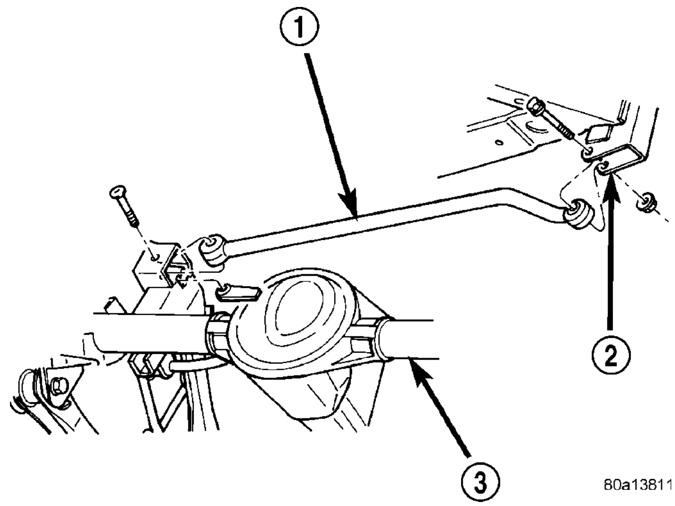


Fig. 3 REAR TRACK BAR

1 - TRACK BAR
2 - FRAME BRACKET
3 - REAR AXLE

(12) Remove upper and lower suspension arms from the axle brackets.
(13) Separate the axle from the vehicle.

INSTALLATION

CAUTION: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. Failure to heed caution may result in damage.

(1) Raise axle with lifting device and align coil springs.
(2) Position upper and lower suspension arms on the axle brackets. Install nuts and bolts, do not tighten bolts at this time.
(3) Install track bar and attachment bolts, do not tighten bolts at this time.
(4) Install shock absorbers and tighten nuts to torque specification.
(5) Install stabilizer bar links and tighten nuts to torque specification.
(6) Install the wheel speed sensors, if necessary.
(7) Install brake components.
(8) Install brake hose to the axle junction block and bleed brakes.
(9) Install axle vent hose.
(10) If equipped with Locker differential connect pressure hose and Locker indicator swith.
(11) Install propeller shaft.
(12) Remove lifting device from axle and lower the vehicle.
(13) Tighten upper and lower control arms nuts to torque specification (Fig. 4).
(14) Tighten track bar bolts to torque specification.

REAR AXLE - 216RBI (Continued)

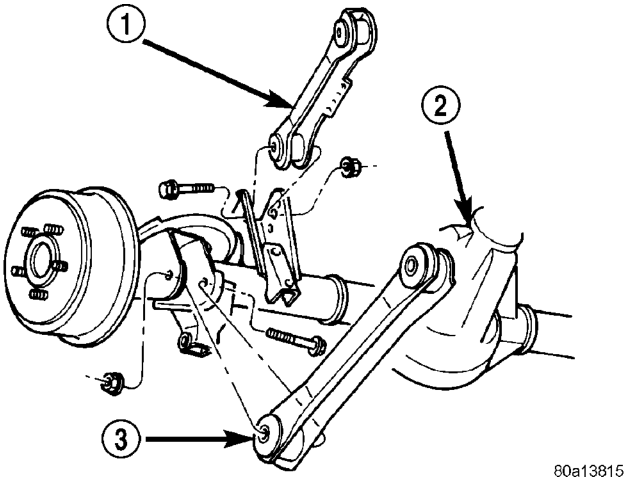


Fig. 4 UPPER AND LOWER SUSPENSION ARMS

1 - UPPER SUSPENSION ARM
2 - REAR AXLE
3 - LOWER SUSPENSION ARM

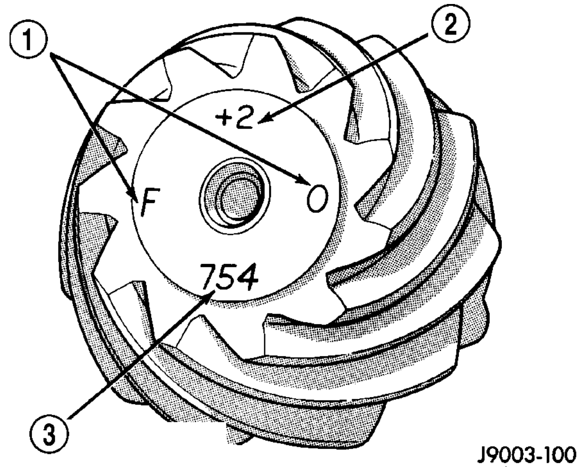


Fig. 5 PINION GEAR ID NUMBERS

1 - PRODUCTION NUMBERS
2 - DRIVE PINION GEAR DEPTH VARIANCE
3 - GEARS MATCHING NUMBER

ADJUSTMENTS

RING AND PINION GEAR

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 5). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing on the pinion shaft.

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. The intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the drive pinion gear (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

REAR AXLE - 216RBI (Continued)

PINION GEAR DEPTH VARIANCE

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

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6730 and Dial Indicator C-3339 (Fig. 6).

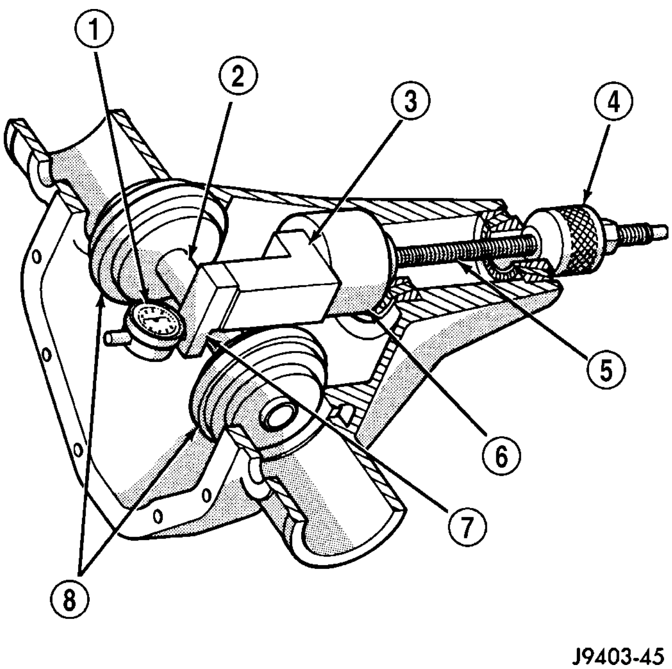


Fig. 6 PINION DEPTH GAUGE TOOLS

1 - DIAL INDICATOR
2 - ARBOR
3 - PINION HEIGHT BLOCK
4 - CONE
5 - SCREW
6 - PINION BLOCK
7 - SCOOTER BLOCK
8 - ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 6734 and rear pinion bearing onto Screw 6741 (Fig. 6).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 7).

(3) Install front pinion bearing and Cone 6740 hand tight.

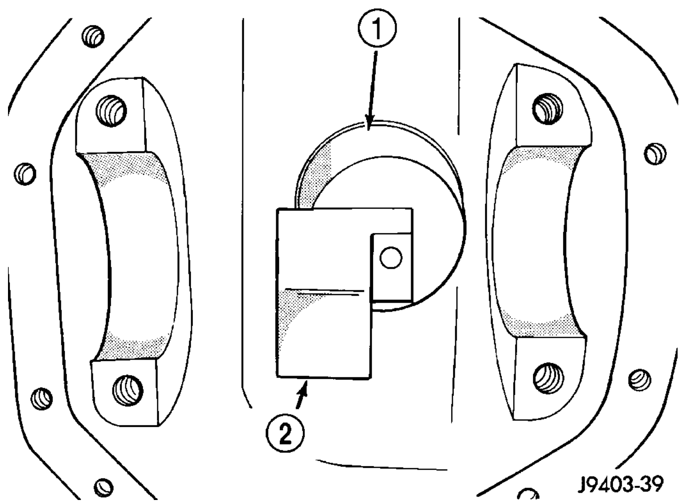


Fig. 7 PINION HEIGHT BLOCK

1 - PINION BLOCK
2 - PINION HEIGHT BLOCK

REAR AXLE - 216RBI (Continued)

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in the housing side bearing cradles (Fig. 8). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

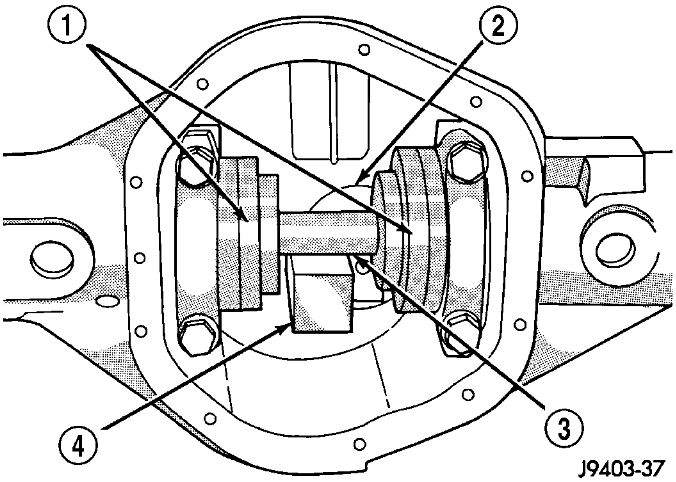


Fig. 8 GAUGE TOOLS IN HOUSING

1 - ARBOR DISC
2 - PINION BLOCK
3 - ARBOR
4 - PINION HEIGHT BLOCK

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

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) Slowly slide the Scooter Block/Dial Indicator across the pinion height block over to the arbor bar (Fig. 9). Move the Scooter Block/Dial Indicator to the crest of the arbor bar and record the highest reading.

(8) Select a shim equal to the thickest dial indicator reading plus or minus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 5).

(9) Remove the pinion depth gauge components from the axle housing.

PRELOAD SHIM SELECTION

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cups and the housing. The proper shim thickness can be determined using slip-fit dummy bearings D-345 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear back-

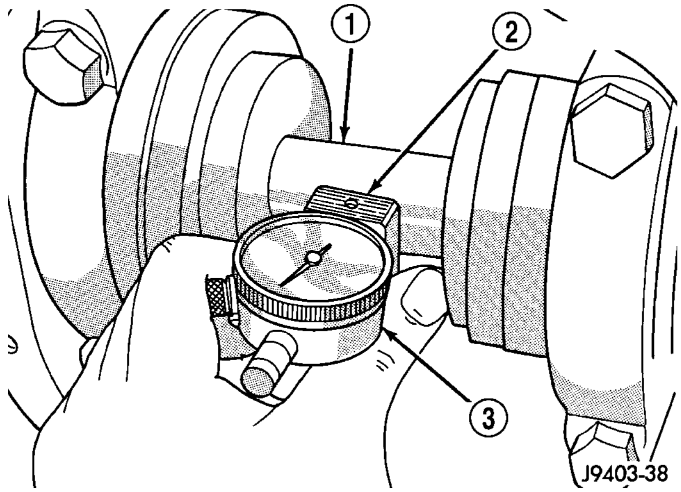


Fig. 9 PINION DEPTH MEASUREMENT

1 - ARBOR
2 - SCOOTER BLOCK
3 - DIAL INDICATOR

lash measurements, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 10).

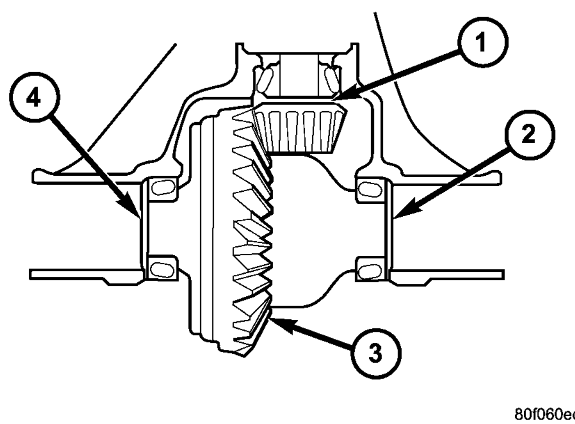


Fig. 10 ADJUSTMENT SHIM LOCATIONS

1 - PINION DEPTH SHIM
2 - DIFFERENTIAL BEARING PRELOAD SHIM
3 - RING GEAR
4 - DIFFERENTIAL BEARING PRELOAD SHIM

REAR AXLE - 216RBI (Continued)

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

(1) Remove differential side bearings from differential case.

(2) Remove factory installed shims from differential case.

(3) Install ring gear on differential case and tighten bolts to specification.

(4) Install dummy side bearings D-345 on differential case.

(5) Install differential case in axle housing (Fig. 11).

(6) Install the marked bearing caps in their correct positions. Install and snug the bolts (Fig. 12).

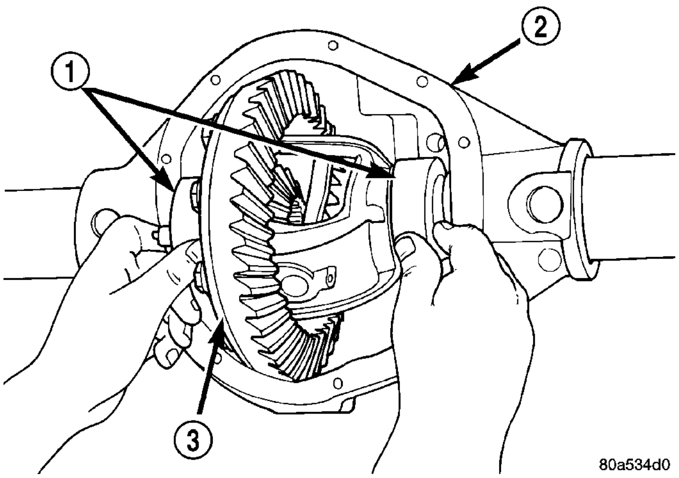


Fig. 11 DIFFERENTIAL DUMMY BEARINGS

1 - DUMMY BEARINGS
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

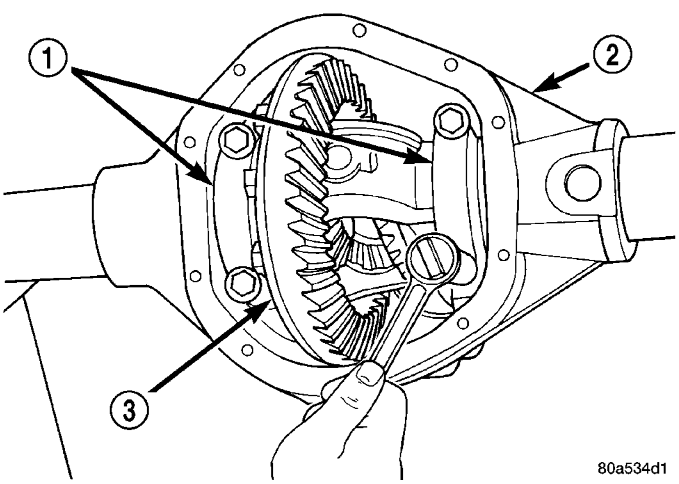


Fig. 12 BEARING CAP BOLTS

1 - BEARING CAP
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

(7) Using a dead-blow hammer seat the differential dummy bearings to each side of the housing (Fig. 13) and (Fig. 14).

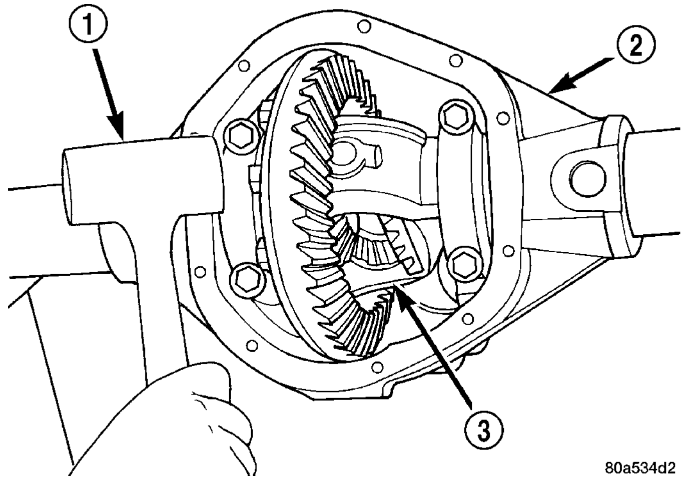


Fig. 13 SEAT DUMMY BEARING PINION SIDE

1 - MALLET
2 - DIFFERENTIAL HOUSING
3 - DIFFERENTIAL CASE

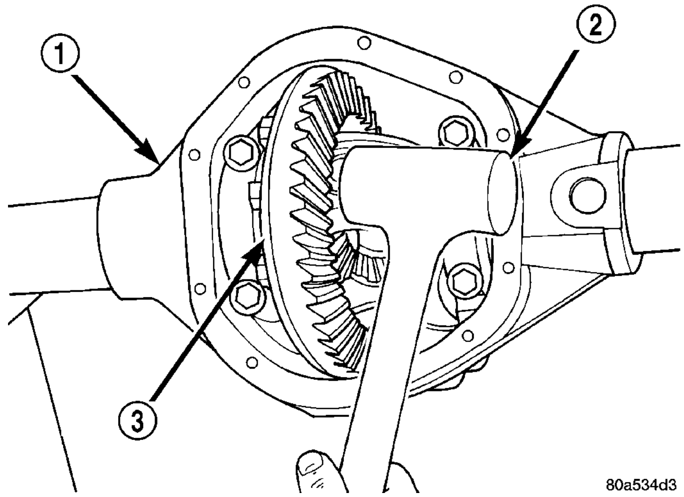


Fig. 14 SEAT DUMMY BEARING RING GEAR SIDE

1 - DIFFERENTIAL HOUSING
2 - MALLET
3 - DIFFERENTIAL CASE

REAR AXLE - 216RBI (Continued)

(8) Thread Pilot Stud C-3288-B into rear cover bolt hole below ring gear (Fig. 15).

(9) Attach a dial indicator C-3339 to Pilot Stud C-3288-B. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 15).

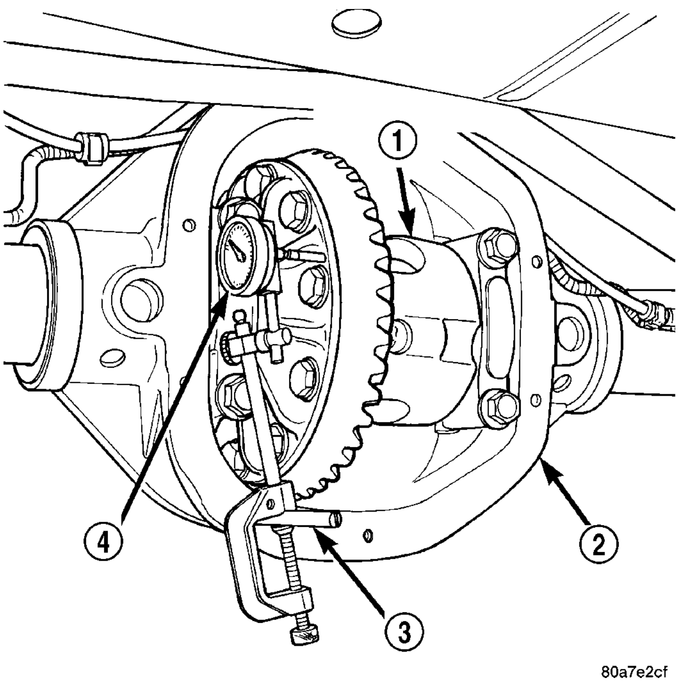


Fig. 15 DIFFERENTIAL SIDE PLAY MEASUREMENT

1 - DIFFERENTIAL CASE
2 - DIFFERENTIAL HOUSING
3 - PILOT STUD
4 - DIAL INDICATOR

(10) Push and hold differential case to pinion gear side of the housing and zero dial indicator (Fig. 16).

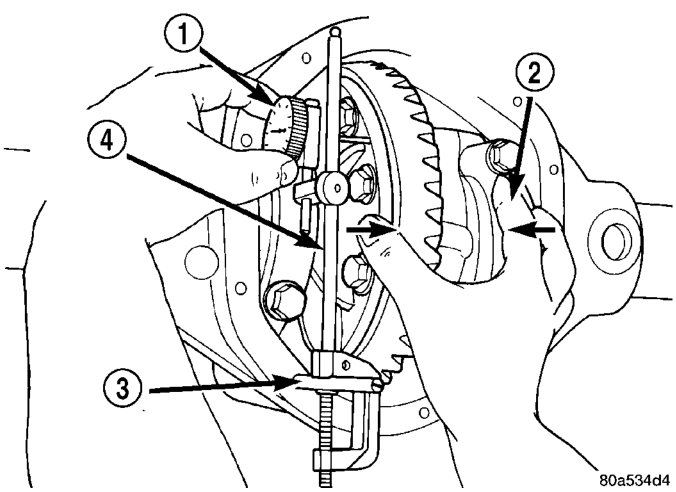


Fig. 16 ZERO DIAL INDICATOR

1 - DIAL INDICATOR
2 - FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PILOT STUD
4 - EXTENSION

(11) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 17).

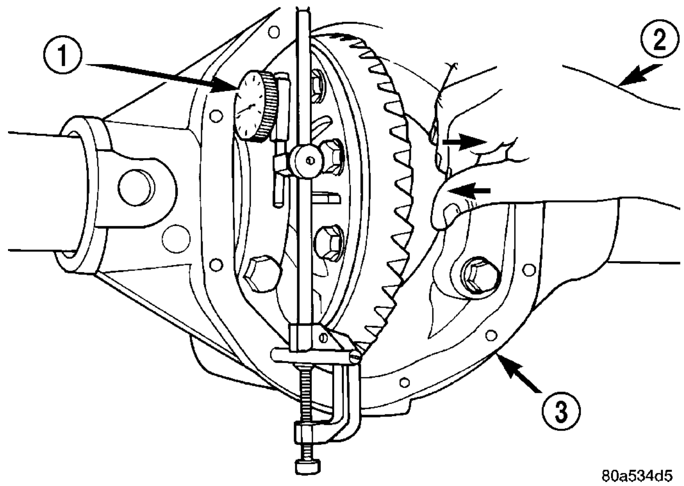


Fig. 17 RECORD DIAL INDICATOR READING

1 - READ DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - DIFFERENTIAL HOUSING

(12) Add dial indicator reading to the starting point shim thickness. This is the total shim thickness to achieve zero differential end play.

(13) Add 0.254 mm (0.010 in.) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.

(14) Rotate dial indicator out of the way on pilot stud.

(15) Remove differential case and dummy bearings from the housing.

(16) Install pinion gear in the housing. Install the pinion yoke and establish the correct pinion rotating torque.

(17) Install differential case and dummy bearings D-345 in the housing (without shims), install bearing caps and tighten bolts snug.

(18) Seat ring gear side dummy bearing (Fig. 14).

(19) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 15).

(20) Push and hold differential case toward the pinion gear and zero dial indicator (Fig. 18).

(21) Push and hold differential case to ring gear side of the housing and record dial indicator reading (Fig. 19).

(22) Subtract 0.05 mm (0.002 in.) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

(23) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the housing.

REAR AXLE - 216RBI (Continued)

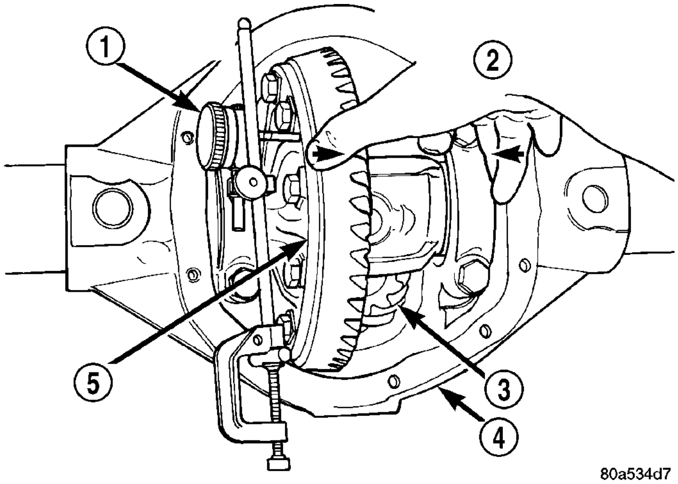


Fig. 18 ZERO DIAL INDICATOR

1 - DIAL INDICATOR FACE
2 - DIFFERENTIAL CASE TO PINION GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

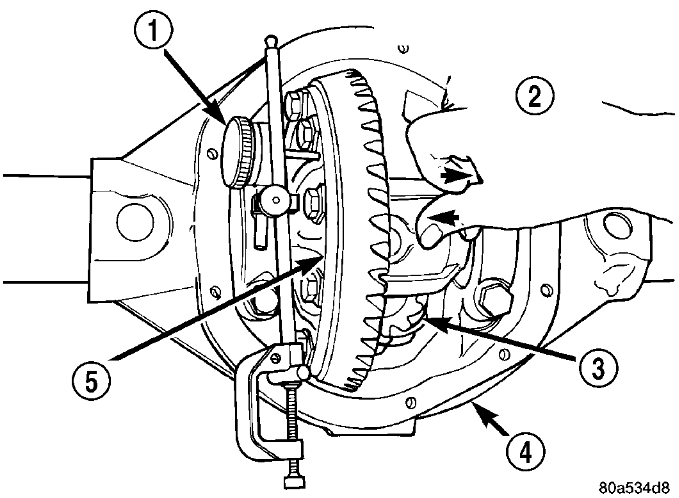


Fig. 19 RECORD DIAL INDICATOR READING

1 - DIAL INDICATOR
2 - DIFFERENTIAL CASE TO RING GEAR SIDE
3 - PINION GEAR
4 - DIFFERENTIAL HOUSING
5 - DIFFERENTIAL CASE

(24) Rotate dial indicator out of the way on pilot stud.

(25) Remove differential case and dummy bearings from the housing.

(26) Install side bearing shims on differential case hubs.

(27) Install new side bearing cones and cups on differential case.

(28) Install spreader W-129-B on the housing and spread axle opening enough to receive differential case.

(29) Install differential case in the housing.

(30) Install differential bearing caps loosely.

(31) Remove spreader from the housing.

(32) Tighten bearing caps bolts to 108 N·m (80 ft. lbs.).

(33) Rotate the differential case several times to seat the side bearings.

(34) Position the indicator plunger against a ring gear tooth (Fig. 20).

(35) Push and hold ring gear upward while not allowing the pinion gear to rotate and zero dial indicator.

(36) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm - 0.20 mm (0.005 in. - 0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the housing to the other (Fig. 21).

(37) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

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

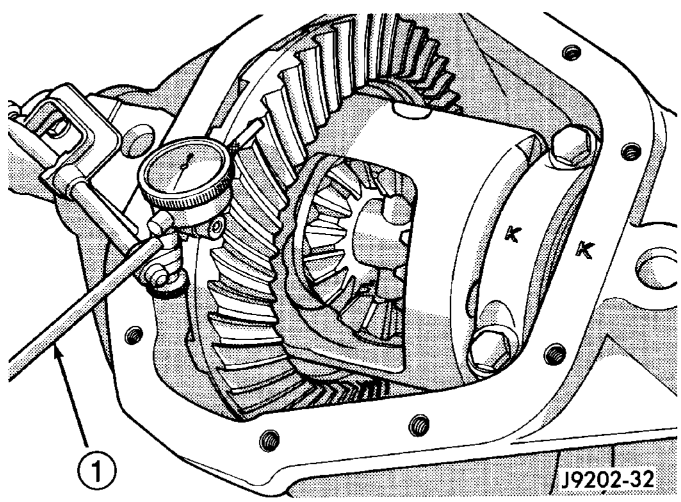


Fig. 20 RING GEAR BACKLASH MEASUREMENT

1 - DIAL INDICATOR

GEAR CONTACT PATTERN

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

The TOP LAND of the gear tooth is the top surface of the tooth. The PROFILE of the gear tooth is the depth of the tooth. The TOE of the gear is the portion of the tooth surface at the end towards the center. The HEEL of the gear is the portion of the tooth

REAR AXLE - 216RBI (Continued)

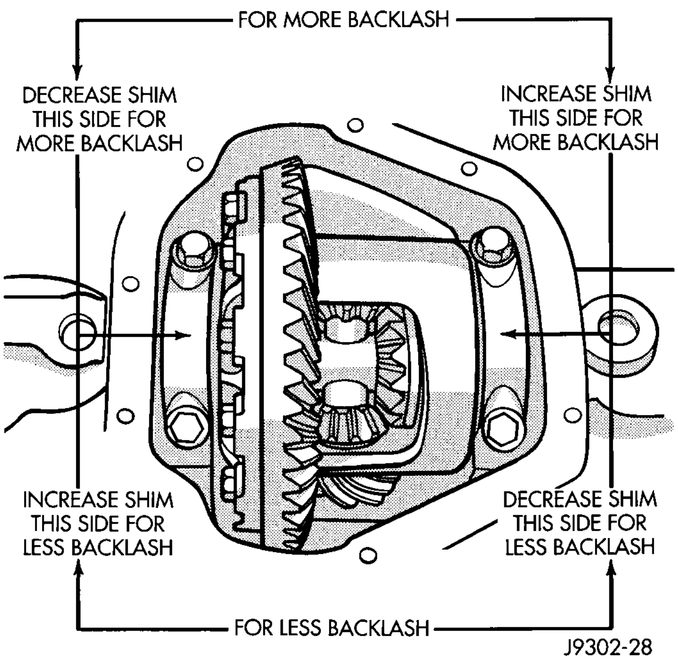


Fig. 21 BACKLASH SHIM ADJUSTMENT

at the outer-end. The ROOT of the gear tooth is the lowest portion of the tooth (Fig. 22).

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

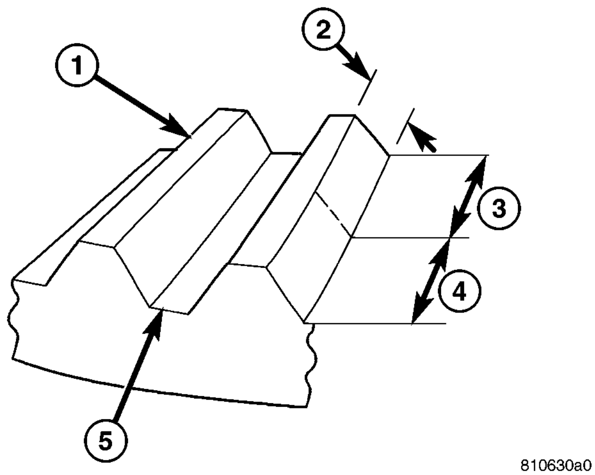


Fig. 22 GEAR DESCRIPTION

1 - TOP LAND
2 - PROFILE
3 - TOE
4 - HEEL
5 - ROOT

(1) Apply a thin coat of hydrated ferric oxide or equivalent to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 23) and (Fig. 24) and adjust pinion depth and gear backlash as necessary.

DIFFERENTIAL BEARING PRELOAD CHECK

The final check on the differential assembly before installing the axles is torque to rotate pinion and differential combined. This will verify the correct differential bearing preload.

Torque to rotate the differential and pinion should be the torque to rotate the pinion plus 0.79-1.24 N·m (7-11 in. lbs.).

REAR AXLE - 216RBI (Continued)

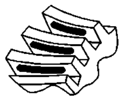
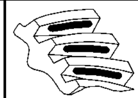
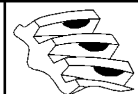
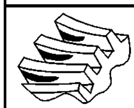
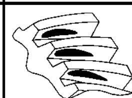
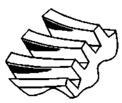
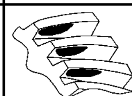
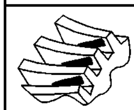
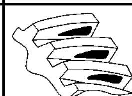
DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	**Desirable pattern.** The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		**Desirable pattern.** The coast pattern should be centered on the tooth,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

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Fig. 23 PATTERN INTERPRETATION (GEAR CUT 2 AXIS)

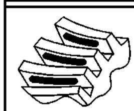
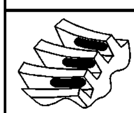
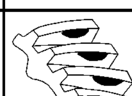
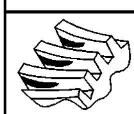
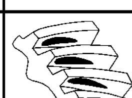
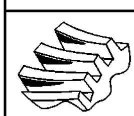
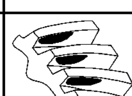
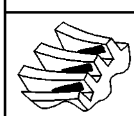
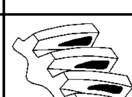
DRIVE SIDE HEEL TOE	CONDITION	COAST SIDE TOE HEEL	CONDITION	ACTION REQUIRED
	**Desirable pattern.** The drive pattern should be centered on the tooth. There should be some clearance between the pattern and the top of the tooth.		**Desirable pattern.** The coast pattern should be centered on the tooth,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

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Fig. 24 PATTERN INTERPRETATION (GEAR CUT 3 AXIS)

REAR AXLE - 216RBI (Continued)

SPECIFICATIONS

REAR AXLE

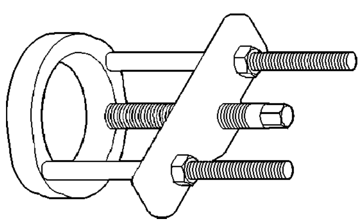
AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	3.07, 3.73, 4.10
Ring Gear Backlash	0.12-0.20 mm (0.005-0.008 in.)
Pinion Bearing Preload - Original Bearings	1-2 N·m (10-20 in. lbs.)
Pinion Bearing Preload - New Bearings	2-4.5 N·m (20-40 in. lbs.)

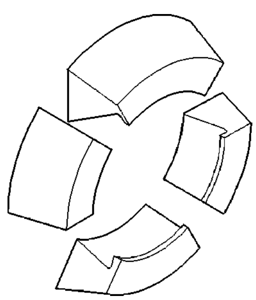
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Fill Hole Plug	34	25	-
Differential Cover Bolts	41	30	-
Bearing Cap Bolts	108	80	-
Ring Gear Bolts	136	100	-
Pinion Nut	217-271	160-200	-

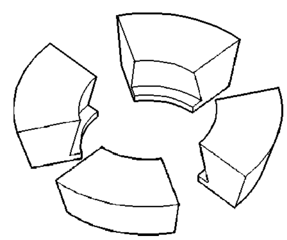
SPECIAL TOOLS



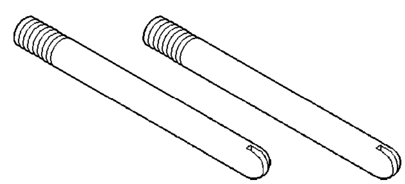
PULLER C-293-PA



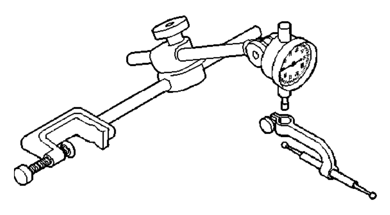
ADAPTERS C-293-18



ADAPTERS C-293-39

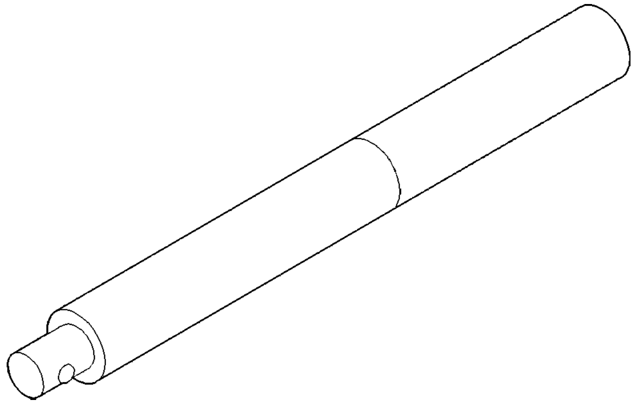


PILOT STUDS C-3288-B

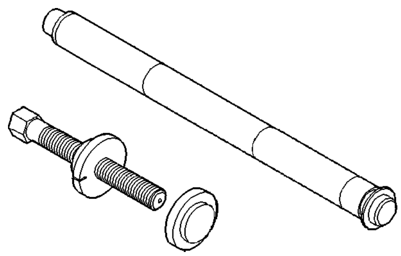


DIAL INDICATOR C-3339

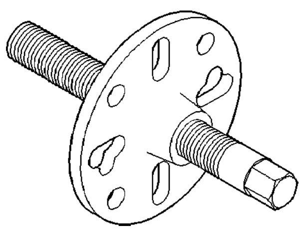
REAR AXLE - 216RBI (Continued)



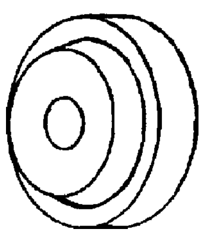
HANDLE C-4171



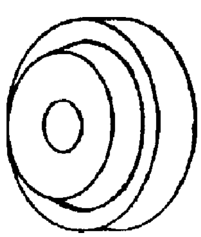
TRAC-LOK TOOLS C-4487



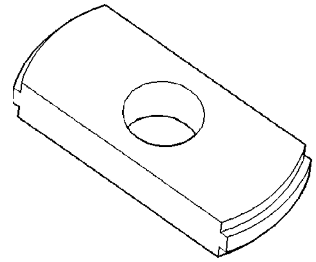
PULLER C-452



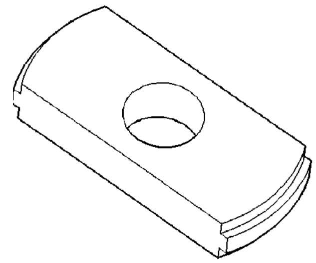
INSTALLER D-144



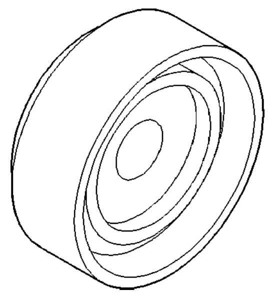
INSTALLER D-145



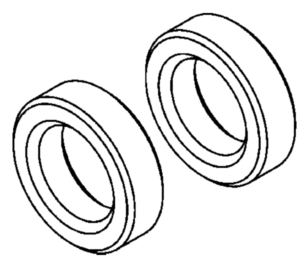
REMOVER D-147



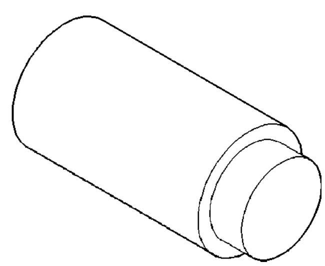
REMOVER D-148



INSTALLER D-156

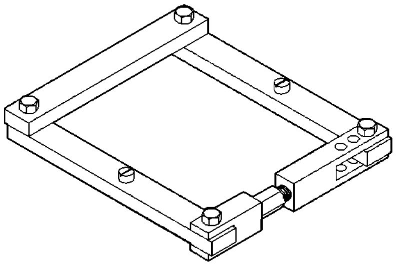


DUMMY BEARINGS D-345

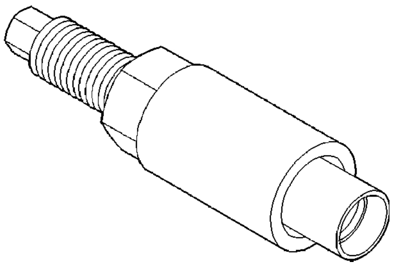


PLUG SP-3289

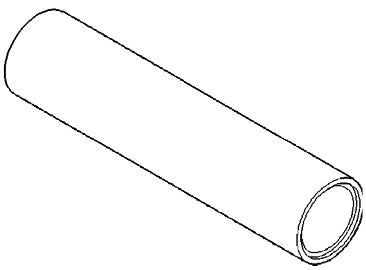
REAR AXLE - 216RBI (Continued)



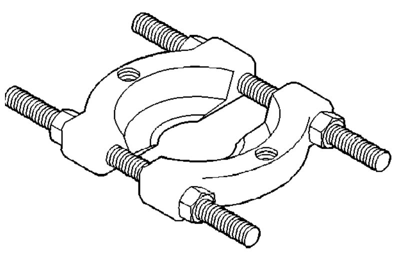
SPREADER W-129-B



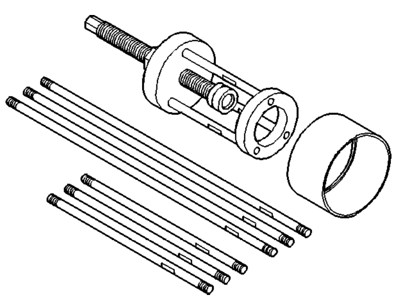
INSTALLER W-162-D



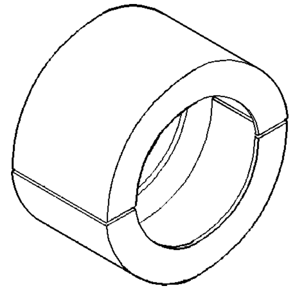
INSTALLER W-262



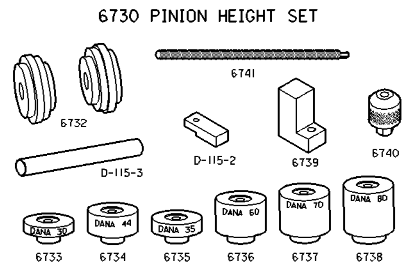
SPLITTER 1130



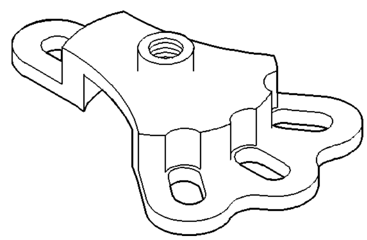
PULLER 6444



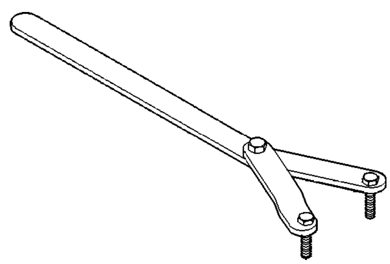
JAWS 6447



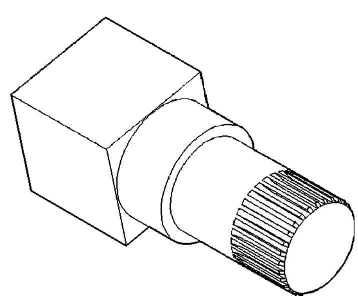
PINION DEPTH SET 6730



PULLER 6790

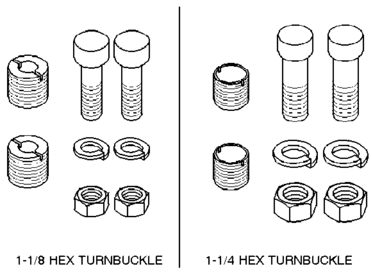


SPANNER WRENCH 6958

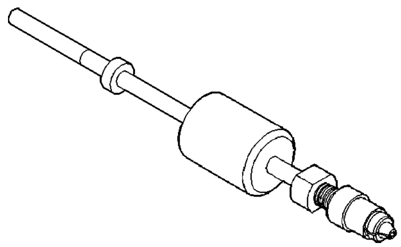


FIXTURE 6963

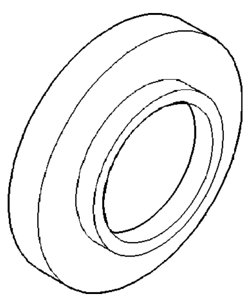
REAR AXLE - 216RBI (Continued)



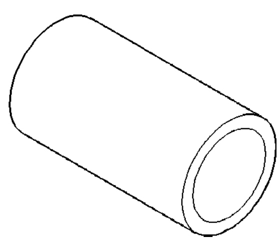
ADAPTER KIT 6987B



SLIDE HAMMER 7420



INSTALLER 7913-A



CUP 8109

AXLE SHAFTS

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake caliper and rotor.

(3) Remove axle retainer plate nuts through access hole in axle flange (Fig. 25).

(4) Pull axle shaft from the axle. If axle will not come out use Slide Hammer 7420 and Adapter 6790.

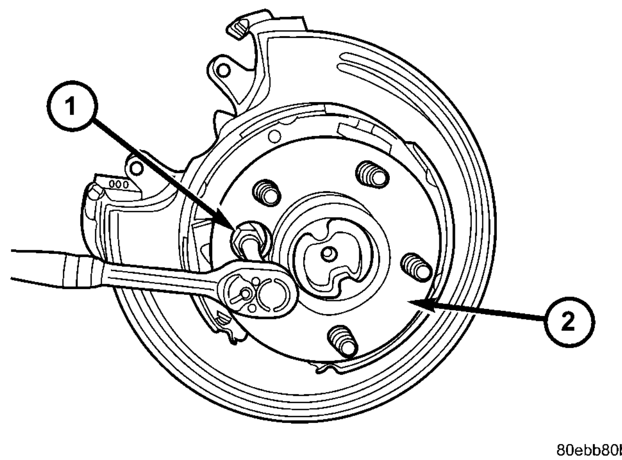


Fig. 25 AXLE SHAFT BOLTS

1 - ACCESS HOLE
2 - AXLE FLANGE

INSTALLATION

WARNING: NEVER REUSE AXLE RETAINING BOLTS AND NUTS. USED TORQUE NUT CAN LOOSEN. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

(1) Install axle into axle tube with the flat area of the retainer plate upward (Fig. 26).

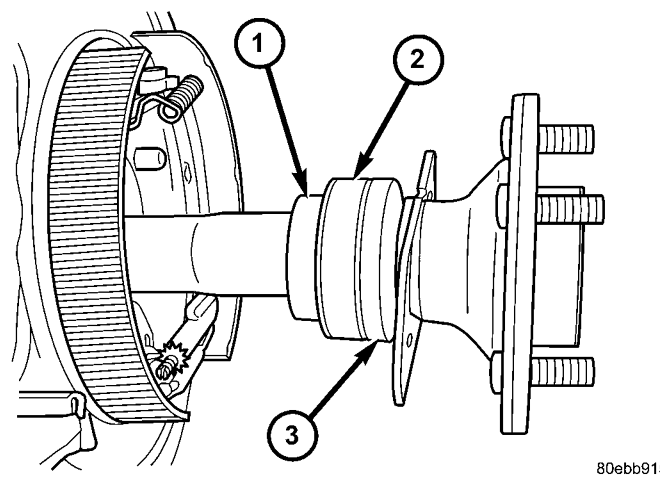


Fig. 26 AXLE SHAFT

1 - RETAINER RING
2 - AXLE BEARING
3 - AXLE SEAL

(2) Install **new** axle retaining bolts.

(3) Install **new** retaining nuts and tighten to 61 N·m (45 ft. lbs.).

(4) Install brake rotor and caliper.

AXLE BEARINGS

REMOVAL

(1) Remove axle shaft from vehicle.

NOTE: It is normal that the axle bearing race is loose in the axle tube.

(2) Drill a shallow hole into soft steel axle bearing retaining ring with a 3/8 in. drill bit (Fig. 27). Use a drill depth stop to avoid marking the axle.

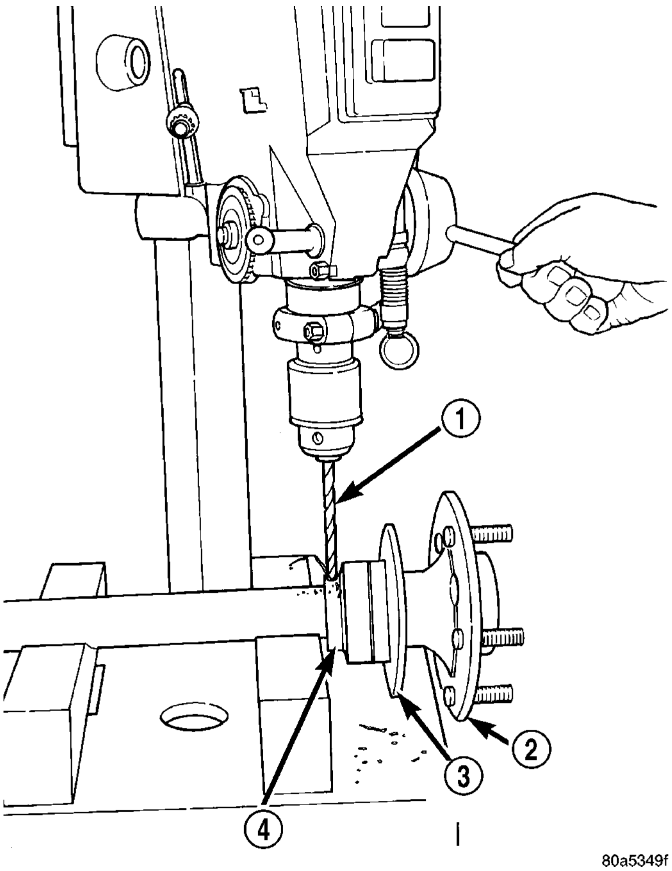


Fig. 27 DRILL RETAINING RING

1 - 3/8 in. DIA. DRILL BIT
2 - AXLE
3 - RETAINING PLATE
4 - SOFT METAL RETAINING RING

(3) With a cold chisel cut the retaining ring across drilled hole. (Fig. 28)

(4) Slide retaining ring from axle shaft.

(5) Remove axle bearing from the shaft with, a press and Splitter 1130 placed between the seal and bearing (Fig. 29).

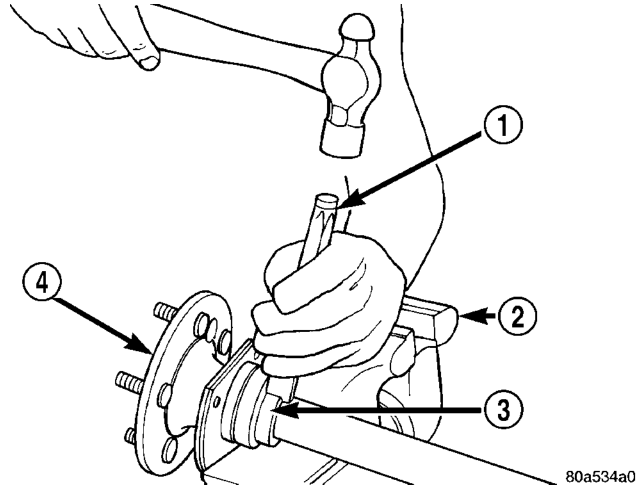


Fig. 28 CUT RETAINING RING

1 - COLD CHISEL
2 - VISE
3 - RETAINING RING
4 - AXLE

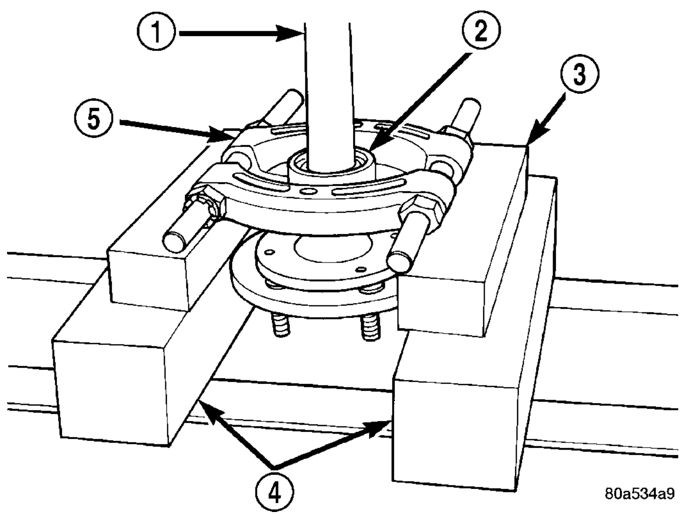


Fig. 29 AXLE BEARING AND SEAL

1 - AXLE
2 - UNIT BEARING
3 - PRESS PLATES
4 - BLOCKS
5 - SPLITTER

(6) Remove seal from axle.

(7) Remove retaining plate from axle shaft.

AXLE BEARINGS (Continued)

INSTALLATION

(1) Verify axle shaft retaining plate is flat with a straight edge.

NOTE: Replace the retaining plate if warped.

(2) Install retaining plate on axle (Fig. 30).

(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.

(4) Install seal on axle with cavity away from retaining plate (Fig. 30).

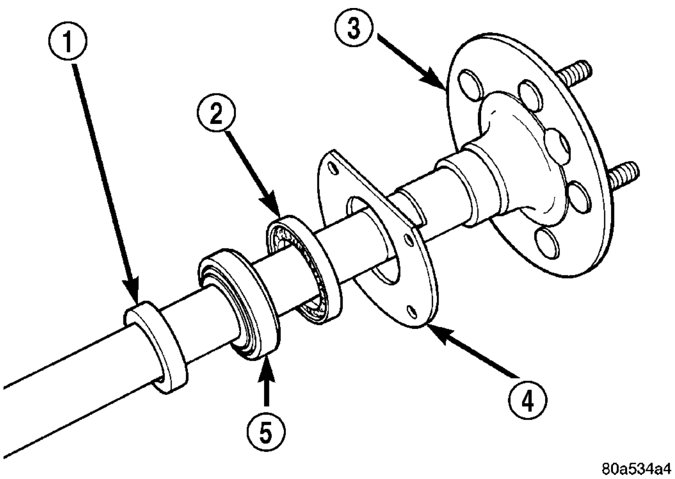


Fig. 30 AXLE BEARING AND SEAL COMPONENTS

1 - RETAINING RING
2 - SEAL
3 - AXLE
4 - RETAINING PLATE
5 - BEARING

(5) Lubricate bearing with Mopar Wheel Bearing Grease, or equivalent. Wipe excess grease from outside of bearing.

(6) Install bearing on the axle shaft with Installer 7913 and a press (Fig. 31).

NOTE: Install bearing with groove on the outer surface toward the seal.

(7) Press soft metal retaining ring onto axle shaft with Installer 7913 and a press (Fig. 32).

(8) Install axle in vehicle.

PINION SEAL

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove brake drums/calipers.

(3) Remove propeller shaft.

(4) Rotate pinion gear three or four times and verify that pinion rotates smoothly.

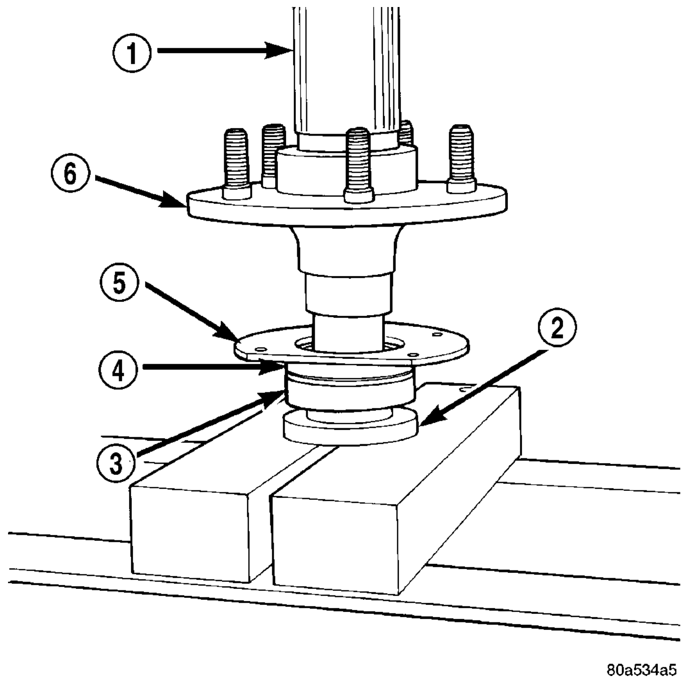


Fig. 31 PRESS BEARING ON AXLE

1 - PRESS RAM
2 - INSTALLER
3 - UNIT BEARING
4 - SEAL
5 - RETAINING PLATE
6 - AXLE

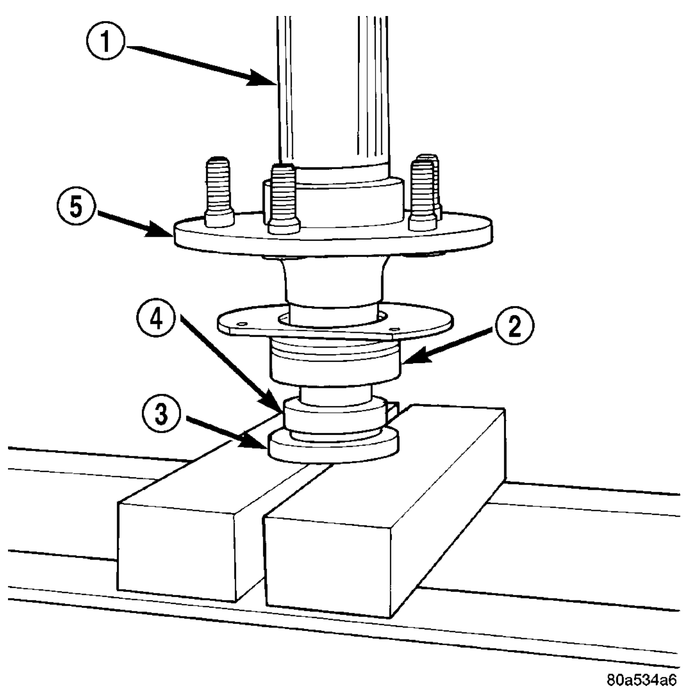


Fig. 32 PRESS RETAINING RING ON AXLE

1 - PRESS RAM
2 - UNIT BEARING
3 - INSTALLER
4 - METAL RETAINING RING
5 - AXLE

PINION SEAL (Continued)

(5) Using Spanner Wrench 6958 to hold the pinion yoke, remove the pinion nut and washer.

(6) Remove pinion yoke with Remover C-452 and Flange Wrench C-3281 (Fig. 33).

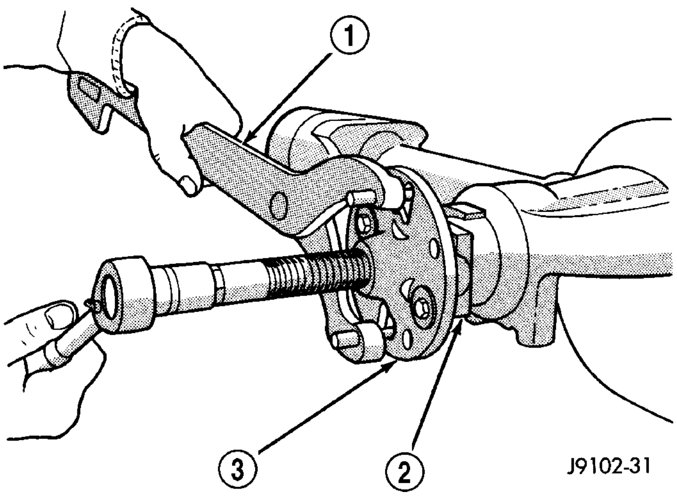


Fig. 33 PINION YOKE REMOVER

1 - FLANGE WRENCH
2 - PINION YOKE
3 - REMOVER

(7) Remove pinion shaft seal with a pry tool or slide hammer mounted screw.

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer 8681 (Fig. 34).

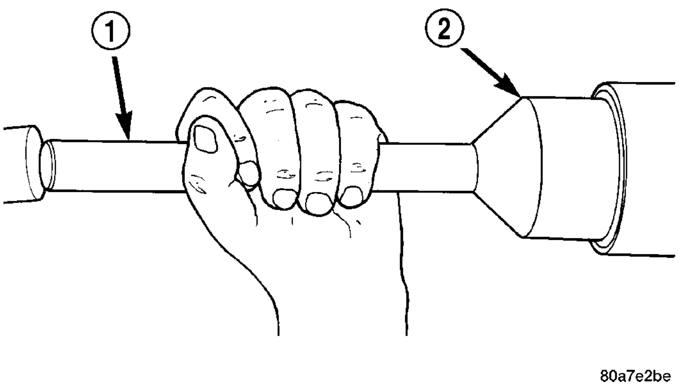


Fig. 34 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

(2) Install yoke on pinion gear with Installer W-162–D, Cup 8109 and Spanner Wrench 6958 (Fig. 35).

(3) Install pinion washer and a **new** nut on the pinion gear and tighten the nut until there is zero bearing end-play.

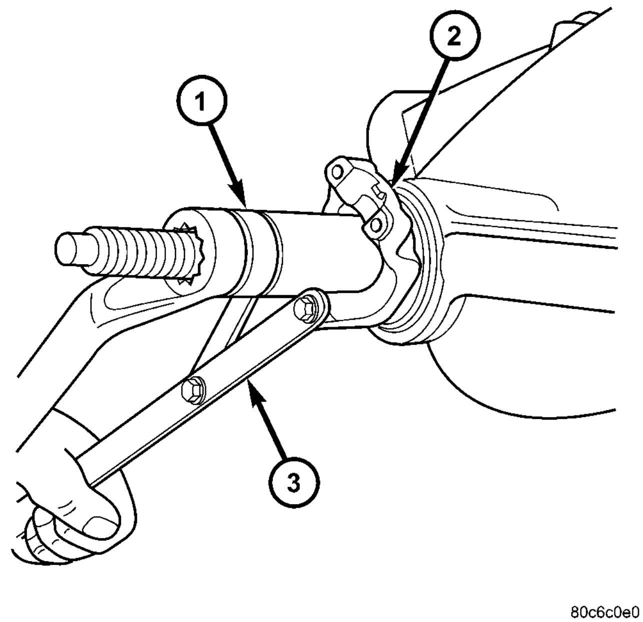


Fig. 35 YOKE SPANNER WRENCH

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

(4) Hold pinion yoke with Spanner Wrench 6958 (Fig. 36) and tighten pinion nut to 217 to 271N·m (160 to 200 ft. lbs.).

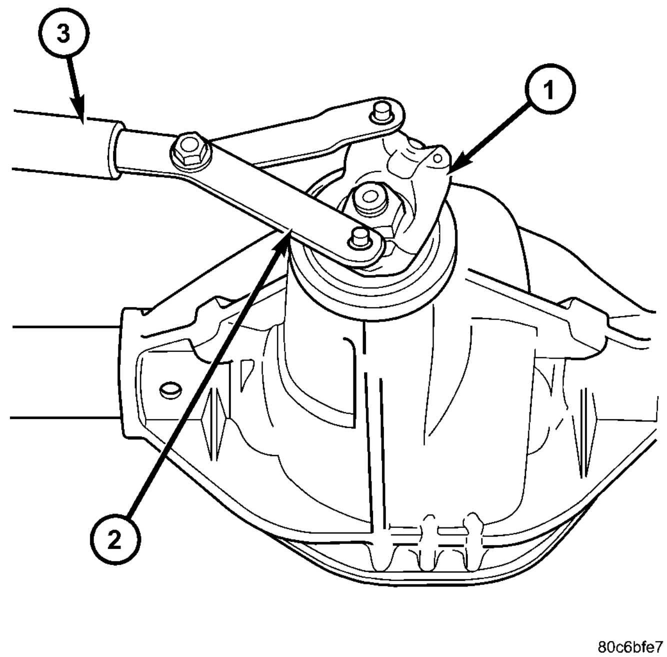


Fig. 36 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

(5) Install propeller shaft.

(6) Install brake drums/calipers.

DIFFERENTIAL COVER

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove drain plug.

(3) If equipped with Tru-Lok, disconnect indicator switch harness and remove connector from differential cover (Fig. 37).

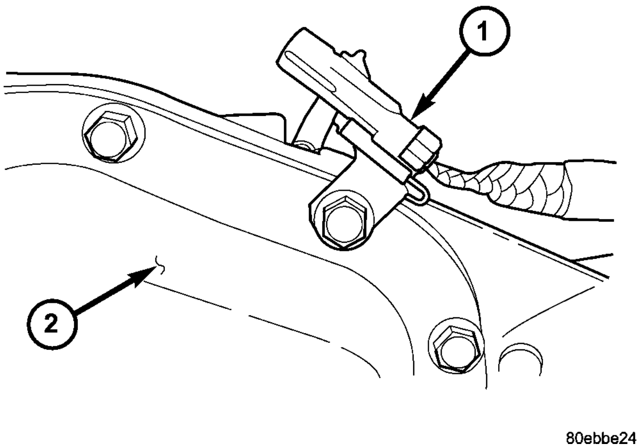


Fig. 37 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(4) Remove cover bolts.

(5) Remove cover and drain lubricant.

INSTALLATION

(1) Apply a 6.35mm (1/4 in.) bead of Mopar Silicone Rubber Sealant or equivalent to the housing cover (Fig. 38).

CAUTION: If housing cover is not installed within 3 to 5 minutes, the cover must be cleaned and new RTV applied. Failure to heed caution may result in damage.

(2) Install cover, identification tag and indicator switch connector if equipped with Tru-Lok (Fig. 39). Tighten cover bolts in a criss-cross pattern to 41 N·m (30 ft. lbs.).

(3) Connect indicator switch harness if equipped with Tru-Lok.

(4) Fill differential to specifications.

(5) Install fill plug and tighten to 34 N·m (25 ft. lbs.).

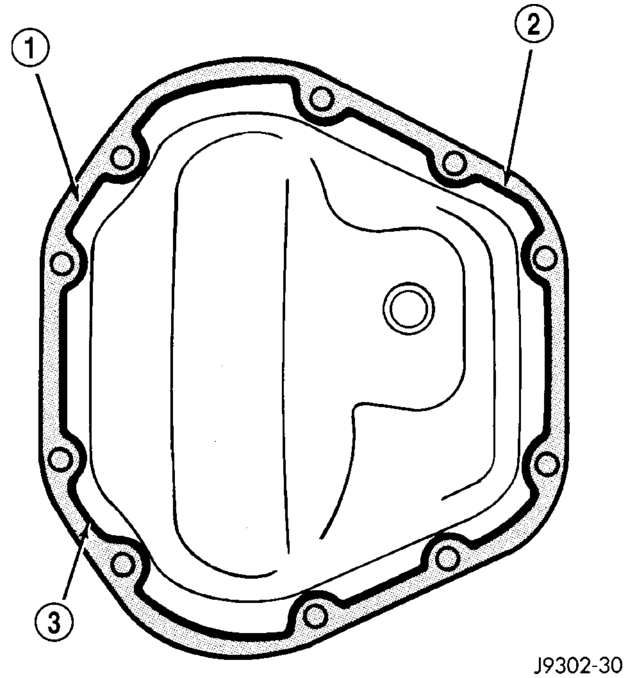


Fig. 38 HOUSING COVER - TYPICAL

1 - SEALANT SURFACE
2 - SEALANT
3 - SEALANT THICKESS

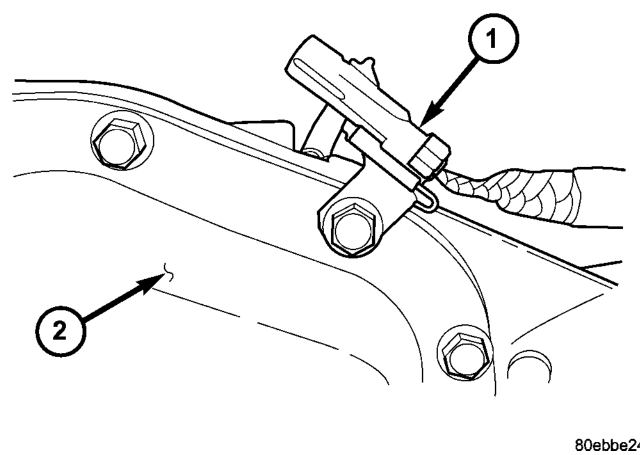


Fig. 39 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

DIFFERENTIAL

REMOVAL

(1) Remove differential housing cover and drain fluid.

(2) Remove axle shafts.

(3) Note the reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 40).

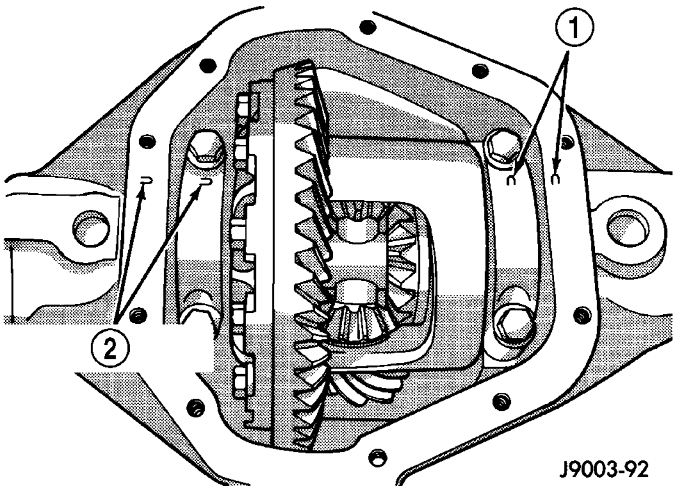


Fig. 40 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(4) Loosen the differential bearing cap bolts.

(5) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 41). Install hold-down clamps and tighten the turnbuckle finger-tight.

(6) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing (Fig. 42) and zero the indicator.

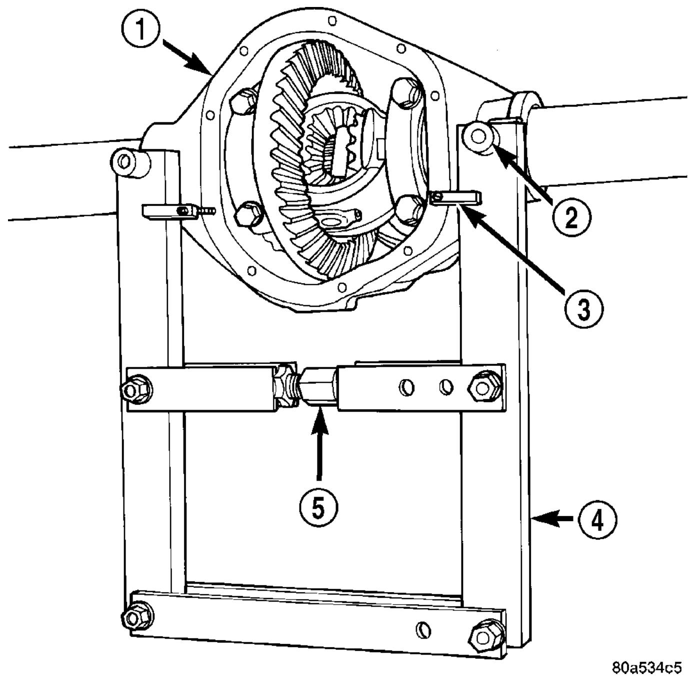


Fig. 41 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

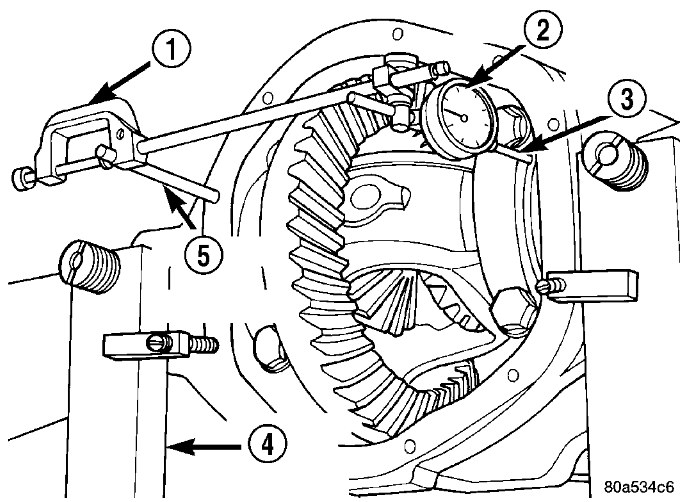


Fig. 42 DIAL INDICATOR LOCATION

1 - CLAMP
2 - DIAL INDICATOR
3 - LEVER ADAPTER
4 - SPREADER
5 - PILOT STUD

DIFFERENTIAL (Continued)

(7) Spread housing while measuring the distance with the dial indicator (Fig. 43).

CAUTION: Never spread the housing over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

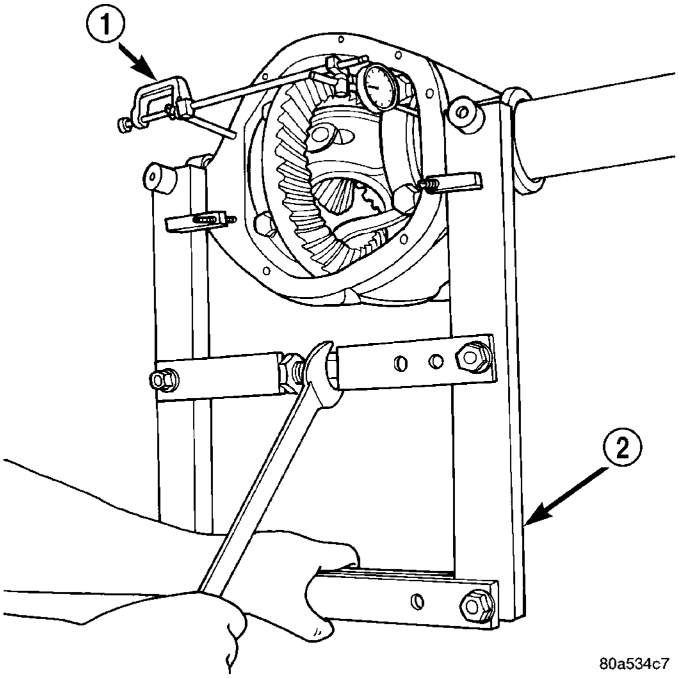


Fig. 43 SPREAD DIFFERENTIAL HOUSING

1 - DIAL INDICATOR
2 - SPREADER

(8) Remove dial indicator.

(9) Hold differential case in position and remove differential bearing caps.

(10) Remove differential from housing and tag differential bearing cups to indicate location (Fig. 44).

(11) Remove spreader from housing.

(12) Clean housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

DISASSEMBLY

(1) Remove pinion shaft lock roll pin with a hammer and punch.

(2) Remove pinion shaft.

(3) Rotate differential side gears and remove differential pinions and thrust washers (Fig. 45).

(4) Remove differential side gears and thrust washers.

ASSEMBLY

(1) Install differential side gears and thrust washers.

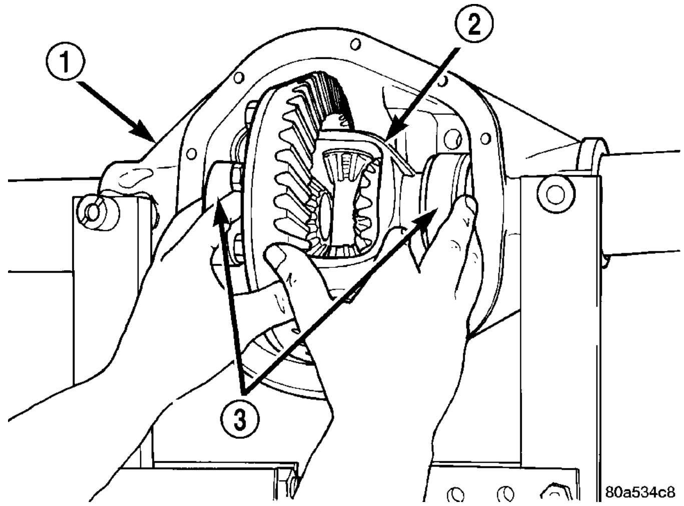


Fig. 44 DIFFERENTIAL CASE REMOVAL

1 - DIFFERENTIAL HOUSING
2 - DIFFERENTIAL CASE
3 - BEARING CUPS

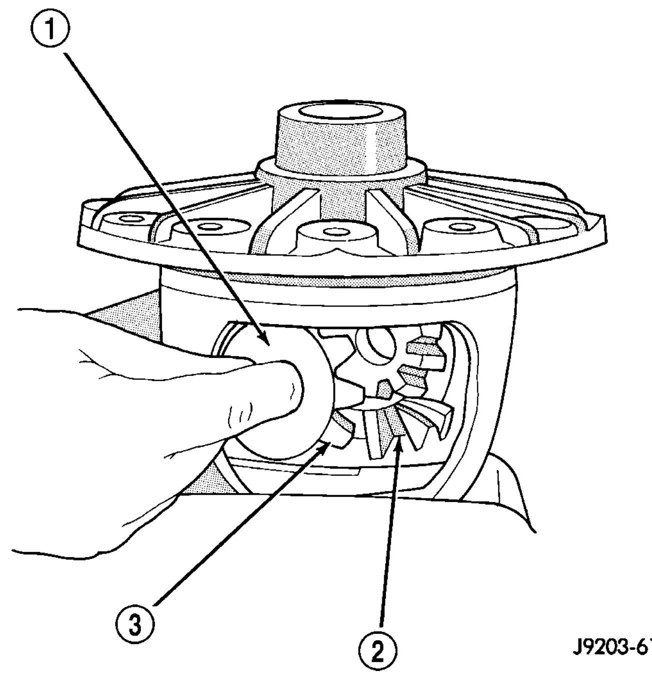


Fig. 45 DIFFERENTIAL GEARS

1 - THRUST WASHER
2 - SIDE GEAR
3 - DIFFERENTIAL PINION

(2) Install differential pinion gears and thrust washers.

(3) Install pinion mate shaft.

(4) Align hole in the pinion mate shaft with the hole in the differential case and install pinion mate shaft roll pin. Stake (peen) metal of case over pin in two places 180 degrees apart.

(5) Lubricate all differential components with hypoid gear lubricant.

DIFFERENTIAL (Continued)

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Position Spreader W-129-B and adapters from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 46). Install hold-down clamps and tighten turnbuckle finger-tight.

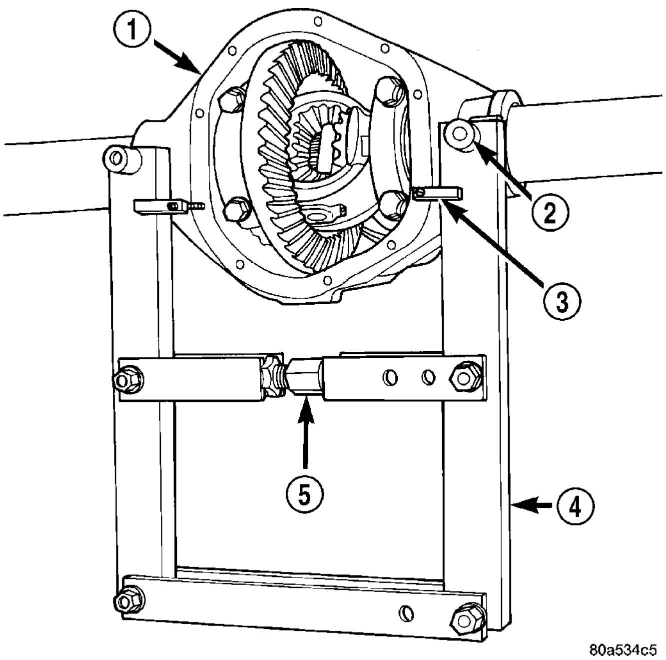


Fig. 46 SPREADER LOCATION

1 - DIFFERENTIAL HOUSING
2 - DOWEL
3 - SAFETY HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

(2) Install Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing and zero the indicator.

(3) Spread housing while measuring the distance with the dial indicator.

CAUTION: Never spread over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

(4) Remove dial indicator.

(5) Install differential case in the housing. Tap differential case to seat bearings cups in the housing.

(6) Install bearing caps in their original locations (Fig. 47).

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

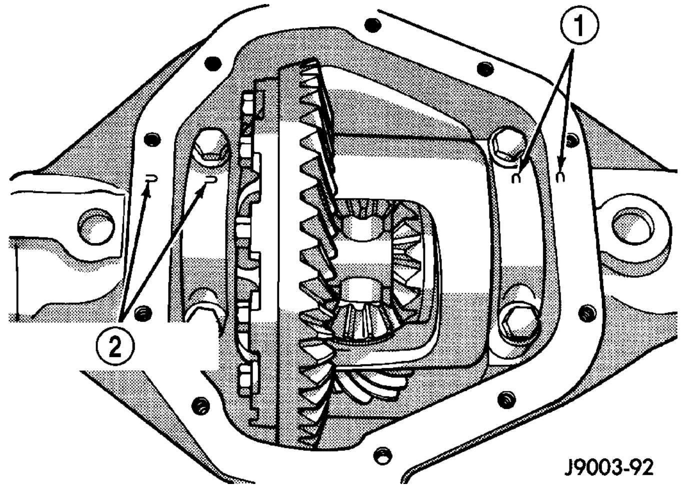


Fig. 47 BEARING CAP REFERENCE

1 - REFERENCE LETTERS
2 - REFERENCE LETTERS

(9) Tighten bearing cap bolts to 108 N·m (80 ft. lbs.).

(10) Install axle shafts.

(11) Install cover and identification tag.

DIFFERENTIAL -TRAC-LOK

DESCRIPTION

The Trac-Lok® differential has a one-piece differential case, and similar internal components as a standard differential, plus two clutch disc packs. Differential bearing preload and ring gear backlash are adjusted with shims located between the differential case bearing cups and housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

OPERATION

This differentials clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 48).

This design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. This differential resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok® operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

DIFFERENTIAL -TRAC-LOK (Continued)

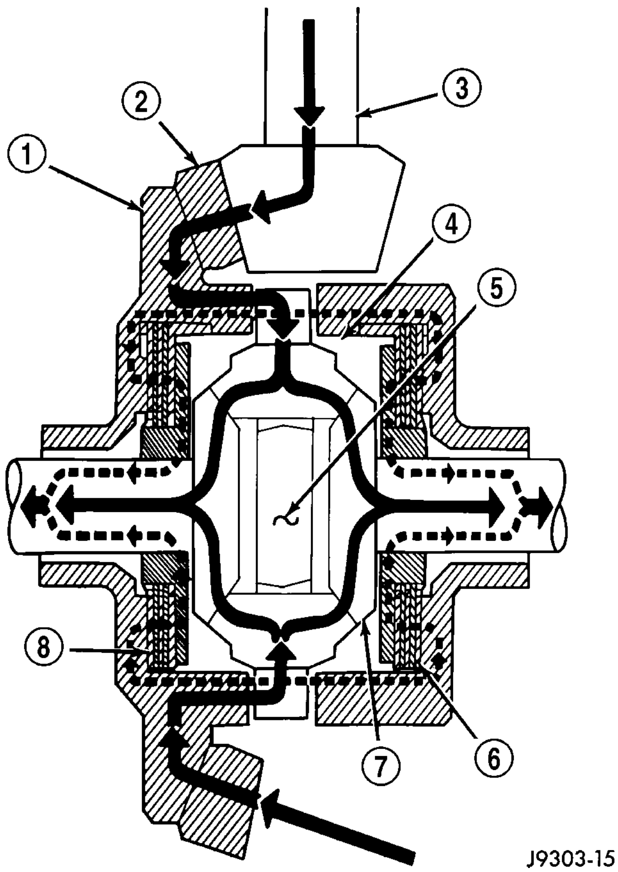


Fig. 48 TRAC-LOK LIMITED SLIP DIFFERENTIAL

1 - CASE
2 - RING GEAR
3 - DRIVE PINION
4 - PINION GEAR
5 - MATE SHAFT
6 - CLUTCH PACK
7 - SIDE GEAR
8 - CLUTCH PACK

DIAGNOSIS AND TESTING

The most common problem is a chatter noise when turning corners. Before removing the unit for repair, drain, flush and refill the axle with the specified lubricant. A container of Mopar Trac-lok® Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

DIFFERENTIAL TEST

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 or equivalent tool to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 49).

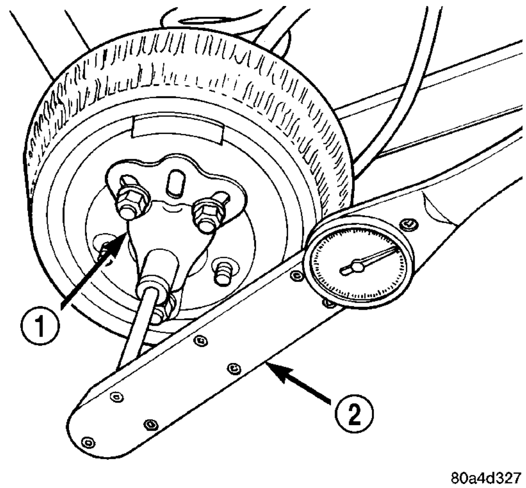


Fig. 49 ROTATING TORQUE TEST

1 - SPECIAL TOOL WITH BOLT IN CENTER HOLE
2 - TORQUE WRENCH

(6) If rotating torque is less than 41 N·m (56 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

DISASSEMBLY

(1) Clamp side gear Fixture 6965 in a vise and set differential case on the fixture (Fig. 50).

NOTE: The Trac-lok® differential can be serviced with the ring gear installed unless the gear hangs over the pinion shaft, then it must be removed.

(2) Remove pinion gear mate shaft roll pin with a hammer and punch.

(3) Remove pinion gear mate shaft with a drift and hammer.

(4) Lubricate and install disc without threaded hole from Trac-lok® Tool C-4487 into lower side gear (Fig. 51).

(5) Lubricate and install disc with threaded hole from Trac-lok® Tool C-4487 into upper side gear. Thread forcing screw from tool into threaded disc until it becomes centered in lower disc.

(6) Position a small screw driver in slot of the threaded disc (Fig. 52) to prevent adapter from turning.

(7) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 53).

DIFFERENTIAL -TRAC-LOK (Continued)

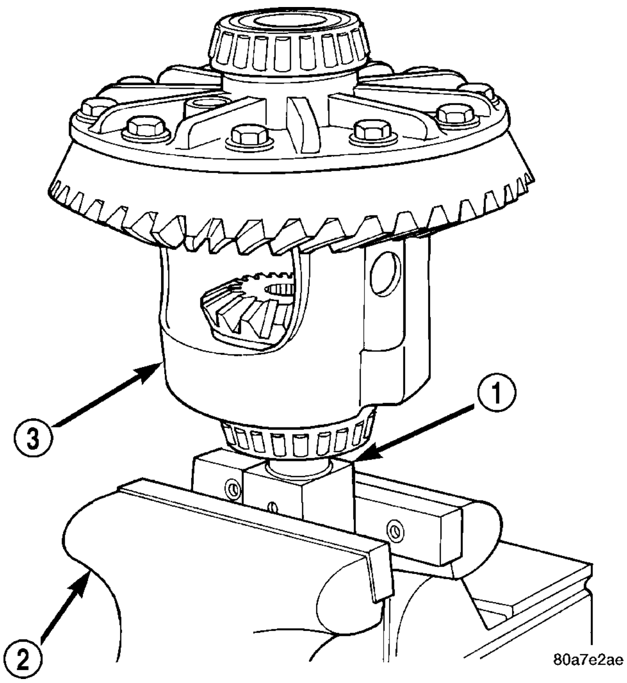


Fig. 50 DIFFERENTIAL CASE FIXTURE

1 - HOLDING FIXTURE
2 - VISE
3 - DIFFERENTIAL

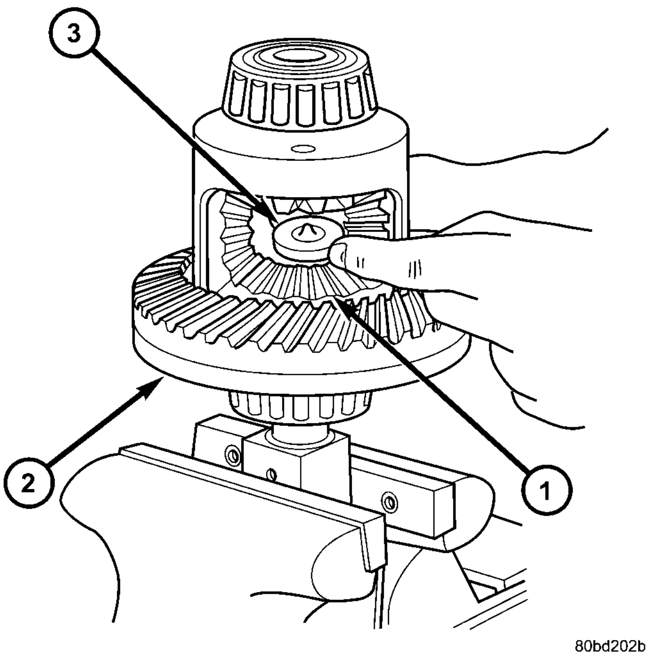


Fig. 51 TRAC-LOK DISC

1 - LOWER SIDE GEAR
2 - DIFFERENTIAL CASE
3 - DISC

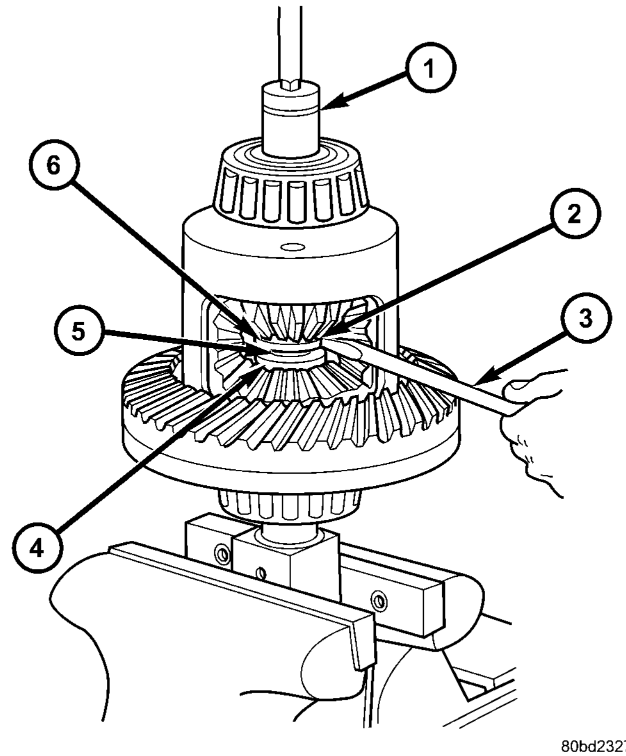


Fig. 52 TRAC-LOK TOOLS ASSEMBLY

1 - SOCKET
2 - SLOT IN DISC
3 - SCREWDRIVER
4 - STEP PLATE
5 - THREADED ROD
6 - DISC

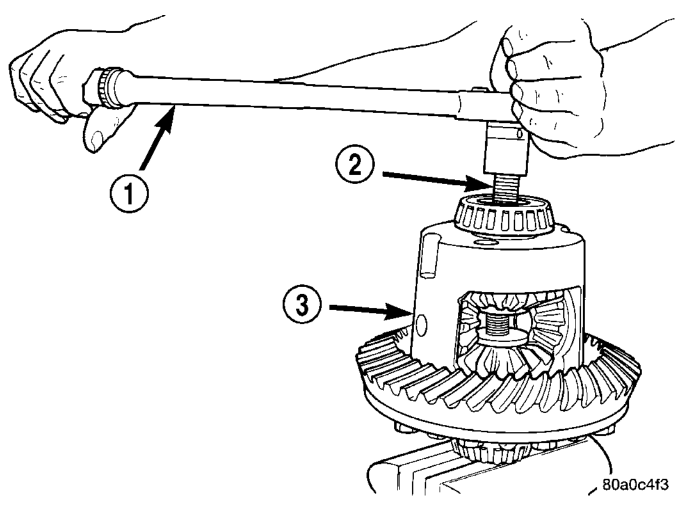


Fig. 53 COMPRESS BELLEVILLE SPRING

1 - TORQUE WRENCH
2 - FORCING SCREW
3 - DIFFERENTIAL CASE

DIFFERENTIAL -TRAC-LOK (Continued)

(8) With a feeler gauge remove thrust washers from behind the pinion gears (Fig. 54).

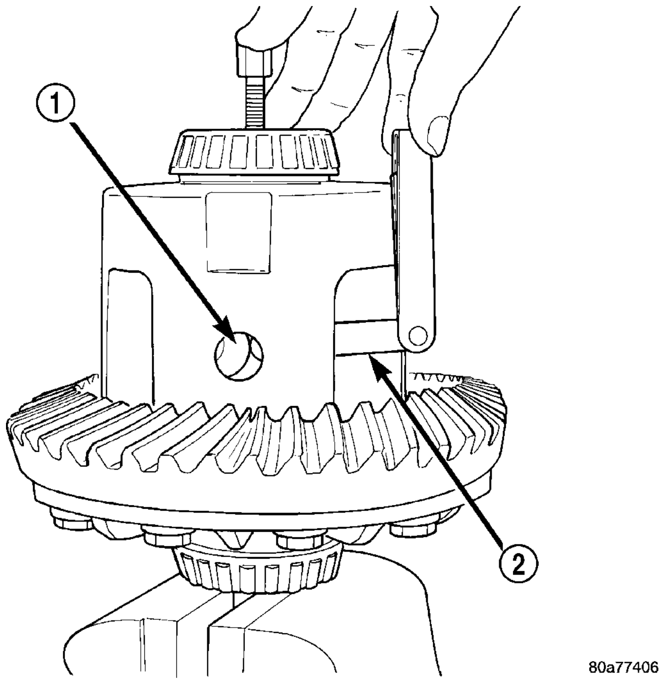


Fig. 54 PINION GEAR THRUST WASHER

1 - THRUST WASHER
2 - FEELER GAUGE

(9) Insert turning bar from tool into the pinion mate shaft hole in the case (Fig. 55).

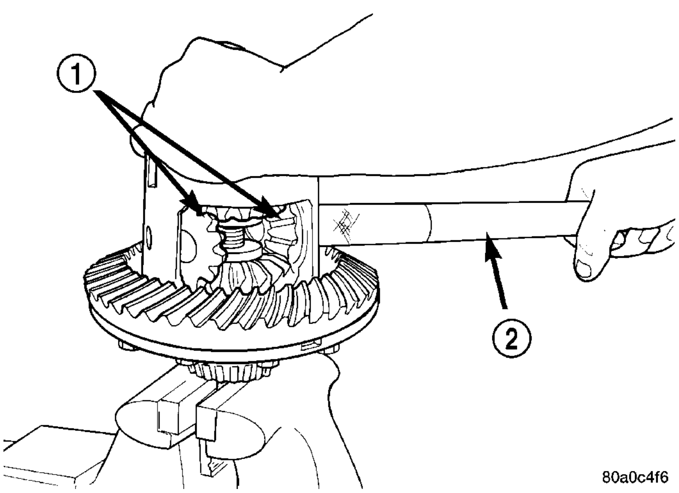


Fig. 55 PINION GEARS

1 - PINION GEARS
2 - TURNING BAR

(10) Loosen forcing screw in small increments until clutch pack tension is relieved and the differential case can be turned using turning bar.

(11) Rotate differential case until the pinion gears can be removed.

(12) Remove pinion gears from differential case.

(13) Remove Forcing Screw, Step Plate and Threaded Adapter.

(14) Remove top side gear, clutch pack retainer and clutch pack. Keep plates in order during removal (Fig. 56).

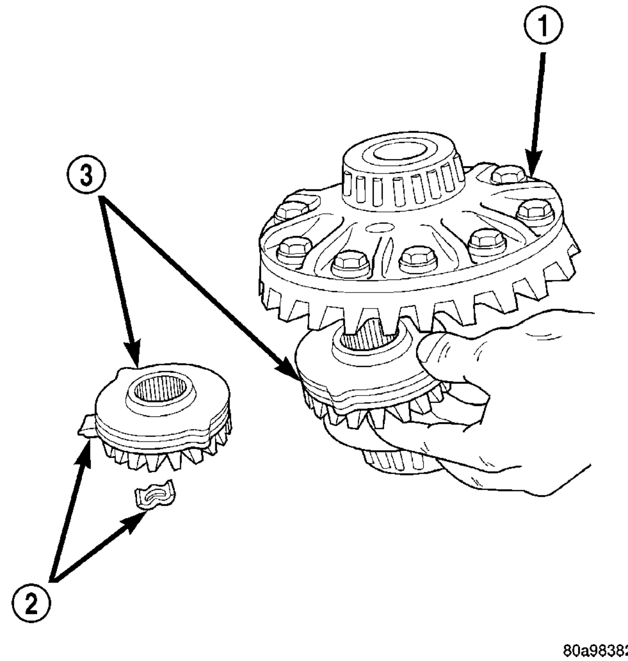


Fig. 56 SIDE GEARS AND CLUTCH DISCS

1 - DIFFERENTIAL CASE
2 - RETAINER
3 - SIDE GEAR AND CLUTCH DISC PACK

(15) Remove differential case from the Holding Fixture. Remove side gear, clutch pack retainer and clutch pack. Keep plates in order during removal.

ASSEMBLY

NOTE: New Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

(1) Lubricate components with gear lubricant.

(2) Assemble clutch discs into packs and secure disc packs with retaining clips (Fig. 57).

NOTE: Dished plate is position with the convex side against the side gear.

(3) Position assembled clutch disc packs on the side gear hubs.

(4) Install clutch pack and side gear in the ring gear side of the differential case, with retaining clips seated in the case pockets (Fig. 58).

(5) Position the differential case on the Holding Fixture 6965.

DIFFERENTIAL -TRAC-LOK (Continued)

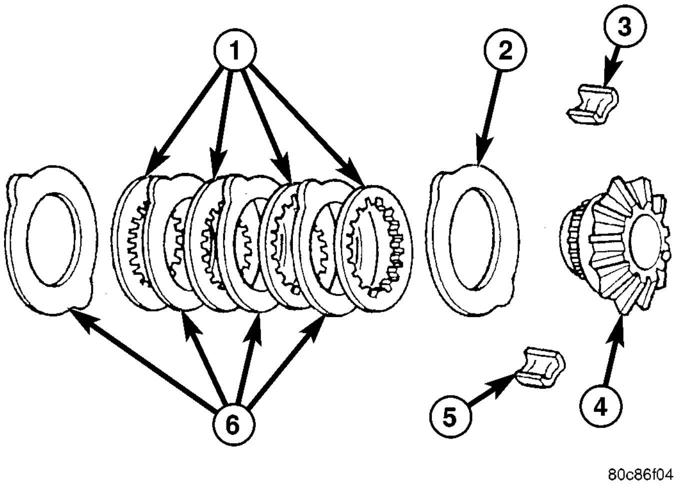


Fig. 57 CLUTCH PACK

1 - DISCS
2 - DISHED PLATE
3 - RETAINER
4 - SIDE GEAR
5 - RETAINER
6 - PLATES

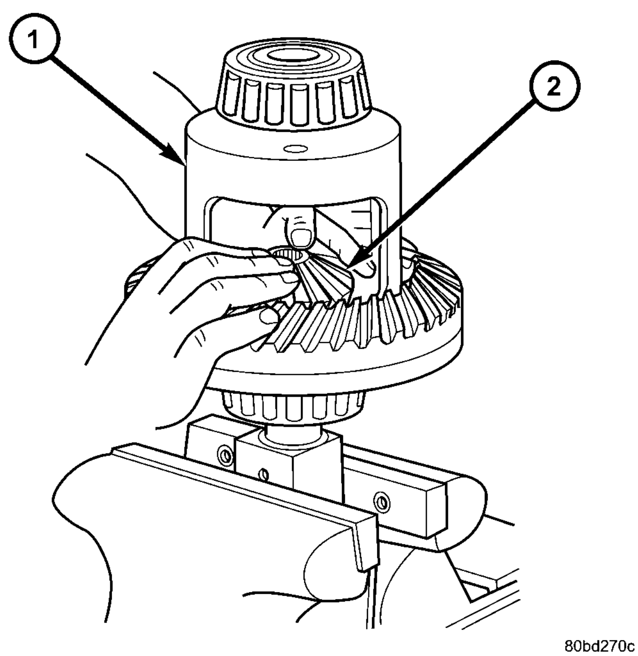


Fig. 58 CLUTCH PACK AND LOWER SIDE GEAR

1 - DIFFERENTIAL CASE
2 - SIDE GEAR AND CLUTCH PACK

(6) Lubricated and install disc without threaded hole from Trac-Lok® Tool C-4487 into lower side gear.

(7) Install upper side gear and clutch disc pack with retaining clips seated in the case pockets (Fig. 59).

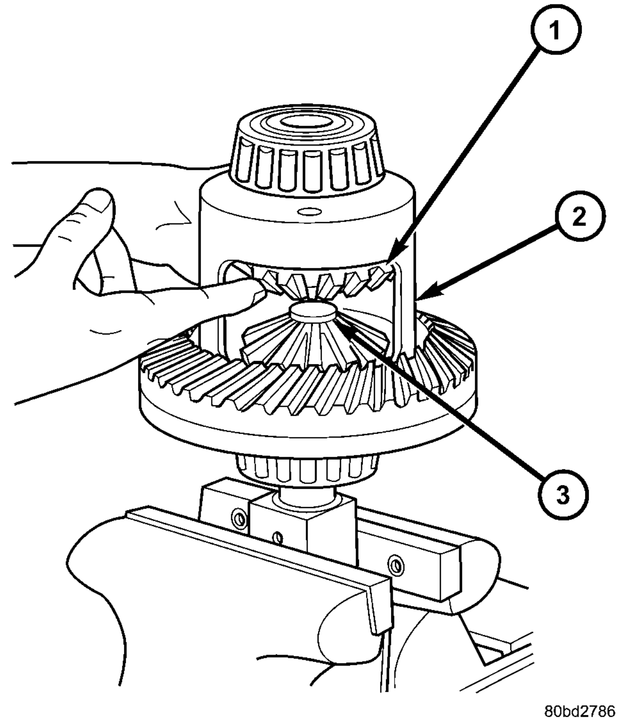


Fig. 59 CLUTCH PACK AND UPPER SIDE GEAR

1 - SIDE GEAR AND CLUTCH PACK
2 - DIFFERENTIAL CASE
3 - DISC

(8) Hold assembly in position and install threaded disc from Trac-Lok® Tool C-4487 into top side gear.

(9) Install forcing screw and tighten screw to slightly compress clutch disc.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.

(11) Rotate case with turning bar C-4487-2 until pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw, Step Plate and Threaded Adapter.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install pinion mate shaft roll pin. Stake (peen) case over pin in two places 180 degrees apart.

(17) Lubricate all differential components with hypoid gear lubricant.

DIFFERENTIAL - TRU-LOK

DESCRIPTION

The differential is a locking differential, that provides a positive mechanical connection between the right and left axle when engauged. The differential uses a dog clutch to connection the right and left axle.

OPERATION

The Tru-lok differential is activated by the axle lock switch located on the dash panel. When the switch is activated, an air pump with a built-in pressure regulator sends 5 PSI of air pressure to a accuator diaphragm in the differential housing. The diaphragm then engages a dog clutch and a position switch. The dog clutch has one gear attached to the differential case and another gear attached to a differential side gear. When the dog clutch is engaged the right and left wheels turn at the same speed. The position switch lights a lamp on the dash to indicate the system has been engaged. The differential works as standard differential when not engaged.

NOTE: The differential is serviced as an assembly, the diaphragm and indicator switch are serviced separately. The differential case must be removed to service the diaphragm actuator and indicator switch.

DIAGNOSIS AND TESTING

UNLOCKED

(1) Block tires opposite the axle to be tested to prevent the vehicle from rolling.

(2) Place transfer case in 4WD Low and automantic transmission in Park (1st gear if manual transmission).

(3) Raise both wheels of the axle to be tested off the ground.

(4) Turn ignition to the ON position and dash switch to the OFF position.

(5) Rotate one tire by hand. The other tire should spin in the opposite direction.

NOTE: If wheel cannot be rotated the differential must be repaired/replaced.

LOCKED

(1) Block tires opposite the axle to be tested to prevent the vehicle from rolling.

(2) Place transfer case in 4WD Low and automantic transmission in Park (1st gear if manual transmission).

(3) Raise both wheels of the axle to be tested off the ground.

(4) Turn ignition to the ON position and dash switch to the ON position.

(5) Try to rotate one tire by hand. You should not be able to rotate the tire.

NOTE: If wheel does rotated verify locker pump operation. If the pump is fuctional the differential must be repaired/replaced.

TRU-LOK INDICATOR SWITCH

(1) Turn ignition switch off.

(2) Disconnect indicator switch harness (Fig. 60) from the differential housing.

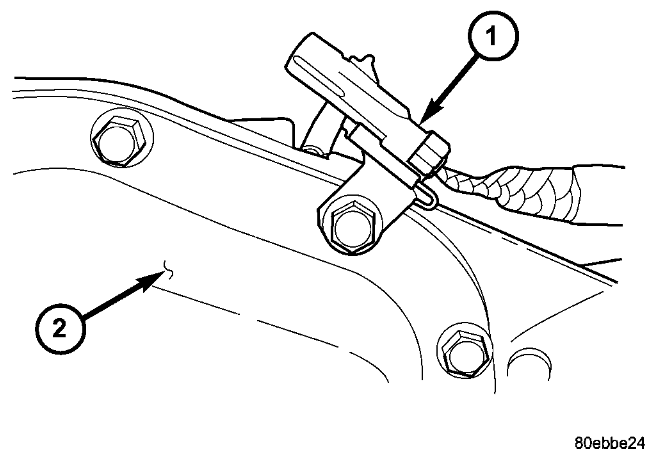


Fig. 60 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

(3) Measure electrical continuity across the switch terminals. Circuit should be closed (zero resistance).

NOTE: If circuit is not closed replace indicator switch.

DIFFERENTIAL - TRU-LOK (Continued)

TRU-LOK PUMPS

(1) Connect a pressure gauge to the rear pump.

(2) Place transfer case in 4WD Low and automatic transmission in Park (1st gear if manual transmission).

(3) Turn ignition to the ON position and push the dash switch to activate the rear pump.

NOTE: If pump is not running, verify pump has (Fig. 61) 12 volts and ground.

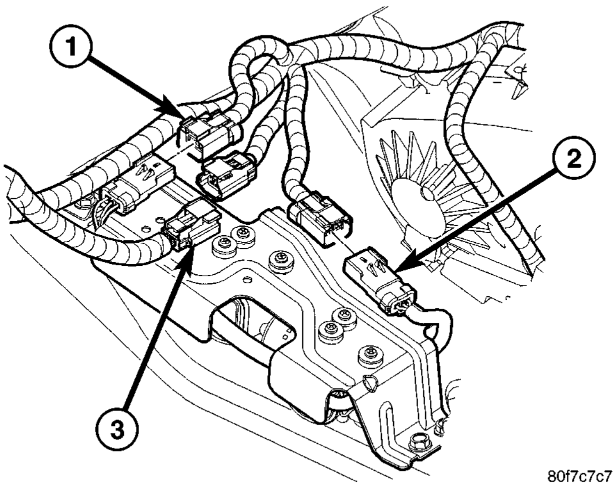


Fig. 61 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

(4) With the pump running the pressure gauge should show 5 psi..

NOTE: If pump does not produce 5 psi. replace the pump.

REMOVAL

(1) Remove drain plug from the differential housing.

(2) Disconnect indicator switch harness and remove connector from differential cover (Fig. 62).

(3) Remove differential housing cover.

(4) Remove axle shafts.

(5) Remove pressure hose from actuator assembly (Fig. 63).

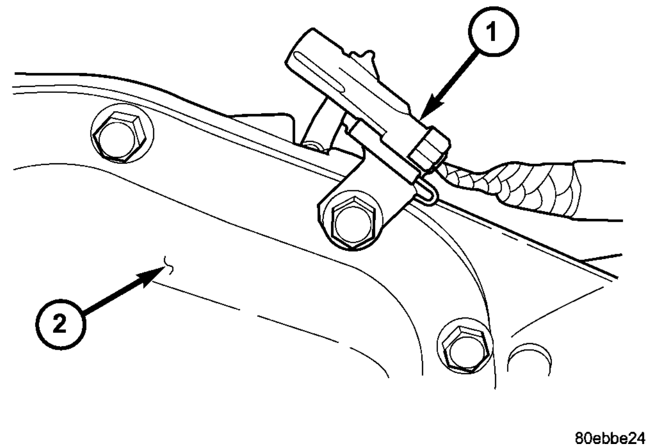


Fig. 62 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

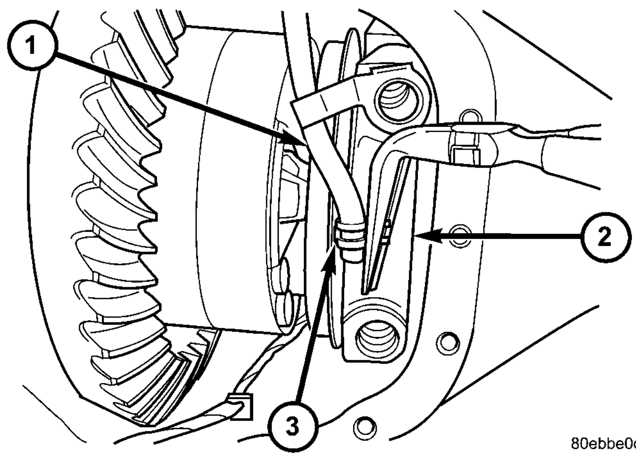


Fig. 63 PRESSURE HOSE

1 - PRESSURE HOSE
2 - BEARING CAP
3 - PRESSURE HOSE CLAMP

DIFFERENTIAL - TRU-LOK (Continued)

(6) Note the reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 64).

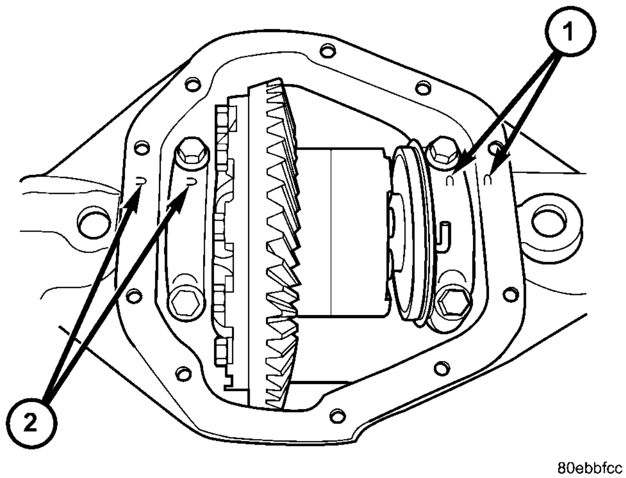


Fig. 64 LOCATION MARKS

1 - REFERENCE MARKS
2 - REFERENCE MARKS

(7) Loosen differential bearing cap bolts.

(8) Position Spreader W-129-B with Adapter Kit 6987B on differential locating holes (Fig. 65). Install hold-down clamps and tighten the turnbuckle finger-tight.

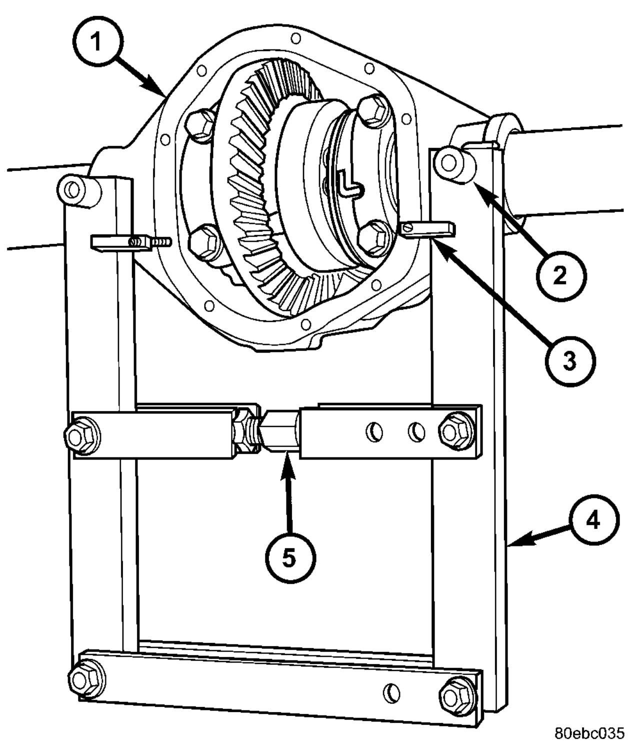


Fig. 65 SPREADER LOCATION

1 - DIFFERENTIAL CASE
2 - ADAPTER
3 - HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

(9) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud (Fig. 66). Load indicator plunger against the opposite side of the housing and zero the indicator.

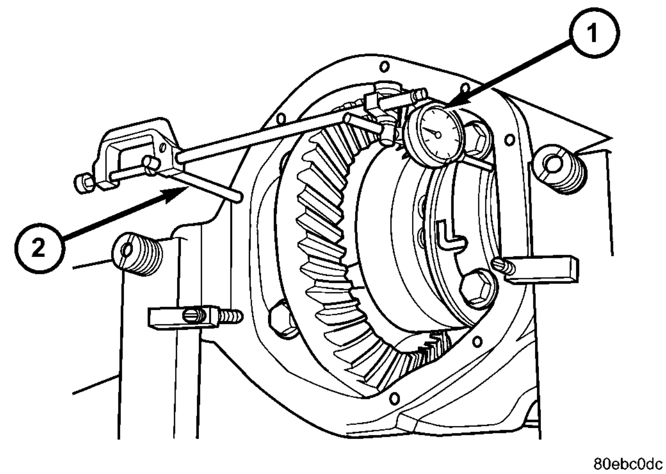


Fig. 66 DIAL INDICATOR LOCATION

1 - DIAL INDICATOR
2 - PILOT STUD

CAUTION: Never spread the housing over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

(10) Spread housing while measuring the distance with the dial indicator (Fig. 67).

(11) Remove dial indicator.

(12) Remove differential bearing cap bolts and ring gear side bearing cap.

(13) Remove differential from housing with pinion gear side bearing cap (Fig. 68) and tag differential bearing cups and preload shims to indicate location.

CAUTION: Do not bend actuator mounting tabs, during differential removal. Failure to heed caution may result in damage.

(14) Remove spreader from housing.

(15) Remove indicator switch (Fig. 69) from differential housing.

(16) Clean the housing cavity with flushing oil, light engine oil or lint free cloth.

NOTE: Do not use water, steam, kerosene or gasoline for cleaning.

DISASSEMBLY

(1) Install Plug C-293-3 into the differential axle shaft hole.

DIFFERENTIAL - TRU-LOK (Continued)

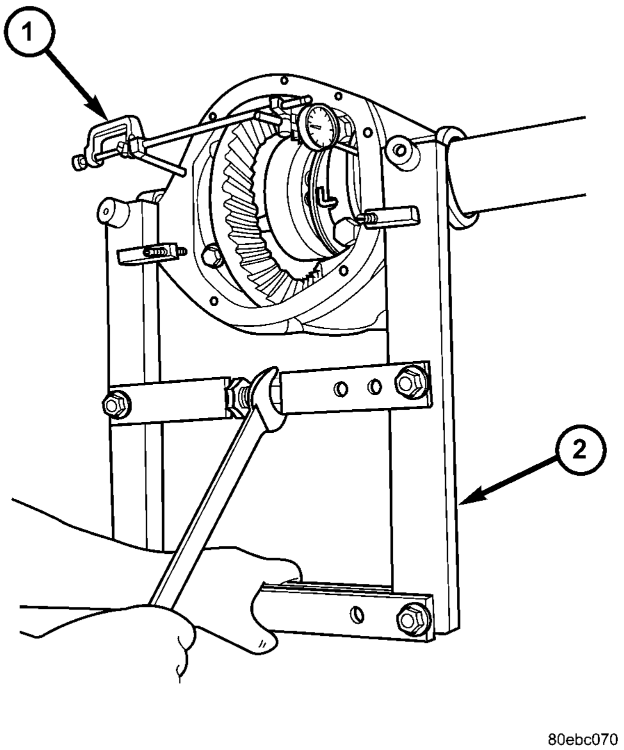


Fig. 67 SPREAD DIFFERENTIAL CASE

1 - DIAL INDICATOR
2 - SPREADER

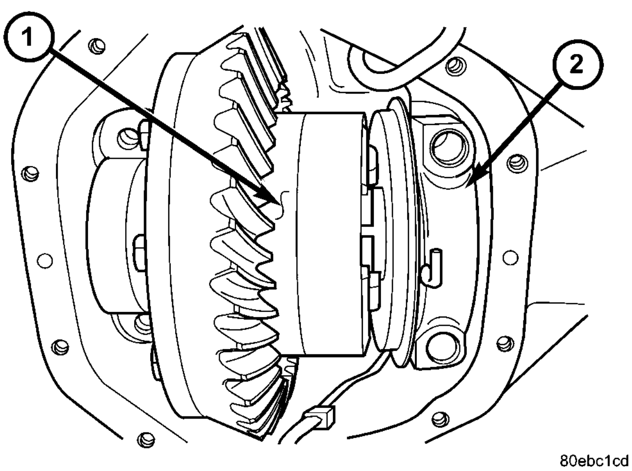


Fig. 68 DIFFERENTIAL

1 - DIFFERENTIAL
2 - BEARING CAP

(2) Remove differential case bearings with Puller 6444, Puller Rods 6444-3 and Puller Flange 6444-1. Position puller (Fig. 70) on the differential.

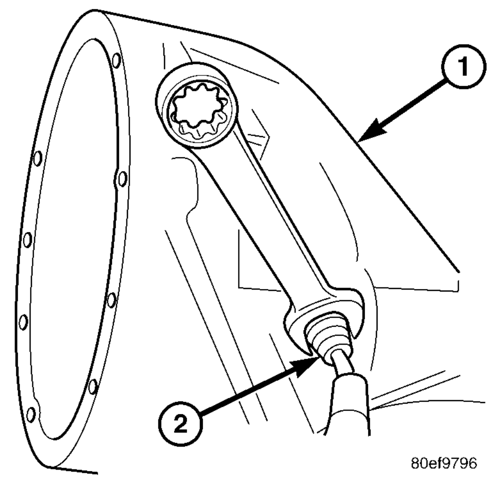


Fig. 69 INDICATOR SWITCH

1 - DIFFERENTIAL CASE
2 - SWITCH

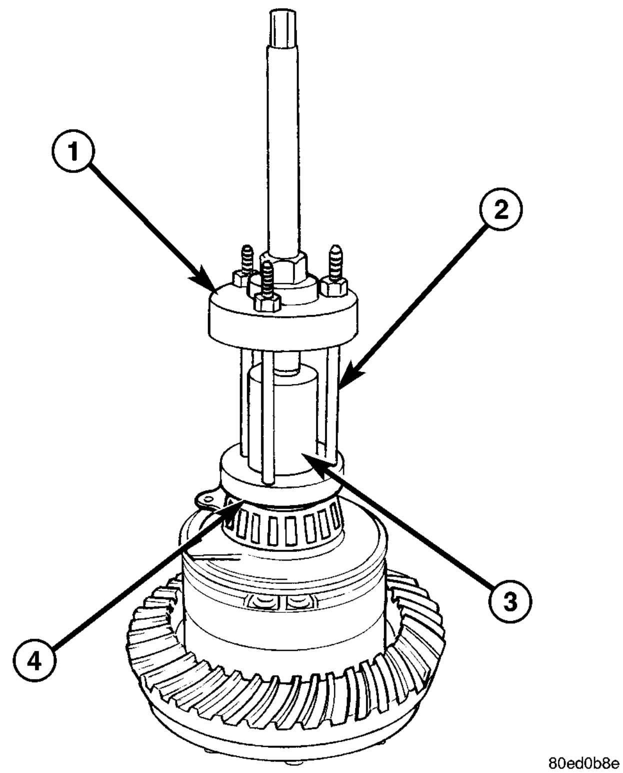


Fig. 70 PULLER AND FLANGE

1 - PULLER
2 - ROD
3 - PLUG
4 - FLANGE

DIFFERENTIAL - TRU-LOK (Continued)

(3) Position Puller Jaws 6444-7 (Fig. 71) around the case bearing and puller flange.

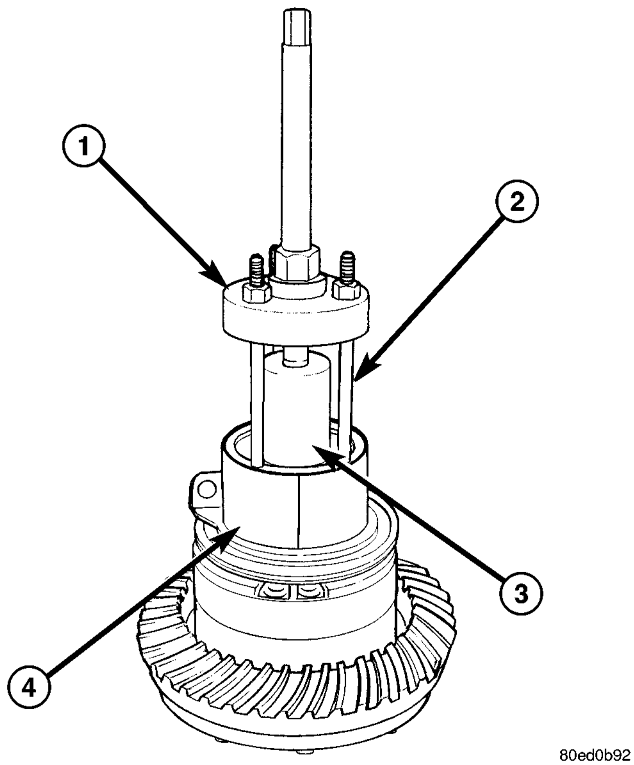


Fig. 71 PULLER AND JAWS

1 - PULLER
2 - ROD
3 - PLUG
4 - JAW

(4) Position Puller Collar 6444-8 (Fig. 72) around the puller jaws.

(5) Tighten the puller nut and remove differential case bearing.

(6) Remove locking actuator (Fig. 73).

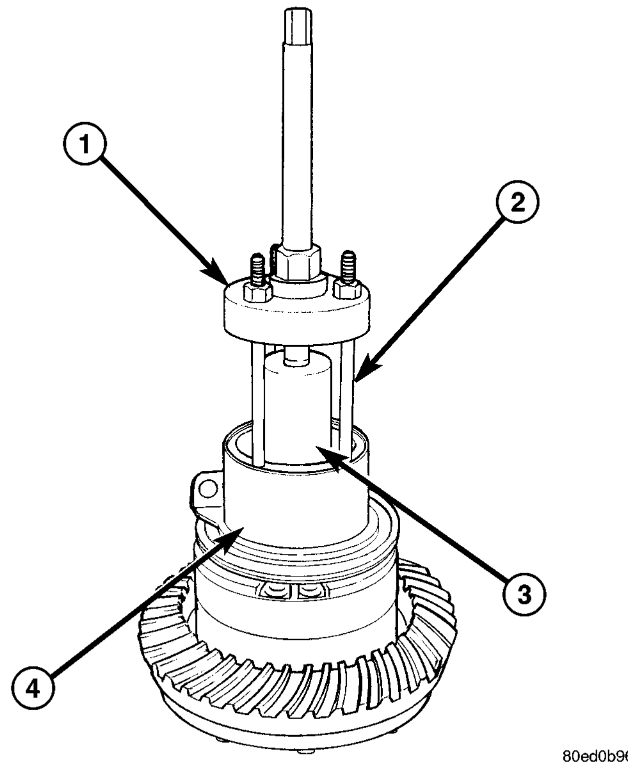


Fig. 72 PULLER AND COLLAR

1 - PULLER
2 - ROD
3 - PLUG
4 - COLLAR

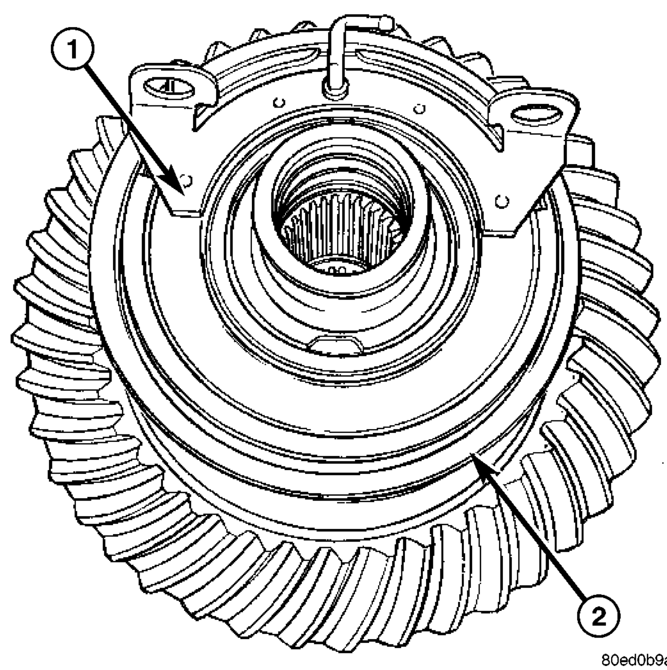


Fig. 73 ACTUATOR

1 - ACTUATOR
2 - PRESSURE PLATE

DIFFERENTIAL - TRU-LOK (Continued)

ASSEMBLY

(1) Verify pressure plate tabs are seated (Fig. 74) in the dog clutch slots.

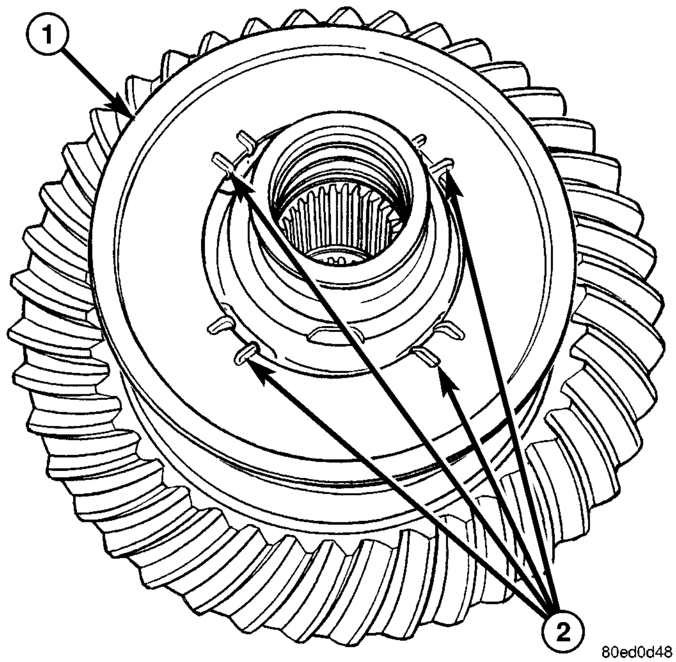


Fig. 74 PRESSURE PLATE

1 - PLATE
2 - PLATE TABS

(2) Place actuator on the pressure plate and case bearing on the case (Fig. 75).

(3) Install differential case bearings with Installer D-156 and Handle C-4171.

INSTALLATION

NOTE: If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer Adjustments (Differential Bearing Preload and Gear Backlash) to determine the proper shim selection.

(1) Install indicator switch into the housing.

(2) Position Spreader W-129-B and adapters from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 76). Install hold-down clamps and tighten the tool turnbuckle finger-tight.

(3) Install Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load indicator plunger against the opposite side of the housing and zero indicator.

(4) Spread housing while measuring the distance with the dial indicator.

CAUTION: Never spread over 0.38 mm (0.015 in). Failure to heed caution may result in damage.

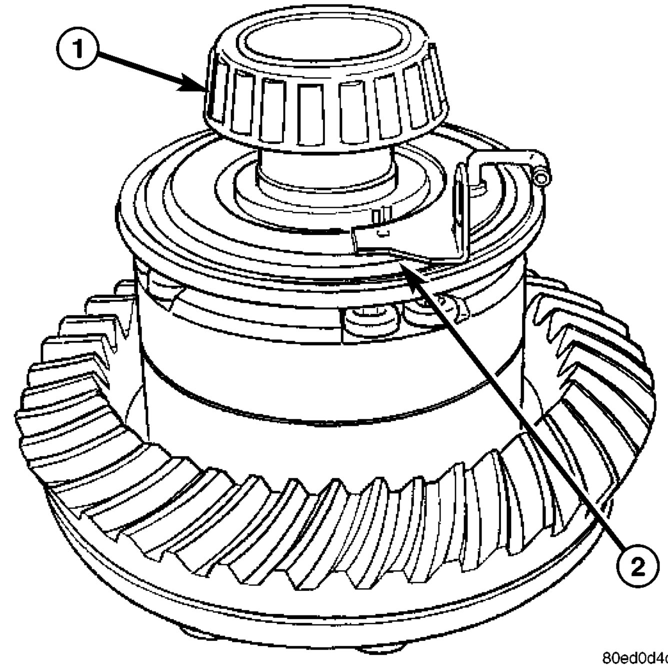


Fig. 75 ACTUATOR AND CASE BEARING

1 - CASE BEARING
2 - ACTUATOR

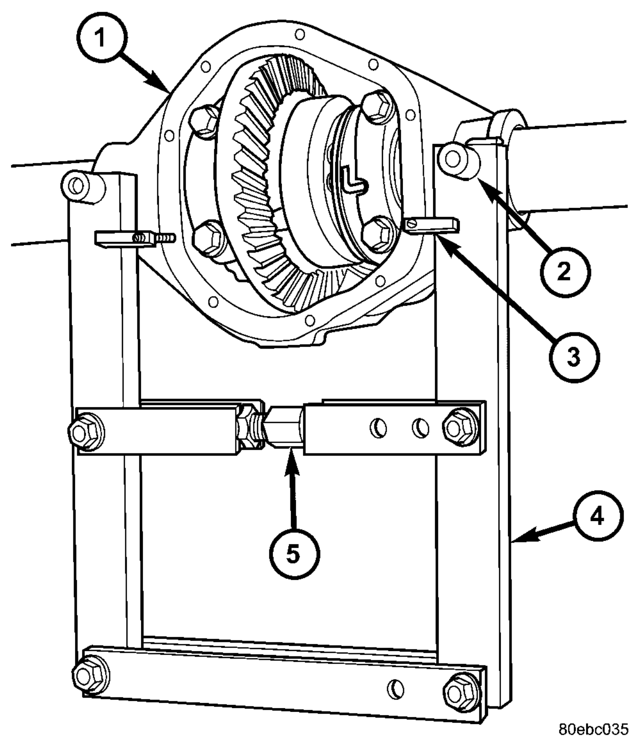


Fig. 76 SPREADER LOCATION

1 - DIFFERENTIAL CASE
2 - ADAPTER
3 - HOLD DOWN
4 - SPREADER
5 - TURNBUCKLE

DIFFERENTIAL - TRU-LOK (Continued)

(5) Remove dial indicator.

(6) Install differential case with pinion gear side bearing cap and differential preload shims in the housing. Tap differential case to seat bearings cups in the housing.

CAUTION: Ensure indicator switch plunger head is positioned under the actuator. Failure to heed caution may result in damage.

(7) Install ring gear side bearing cap with reference marks aligned (Fig. 77).

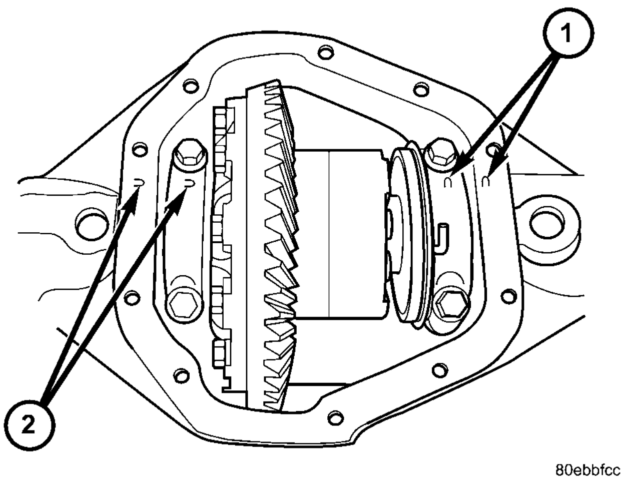


Fig. 77 BEARING CAP REFERENCE MARKS

1 - REFERENCE MARKS
2 - REFERENCE MARKS

(8) Loosely install differential bearing cap bolts.

(9) Remove axle housing spreader.

(10) Tighten bearing cap bolts to 108 N·m (80 ft. lbs.).

(11) With a 1/4 inch drill bit check the clearance between the actuator and actuator pressure plate at the top and the bottom.

CAUTION: If clearance is not correct, indicator switch plunger may be on top of the actuator or actuator mounting tabs may be bent. Failure to heed caution may result in damage.

(12) Install pressure hose on the actuator assembly.

(13) Install axle shafts.

(14) Install differential cover, identification tag and indicator switch connector (Fig. 78).

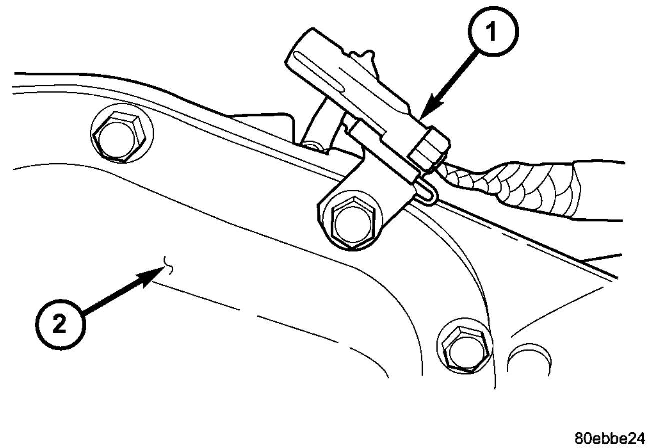


Fig. 78 INDICATOR SWITCH CONNECTOR

1 - CONNECTOR
2 - DIFFERENTIAL COVER

DIFFERENTIAL - TRU-LOK PUMP

REMOVAL

(1) Disconnect pumps and axle harness connectors (Fig. 79).

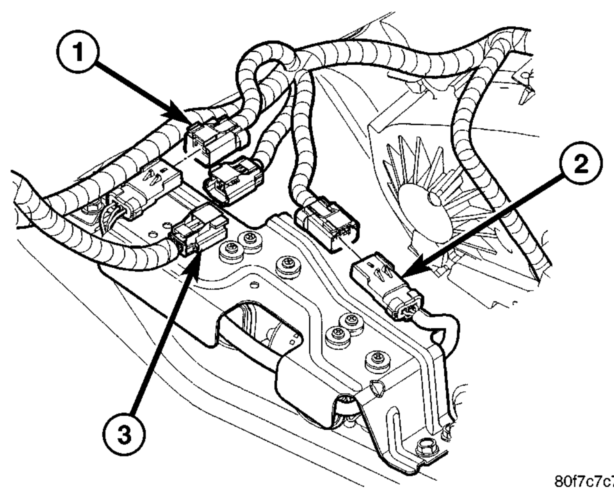


Fig. 79 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

DIFFERENTIAL - TRU-LOK PUMP (Continued)

(2) Remove pressure hoses from the front and rear pumps.

(3) Remove pump mounting bracket bolts (Fig. 80).

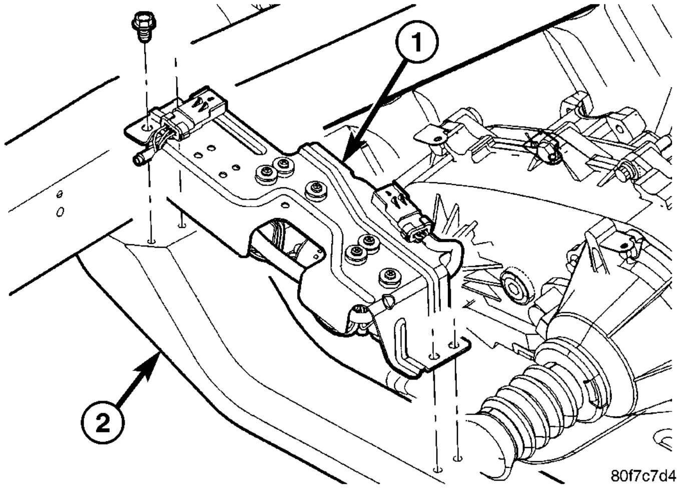


Fig. 80 PUMP BRACKET

1 - PUMP BRACKET
2 - CROSSMEMBER/SKID PLATE

(4) Remove pumps and bracket assembly from the vehicle.

(5) Remove pump connectors from the mounting bracket.

(6) Remove pump mounting screws (Fig. 81) from the bracket and remove pump/pumps.

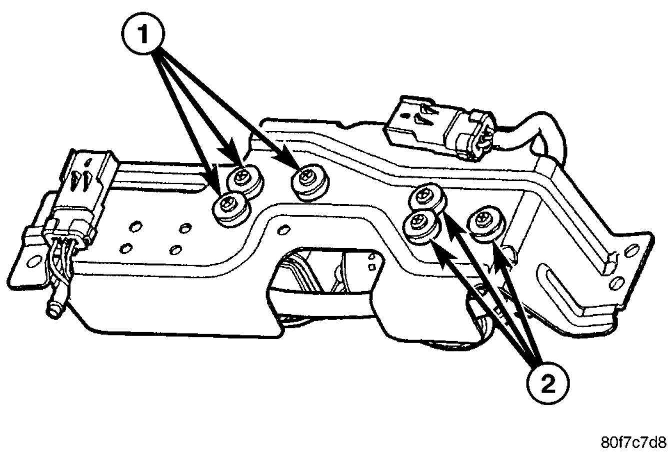


Fig. 81 PUMP SCREWS

1 - REAR PUMP SCREWS
2 - FRONT PUMP SCREWS

INSTALLATION

(1) Align pump with screw holes in pump bracket.

(2) Install and tighten pump mounting screws (Fig. 82).

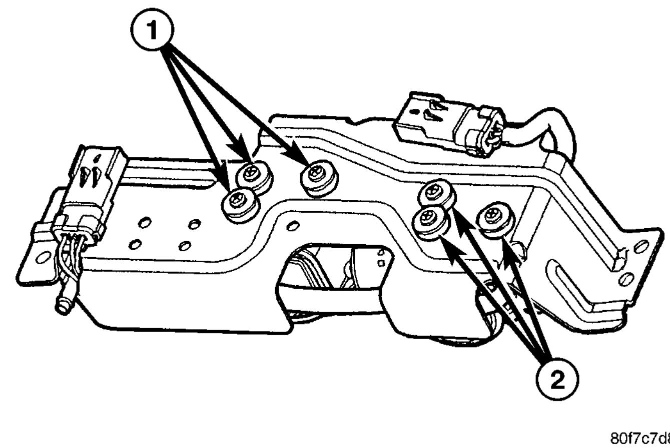


Fig. 82 PUMP SCREWS

1 - REAR PUMP SCREWS
2 - FRONT PUMP SCREWS

(3) Install pump bracket assembly on the cross-member/skid plate and install pump bracket mounting bolts (Fig. 83).

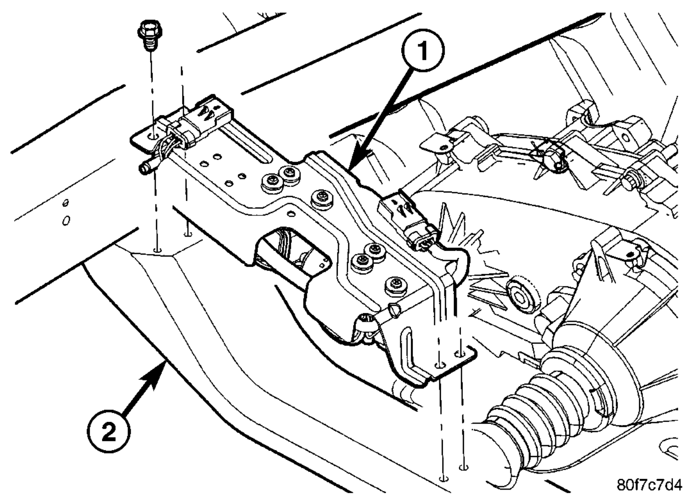


Fig. 83 PUMP BRACKET

1 - PUMP BRACKET
2 - CROSSMEMBER/SKID PLATE

DIFFERENTIAL - TRU-LOK PUMP (Continued)

(4) Tighten pump bracket bolts to 14 N·m (125 in. lbs.).

(5) Connector pump and axle harness connectors (Fig. 84).

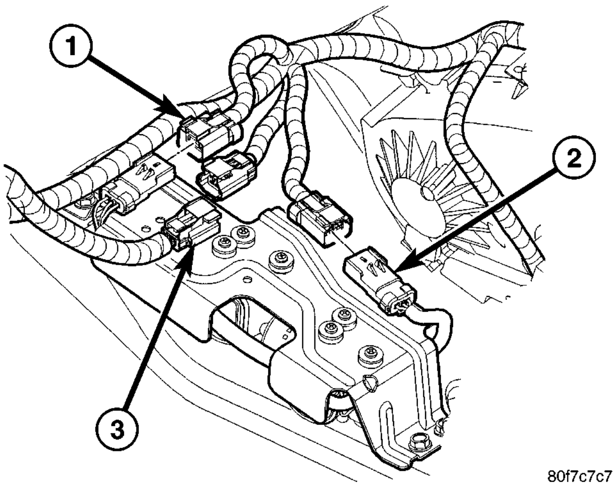


Fig. 84 PUMP CONNECTORS

1 - REAR PUMP CONNECTOR
2 - FRONT PUMP CONNECTOR
3 - AXLE HARNESS

(6) Install pressure hoses on the pumps.

(7) Verify pump operation.

DIFFERENTIAL CASE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove bearings from the differential case with Puller/Press C-293-PA, Adapters C-293-18 and Plug SP-3289 (Fig. 85).

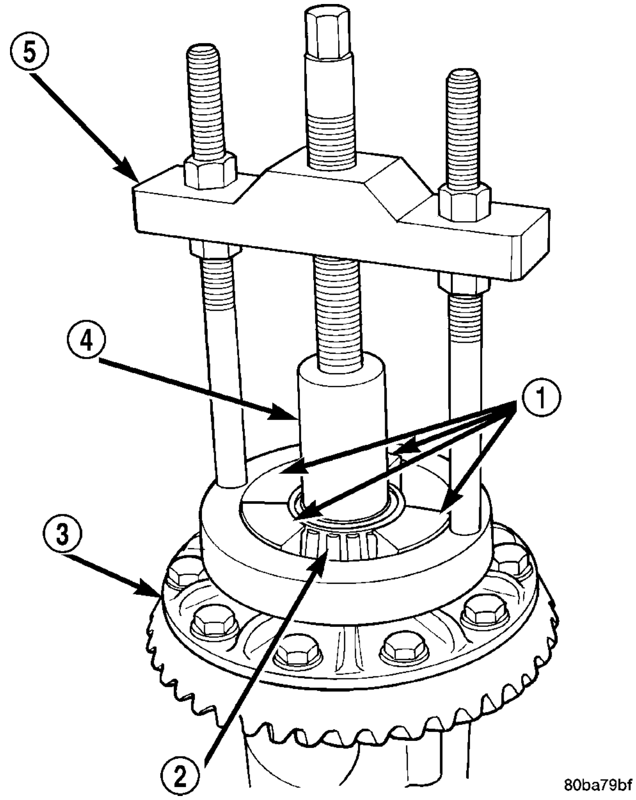


Fig. 85 DIFFERENTIAL CASE BEARING

1 - ADAPTERS
2 - BEARING
3 - DIFFERENTIAL
4 - PLUG
5 - PULLER

INSTALLATION

NOTE: If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to Adjustments for (Differential Bearing Preload and Gear Backlash) procedures.

(1) Install differential side bearings with Installer D-156 and Handle C-4171 (Fig. 86).

(2) Install differential into the housing.

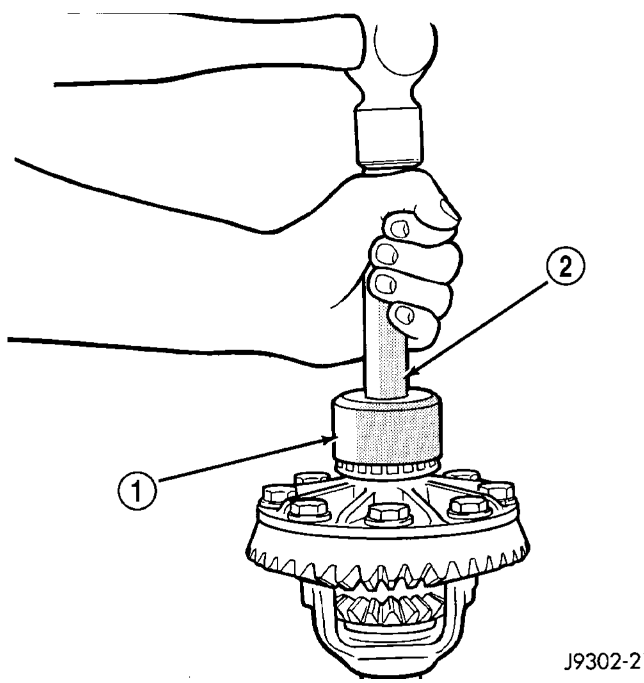


Fig. 86 DIFFERENTIAL SIDE BEARING

1 - INSTALLER
2 - HANDLE

PINION GEAR/RING GEAR/ TONE RING

REMOVAL

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

(1) With vehicle in neutral, position vehicle on hoist.

(2) Remove differential assembly from axle housing.

(3) Place differential case in a vise with soft metal jaw.

(4) Remove bolts holding ring gear to differential case.

(5) Driver ring gear off the differential case with a dead-blow hammer (Fig. 87).

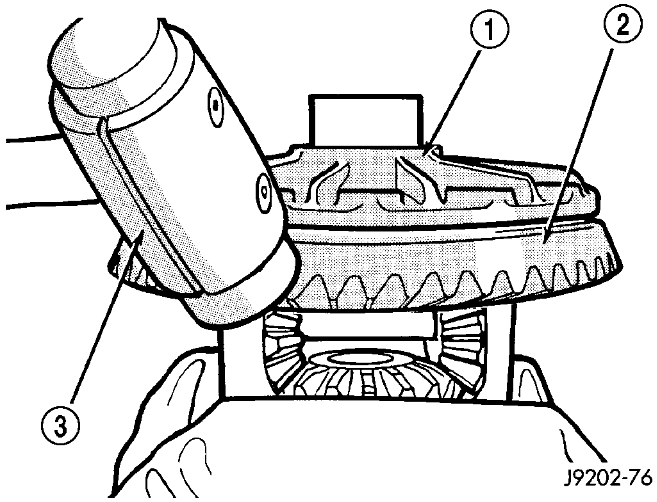


Fig. 87 RING GEAR

1 - CASE
2 - RING GEAR
3 - DEAD-BLOW HAMMER

(6) Using Spanner Wrench 6958 to hold yoke, remove the pinion nut and washer (Fig. 88).

(7) Remove pinion yoke from pinion shaft with Remover C-452 and Flange Wrench C-3281 (Fig. 89).

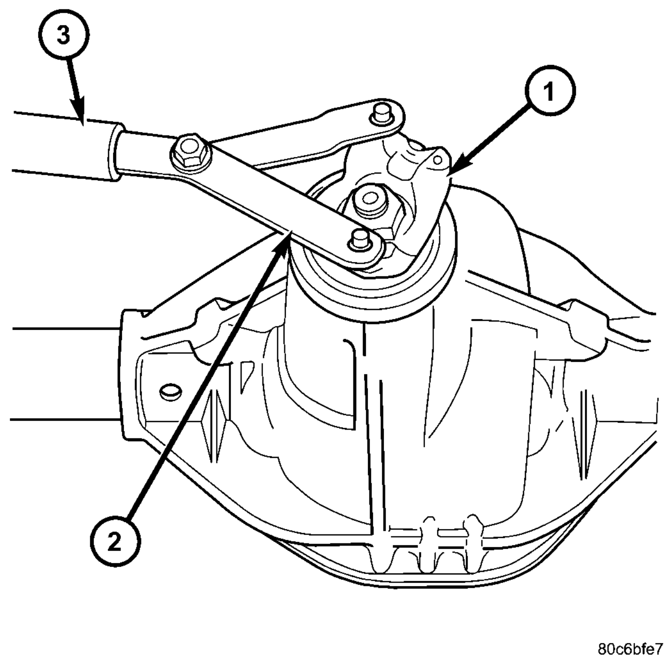


Fig. 88 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

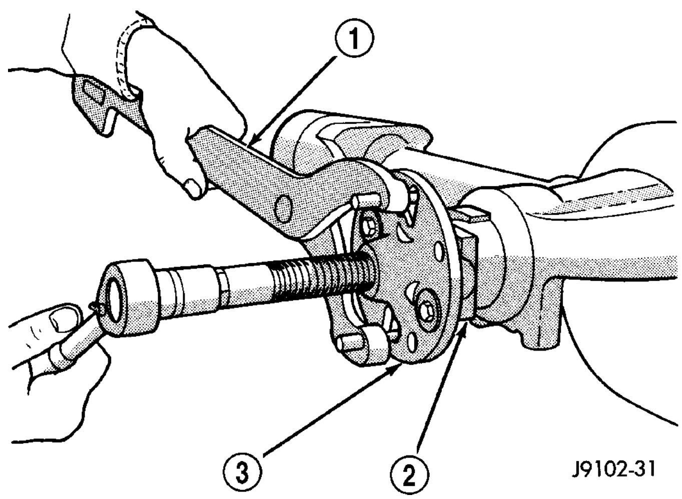


Fig. 89 PINION YOKE REMOVER

1 - REMOVER
2 - PINION YOKE
3 - FLANGE WRENCH

PINION GEAR/RING GEAR/TONE RING (Continued)

(8) Remove pinion gear from the housing (Fig. 90).

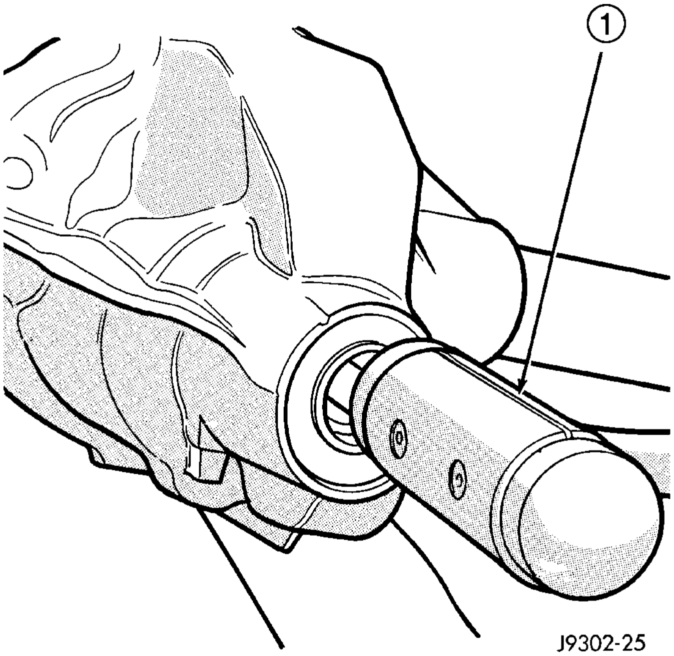


Fig. 90 PINION GEAR

1 - DEAD-BLOW HAMMER

(9) Remove front pinion bearing cup, bearing and pinion seal with Remover D-147 and Handle C-4171 (Fig. 91).

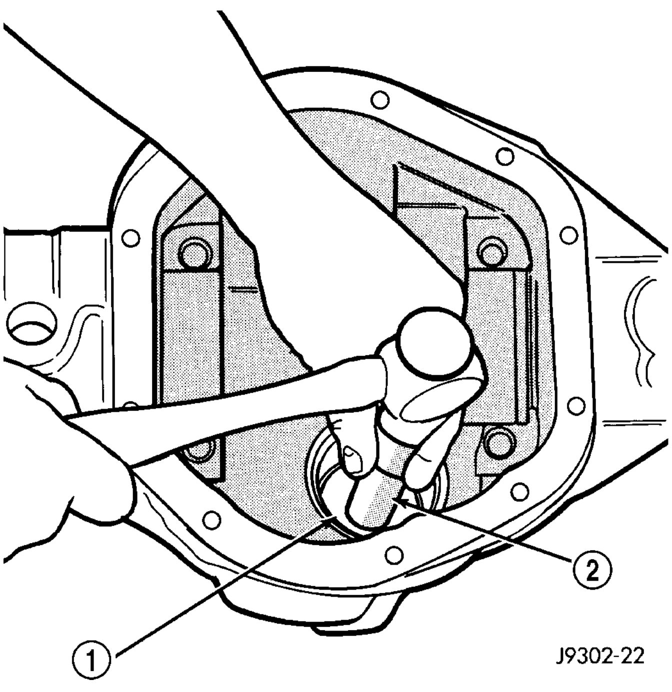


Fig. 91 FRONT BEARING CUP

1 - REMOVER
2 - HANDLE

(10) Remove rear pinion bearing cup from axle housing with remover D-148 and Handle C-4171 (Fig. 92).

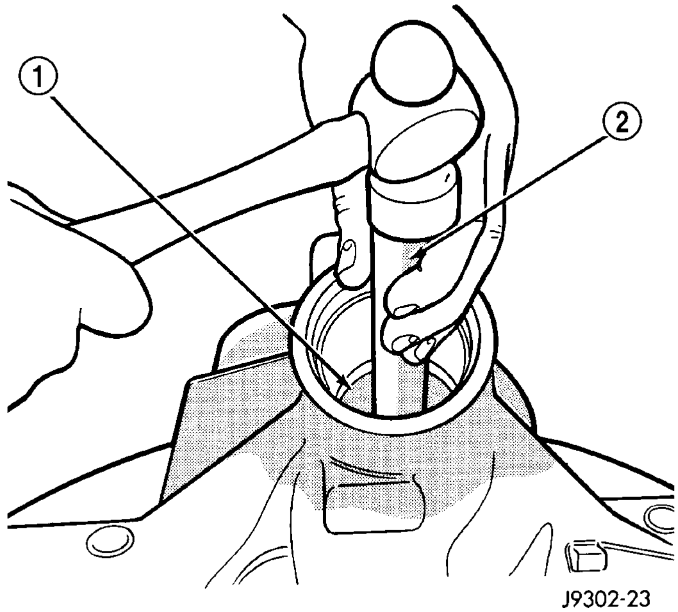


Fig. 92 REAR BEARING CUP

1 - DRIVER
2 - HANDLE

(11) Remove rear pinion bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-39 (Fig. 93).

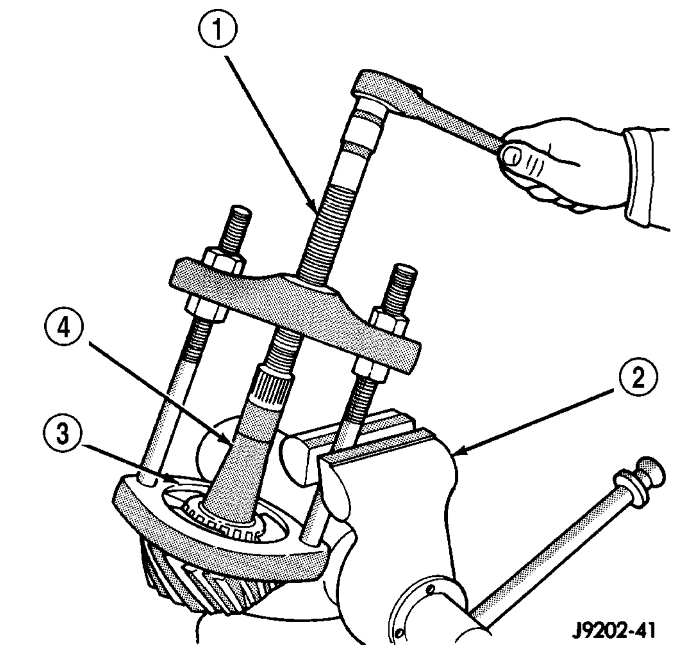


Fig. 93 REAR PINION BEARING

1 - PULLER
2 - VISE
3 - ADAPTERS
4 - PINION GEAR SHAFT

PINION GEAR/RING GEAR/TONE RING (Continued)

(12) Remove and record pinion depth shims from the pinion gear shaft.

INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing and pinion gear head to achieve proper ring and pinion gear mesh. If the ring and pinion gears are reused, the original pinion depth shim can be used. Refer to Adjustments (Pinion Gear Depth) to select the proper shim thickness.

(1) Install pinion depth shim in rear pinion bearing cup bore.

(2) Apply Mopar Door Ease or equivalent lubricant to the outside surface of pinion bearing cups. Install rear bearing cup with Installer D-145 and Handle C-4171 (Fig. 94) and verify cup is seated.

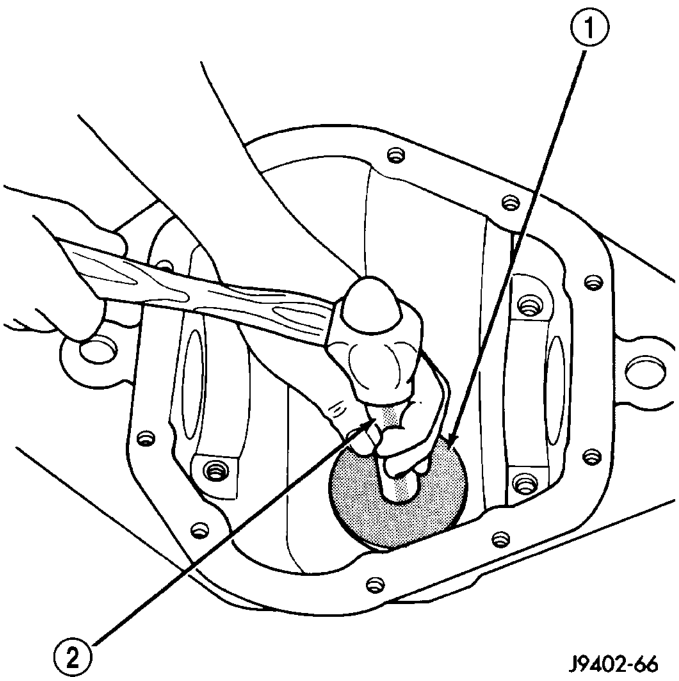


Fig. 94 REAR BEARING CUP

1 - INSTALLER
2 - HANDLE

(3) Install front bearing cup with Installer D-144 and Handle C-4171 (Fig. 95) and verify cup is seated.

(4) Install front pinion bearing and oil slinger, if equipped.

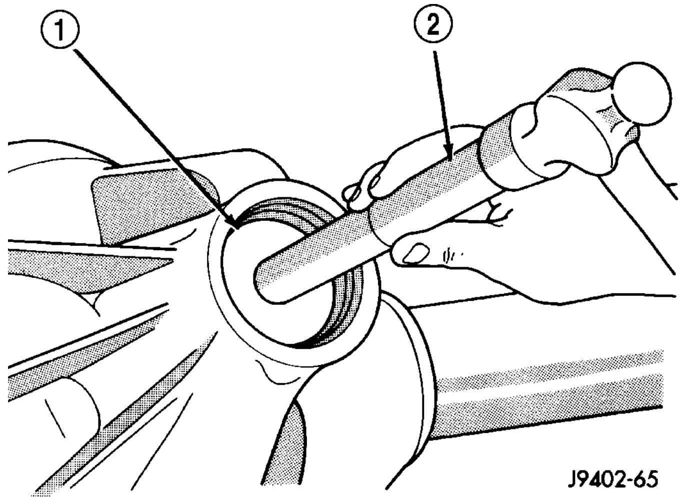


Fig. 95 FRONT BEARING CUP

1 - INSTALLER
2 - HANDLE

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer 8681 (Fig. 96).

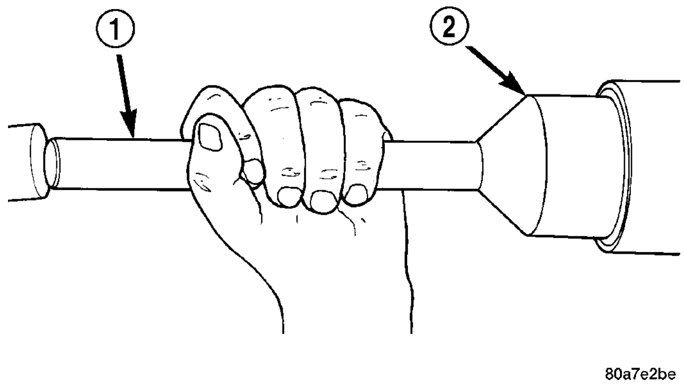


Fig. 96 PINION SEAL INSTALLER

1 - HANDLE
2 - INSTALLER

PINION GEAR/RING GEAR/TONE RING (Continued)

(6) Install pinion depth shim on the pinion shaft. Install rear pinion bearing on the pinion gear with Installer W-262 and a press (Fig. 97).

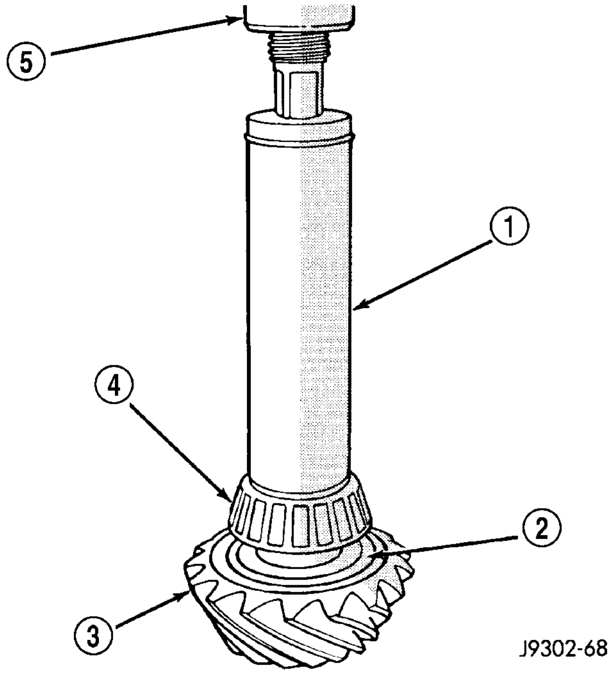


Fig. 97 REAR PINION BEARING

1 - INSTALLER
2 - SHIM
3 - DRIVE PINION GEAR
4 - REAR PINION BEARING
5 - PRESS

(7) Install pinion gear into the housing.

(8) Install yoke with Installer W-162-B, Cup 8109 and Spanner Wrench 6958 (Fig. 98).

(9) Install pinion washer and a **new** nut hold pinion yoke Spanner Wrench 6958 (Fig. 99) and tighten nut to 217-271 N·m (160-200 ft. lbs.).

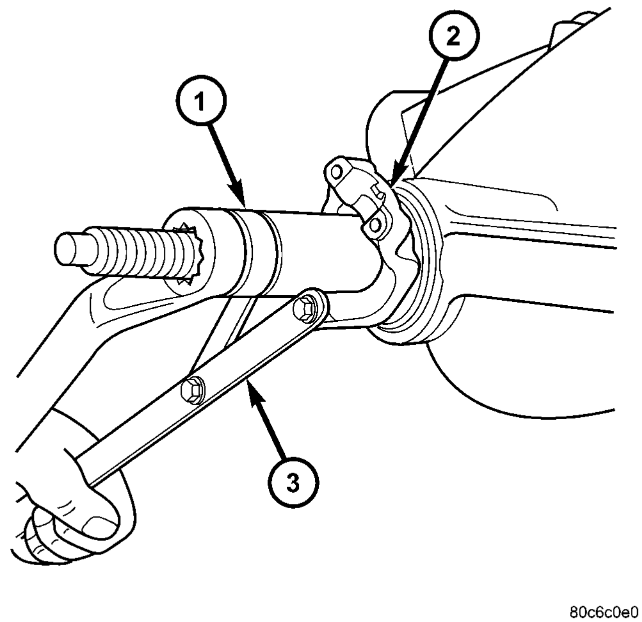


Fig. 98 PINION YOKE INSTALLER

1 - INSTALLER
2 - PINION YOKE
3 - SPANNER WRENCH

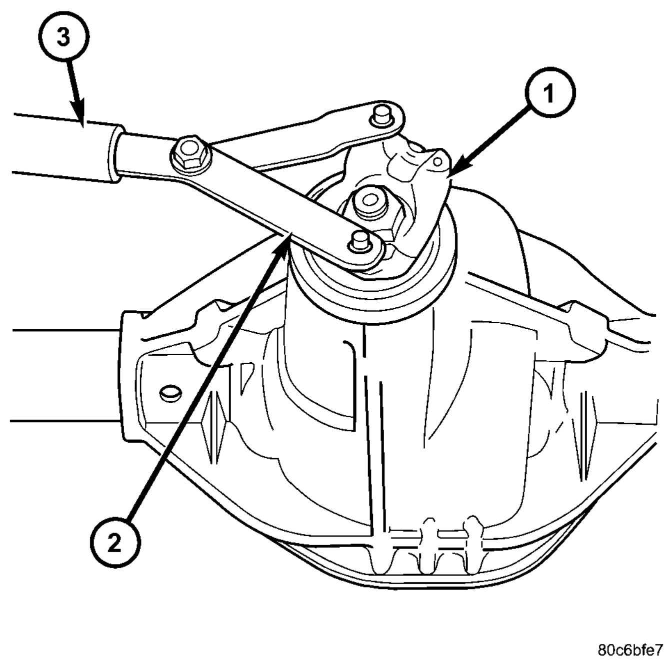


Fig. 99 YOKE SPANNER WRENCH

1 - PINION YOKE
2 - SPANNER WRENCH
3 - PIPE

PINION GEAR/RING GEAR/TONE RING (Continued)

(10) Check bearing preload torque with an inch pound torque wrench (Fig. 100). The torque necessary to rotate the pinion gear should be:

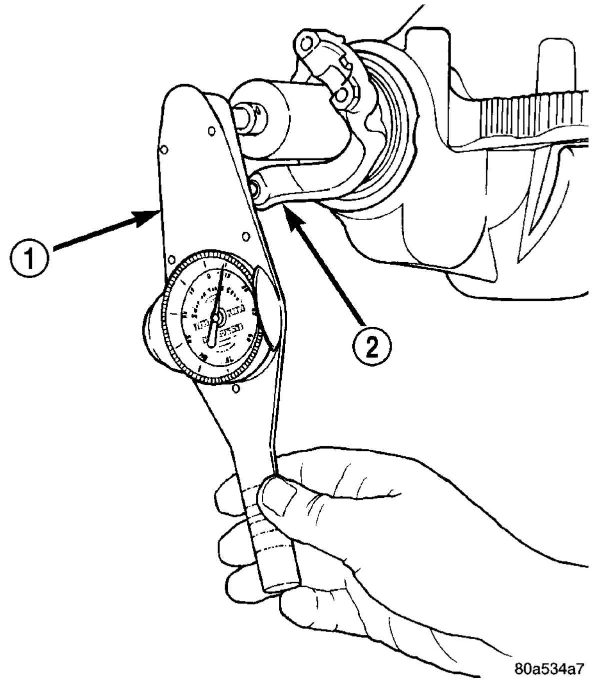


Fig. 100 PINION ROTATING TORQUE

1 - TORQUE WRENCH
2 - PINION YOKE

- Original Bearings: 1 to 2.26 N·m (10 to 20 in. lbs.).
- New Bearings: 2.26 to 4.52 N·m (20 to 40 in. lbs.).

(11) If rotating torque is above the desired amount, remove the pinion yoke and increase the preload shim pack thickness. Increasing the shim pack thickness 0.025 mm (0.001 in.) will decrease the rotating torque approximately 0.9 N·m (8 in. lbs.).

(12) If the maximum tightening torque is reached prior to achieving the desired rotating torque, remove the pinion yoke and decrease the thickness of the preload shim pack. Decreasing the shim pack thickness 0.025 mm (0.001 in.) will increase the rotating torque approximately 0.9 N·m (8 in. lbs.).

(13) Invert differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

CAUTION: Never reuse ring gear bolts, the bolts can fracture causing extensive damage. Failure to heed caution may result in damage.

(14) Invert differential case in the vise.

(15) Install **new** ring gear bolts and alternately tighten to 108 N·m (100 ft. lbs.) (Fig. 101).

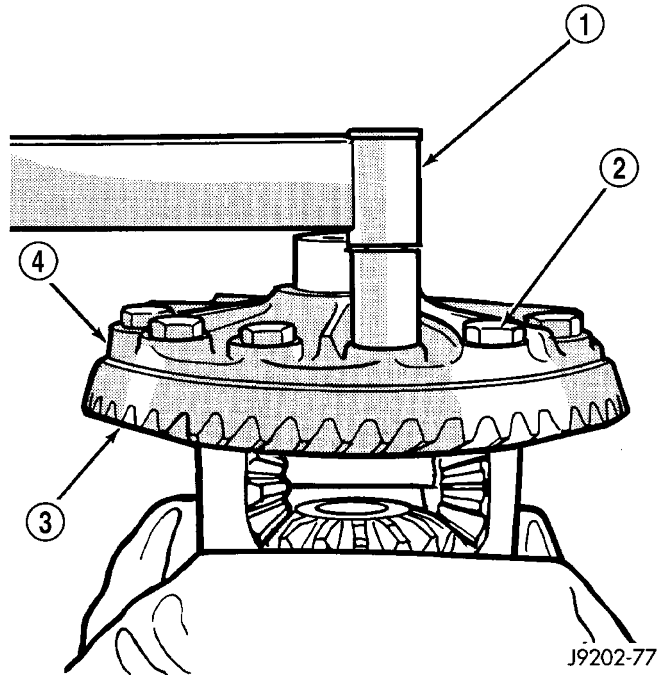


Fig. 101 RING GEAR

1 - TORQUE WRENCH
2 - RING GEAR BOLT
3 - RING GEAR
4 - CASE

(16) Install differential in axle housing and verify gear mesh and contact pattern. Refer to Adjustment (Gear Contact Pattern).

BRAKES

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BRAKES - BASE

DESCRIPTION

DESCRIPTION - BRAKE SYSTEM

Power assist front disc and rear drum brakes are standard equipment. Disc brake components consist of single piston calipers and ventilated rotors. Rear drum brakes are dual shoe units with cast brake drums.

The parking brake mechanism is lever and cable operated. The cables are attached to levers on the rear drum brake secondary shoes. The parking brakes are operated by a hand lever.

A dual diaphragm vacuum power brake booster is used for all applications. All models have an aluminum master cylinder with plastic reservoir.

All models are equipped with a combination valve. The valve contains a pressure differential valve and switch and a fixed rate rear proportioning valve.

Factory brake lining on all models consists of an organic base material combined with metallic particles. The original equipment linings do not contain asbestos.

BRAKES - BASE (Continued)

DESCRIPTION - SERVICE WARNINGS & CAUTIONS

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF ASBESTOS FIBERS FROM BRAKE COMPONENTS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WITH A WATER DAMPENED CLOTH. DO NOT SAND, OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DISPOSE OF ALL RESIDUE CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE EXPOSURE TO YOURSELF AND OTHERS. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.

CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, wheel cylinders, brake drums, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.

(2) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

(3) Inspect brake fluid level and condition. Note that the front disc brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brake lines, and master cylinder.

(b) If fluid appears contaminated, drain out a sample. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.

(4) Check parking brake operation. Verify free movement and full release of cables and pedal. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) If components checked appear OK, road test the vehicle.

ROAD TESTING

(1) If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

BRAKES - BASE (Continued)

(2) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper/wheel cylinder. Internal leakage in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

If leakage is severe, fluid will be evident at or around the leaking component. However, internal leakage in the master cylinder may not be physically evident.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, worn lining, rotors, or drums are the most likely causes.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, or replace thin drums and suspect quality brake lines and hoses.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums. Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Possible causes for brake drag condition are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper or wheel cylinder piston.
- Caliper binding on corroded bushings or rusted slide surfaces.
- Loose caliper mounting bracket.
- Drum brake shoes binding on worn/damaged support plates.
- Mis-assembled components.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Possible causes for front brake pull condition are:

- Contaminated lining in one caliper.
- Seized caliper piston.
- Binding caliper.
- Loose caliper.
- Rusty adapter/caliper slide surfaces.
- Improper brake shoes.
- Damaged rotor.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

BRAKES - BASE (Continued)

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brake shoes can also produce a thump noise.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or wheel cylinders, worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

STANDARD PROCEDURE

STANDARD PROCEDURE - MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

(1) Remove reservoir filler caps and fill reservoir.

(2) If calipers, or wheel cylinders were overhauled, open all caliper and wheel cylinder bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

(3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 1). Be sure end of bleed hose is immersed in fluid.

(4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

STANDARD PROCEDURE - PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

BRAKES - BASE (Continued)

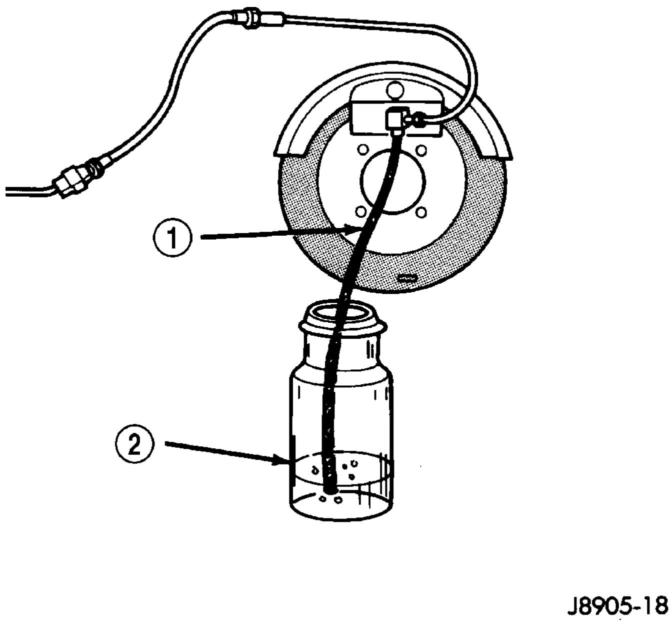


Fig. 1 Bleed Hose Setup

1 - BLEED HOSE
2 - FLUID CONTAINER PARTIALLY FILLED WITH FLUID

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

SPECIFICATIONS

BRAKE COMPONENTS

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Disc Brake Caliper Type	Sliding
Disc Brake Rotor Type Front	Ventilated
Disc Brake Rotor Type Rear	Solid
Disc Brake Rotor Diameter Front	279.4 x 23.876 mm (11 x 0.94 in.)
Disc Brake Rotor Diameter Rear	285 x 12 mm (11 x 0.472 in.)
Disc Brake Rotor Ventilated Front	Max. Runout 0.12 mm (0.005 in.)
Disc Brake Rotor Solid Rear	Max. Runout 0.102 mm (0.004 in)
Disc Brake Rotor Ventilated Front	Max. Thickness Variation 0.013 mm (0.0005 in.)
Disc Brake Rotor Solid Rear	Max Thickness Variation 0.018 mm (0.0007 in)
Disc Brake Rotor Ventilated Front	Min. Thickness 22.7 mm (0.8937 in.)
Disc Brake Rotor Solid Rear	Min. Thickness 11.00 mm (0.433 in.)
Brake Drum Diameter	228.6 x 63.5 mm (9 x 2.5 in.)
Brake Booster Type	Tandem Diaphragm

BRAKES - BASE (Continued)

TORQUE CHART

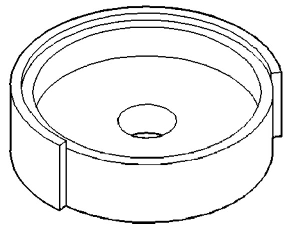
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Pedal Support Bolt	28	21	—
Brake Booster Mounting Nuts	39	29	—
Master Cylinder Mounting Nuts	17	13	—
Master Cylinder Brake Lines	19	14	—
Combination Valve Mounting Nuts	20	15	—
Combination Valve Brake Lines	19	14	—
Caliper Mounting Bolts Front	15	11	—
Caliper Mounting Bolts Rear	25	—	220
Caliper Brake Hose Banjo Bolt Front	31	23	—
Caliper Brake Hose Banjo Bolt Rear	31	23	—
Wheel Cylinder Mounting Bolts	10	7	—
Wheel Cylinder Brake Line	16	12	—
Parking Brake Lever Bolts	12	9	—
Parking Brake Lever Bracket Bolts	12	9	—
Parking Brake Cable Retainer Nut	1.5	—	14

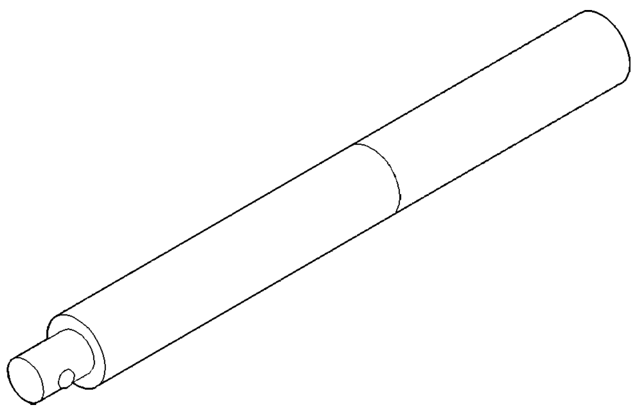
BRAKES - BASE (Continued)

SPECIAL TOOLS

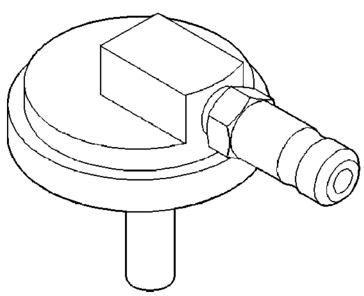
BASE BRAKES



Installer Caliper Dust Boot C-4842



Handle C-4171



Adaptor Cap Pressure Bleeder 6921

BRAKE LINES

DESCRIPTION

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Double walled steel tubing is used to connect the master cylinder to the major hydraulic braking components and then to the flexible rubber hoses. Double inverted style and ISO style flares are used on the brake lines.

OPERATION

The hoses and lines transmit the brake fluid hydraulic pressure to the calipers and or wheel cylinders.

DIAGNOSIS AND TESTING - BRAKE LINE AND HOSES

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper seal washers at all caliper connections. Be sure brake line connections are properly made (not cross threaded) and tightened to recommended torque.

STANDARD PROCEDURE

STANDARD PROCEDURE - BRAKE TUBE FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare (Fig. 2).

STANDARD PROCEDURE - DOUBLE INVERTED FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

(1) Cut off damaged tube with Tubing Cutter.

(2) Ream cut edges of tubing to ensure proper flare.

BRAKE LINES (Continued)

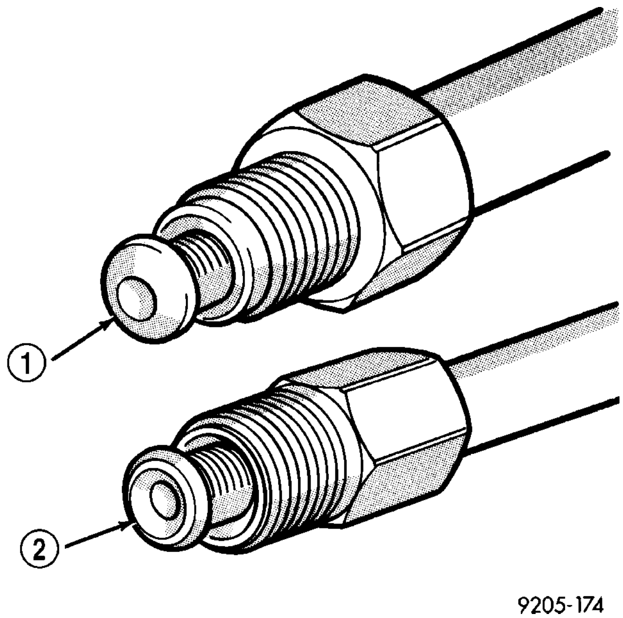


Fig. 2 Inverted Flare And ISO Flare

1 - ISO-STYLE FLARE
2 - DOUBLE INVERTED-STYLE FLARE

(3) Install replacement tube nut on the tube.

(4) Insert tube in flaring tool.

(5) Place gauge form over the end of the tube.

(6) Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.

(7) Tighten the tool bar on the tube

(8) Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc (Fig. 3).

(9) Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.

(10) Remove the plug gauge and complete the inverted flare.

STANDARD PROCEDURE - ISO FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

To make a ISO flare use a Flaring Tool kit.

(1) Cut off damaged tube with Tubing Cutter.

(2) Remove any burrs from the inside of the tube.

(3) Install tube nut on the tube.

(4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 4). Then tighten the tool bar on the tube.

(5) Install the correct size adaptor on the flaring tool yoke screw.

(6) Lubricate the adaptor.

(7) Align the adaptor and yoke screw over the tube (Fig. 4).

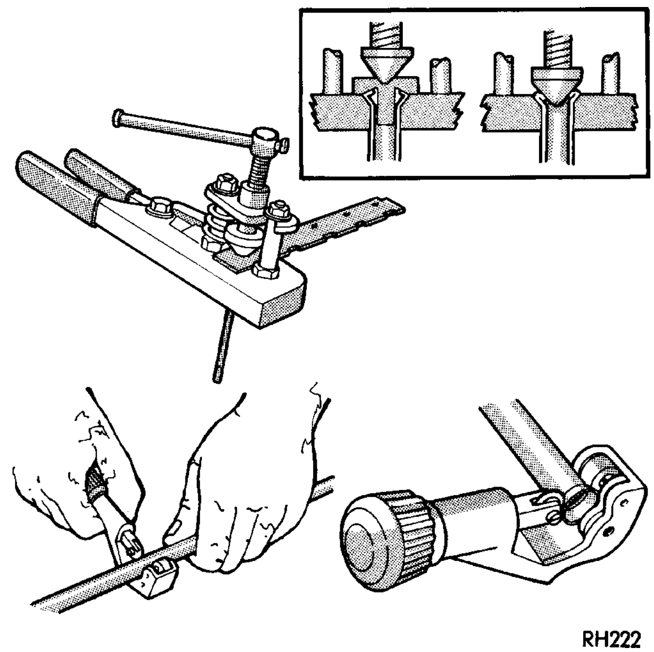


Fig. 3 Inverted Flare Tools

(8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

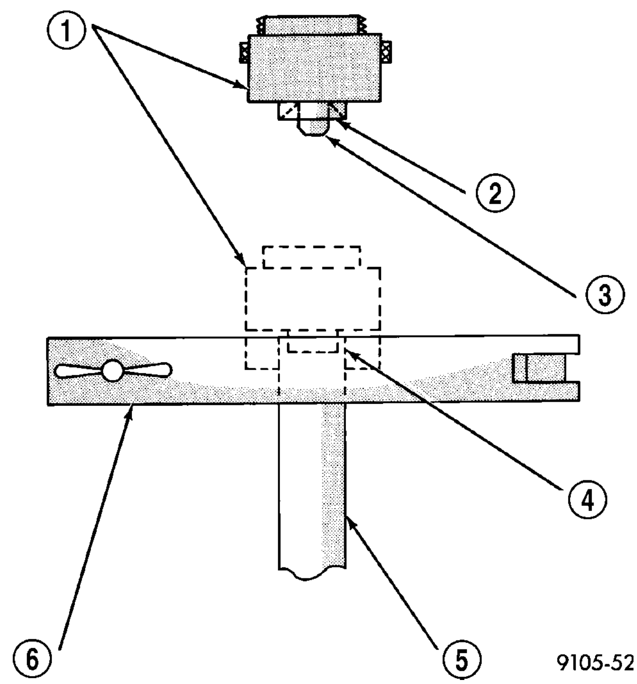


Fig. 4 ISO Flaring

1 - ADAPTER
2 - LUBRICATE HERE
3 - PILOT
4 - FLUSH WITH BAR
5 - TUBING
6 - BAR ASSEMBLY

DISC BRAKE CALIPERS

DESCRIPTION

The calipers are a single piston type. The calipers are free to slide laterally, this allows continuous compensation for lining wear.

OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal (Fig. 5).

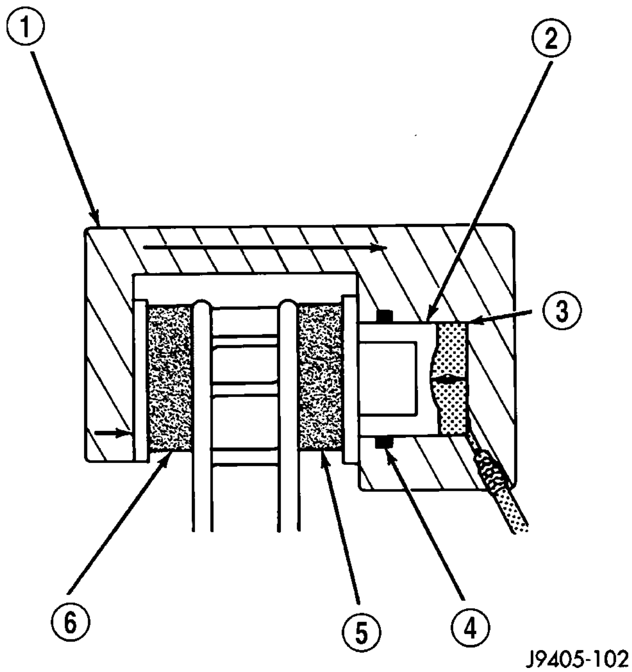


Fig. 5 Brake Caliper Operation

1 - CALIPER
2 - PISTON
3 - PISTON BORE
4 - SEAL
5 - INBOARD SHOE
6 - OUTBOARD SHOE

Fluid pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 6). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake shoe.

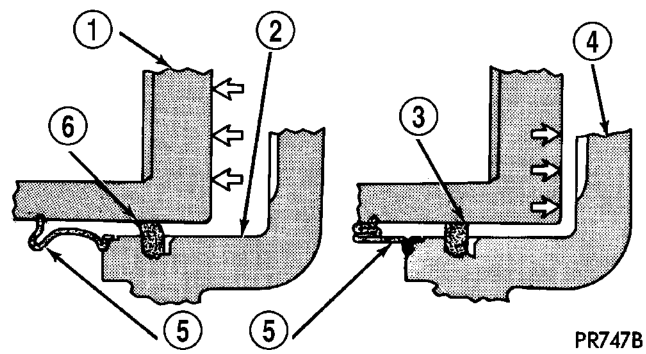


Fig. 6 Lining Wear Compensation By Piston Seal

1 - PISTON
2 - CYLINDER BORE
3 - PISTON SEAL BRAKE PRESSURE OFF
4 - CALIPER HOUSING
5 - DUST BOOT
6 - PISTON SEAL BRAKE PRESSURE ON

REMOVAL

REMOVAL - FRONT

(1) Raise and support vehicle.

(2) Remove front wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with suction gun.

(4) Bottom caliper piston in bore with C-clamp. Position clamp screw on outboard brake shoe and clamp frame on rear of caliper (Fig. 7). **Do not allow clamp screw to bear directly on outboard shoe retainer spring. Use wood or metal spacer between shoe and clamp screw.**

DISC BRAKE CALIPERS (Continued)

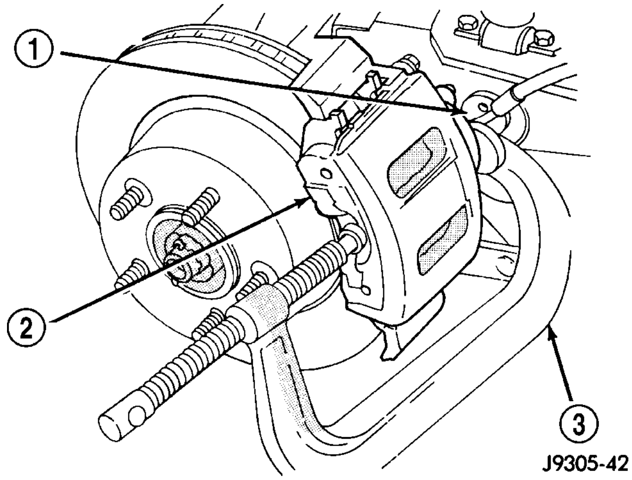


Fig. 7 Bottoming Caliper Piston With C-Clamp

1 - CALIPER BOSS
2 - OUTBOARD BRAKESHOE
3 - C-CLAMP

(5) Remove brake hose mounting bolt and discard washers (Fig. 8).

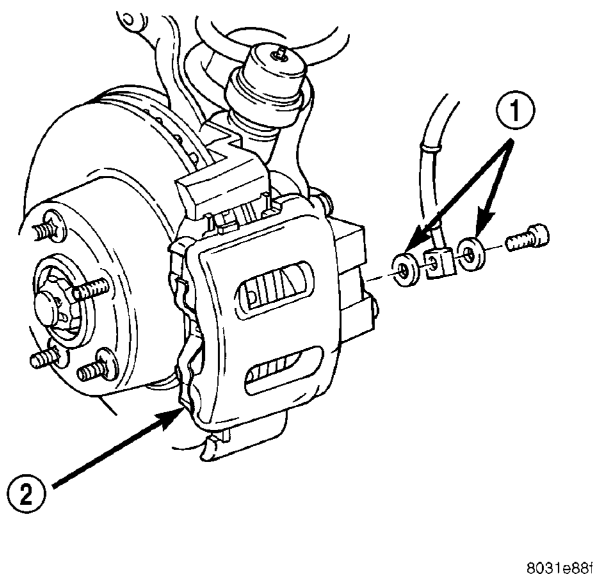


Fig. 8 Brake Hose And Bolt

1 - FITTING WASHERS
2 - CALIPERS

(6) Remove caliper mounting bolts (Fig. 9).
(7) Tilt top of caliper outward with pry tool if necessary (Fig. 10) and remove caliper.
(8) Remove caliper from vehicle.

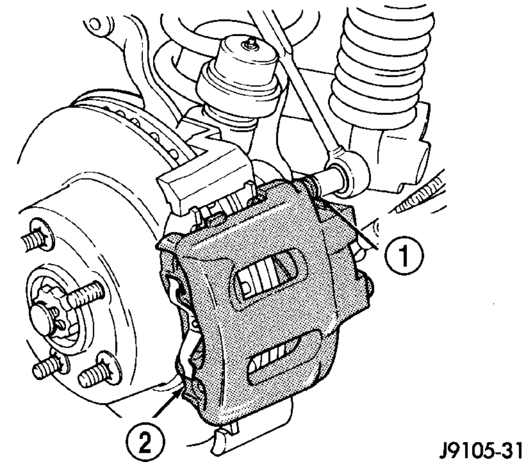


Fig. 9 Caliper Mounting Bolts

1 - CALIPER MOUNTING BOLT (2)
2 - CALIPER

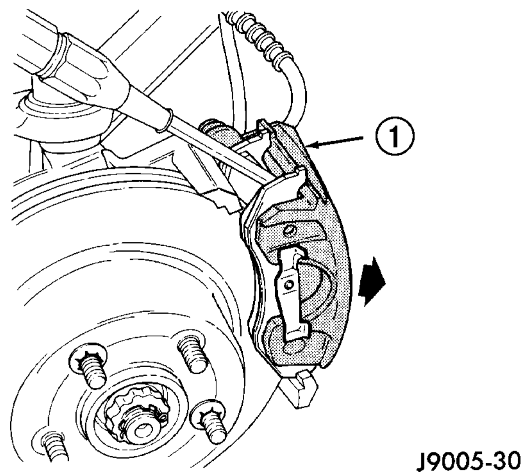


Fig. 10 Caliper Removal

1 - TILT CALIPER OUTBOARD TO REMOVE

REMOVAL - REAR

(1) Install prop rod on the brake pedal to keep pressure on the brake system.
(2) Raise and support vehicle.
(3) Remove the wheel and tire assembly.
(4) Remove the brake hose banjo bolt if replacing caliper.
(5) Remove the caliper mounting slide pin bolts (Fig. 11).
(6) Remove the caliper from vehicle.

DISC BRAKE CALIPERS (Continued)

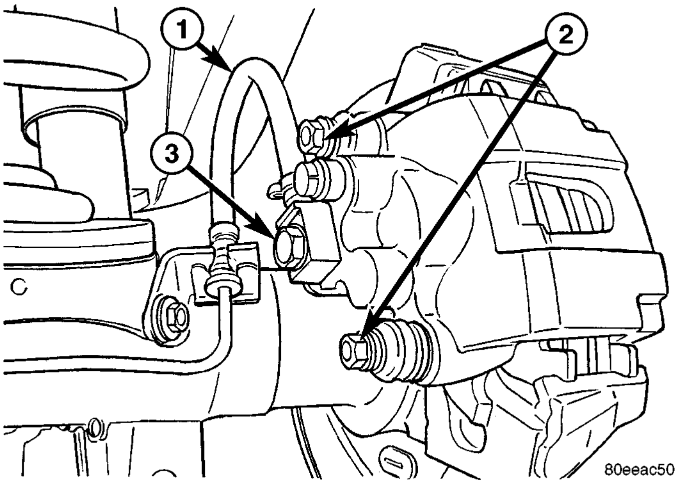


Fig. 11 CALIPER MOUNTING

1 - BRAKE HOSE
2 - CALIPER MOUNTING BOLTS
3 - BANJO BOLT

DISASSEMBLY

(1) Remove brake shoes from caliper.

(2) Drain brake fluid out of caliper.

(3) Take a piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the piston. This will cushion and protect caliper piston during removal (Fig. 12).

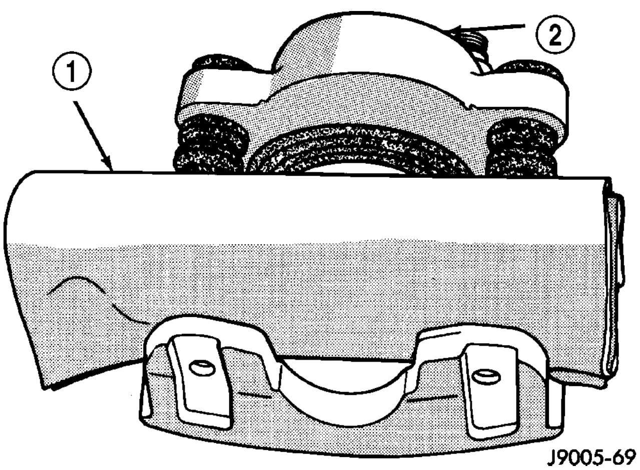


Fig. 12 Padding Caliper Interior

1 - SHOP TOWELS OR CLOTHS
2 - CALIPER

(4) Remove caliper piston with **short bursts** of low pressure compressed air. Direct air through fluid inlet port and ease piston out of bore (Fig. 13).

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS MAY RESULT IN PERSONAL INJURY.

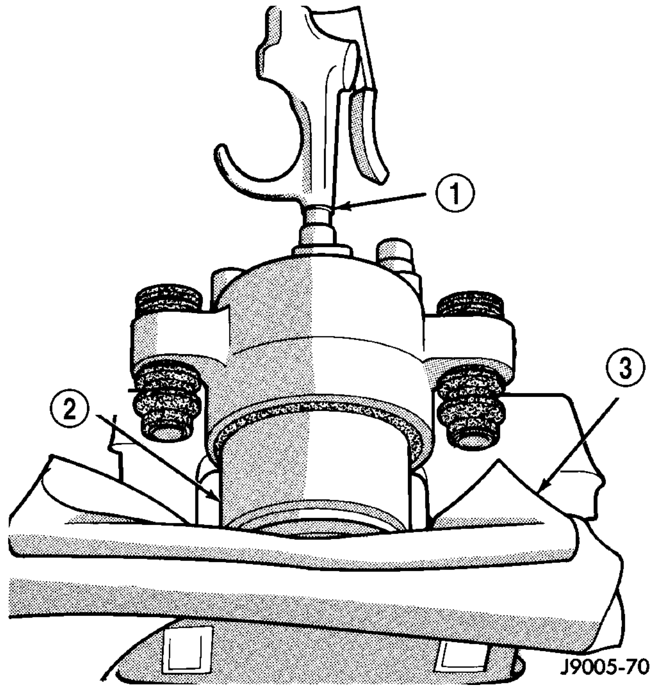


Fig. 13 Caliper Piston Removal

1 - AIR GUN
2 - CALIPER PISTON
3 - PADDING MATERIAL

(5) Remove caliper piston dust boot with suitable pry tool (Fig. 14).

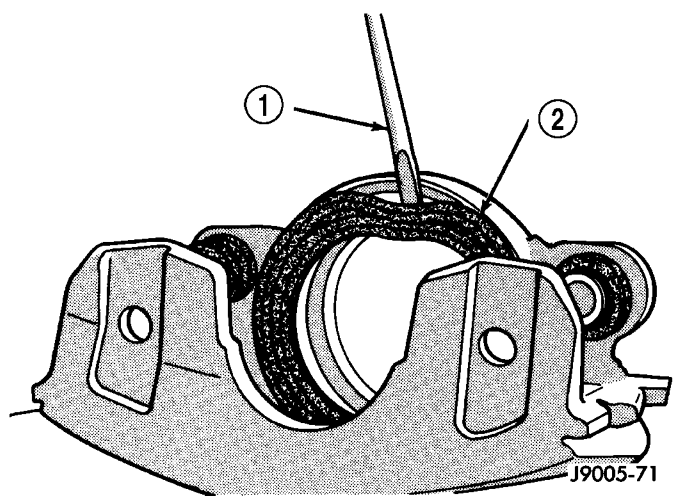


Fig. 14 Caliper

1 - COLLAPSE BOOT WITH PUNCH OR SCREWDRIVER
2 - PISTON DUST BOOT

(6) Remove caliper piston seal with wood or plastic tool (Fig. 15). Do not use metal tools as they will scratch piston bore.

DISC BRAKE CALIPERS (Continued)

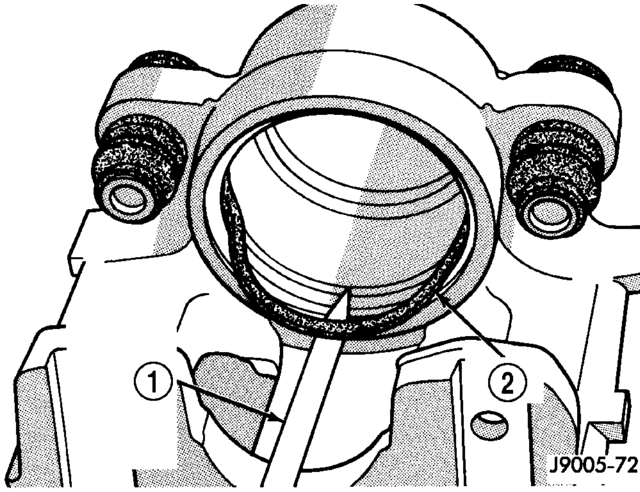


Fig. 15 Piston Seal Removal

1 - REMOVE SEAL WITH WOOD PENCIL OR SIMILAR TOOL
2 - PISTON SEAL

(7) Remove caliper mounting bolt bushings and boots (Fig. 16).

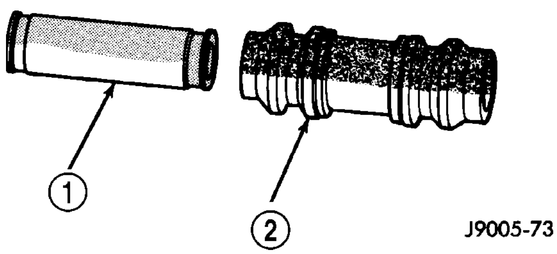


Fig. 16 Mounting Bolt Bushing And Boot

1 - CALIPER SLIDE BUSHING
2 - BOOT

CLEANING

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

CAUTION: Do not use gasoline, kerosene, paint thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.

INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 17). The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

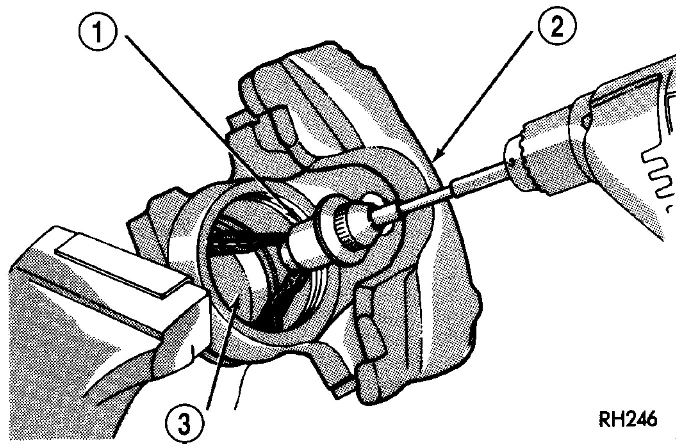


Fig. 17 Polishing Piston Bore

1 - SPECIAL HONE
2 - CALIPER
3 - PISTON BORE

ASSEMBLY

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

(1) Lubricate caliper piston bore, new piston seal and piston with clean brake fluid.

(2) Lubricate caliper bushings and interior of bushing boots with silicone grease.

DISC BRAKE CALIPERS (Continued)

(3) Install bushing boots in caliper, then insert bushing into boot and push bushing into place (Fig. 18).

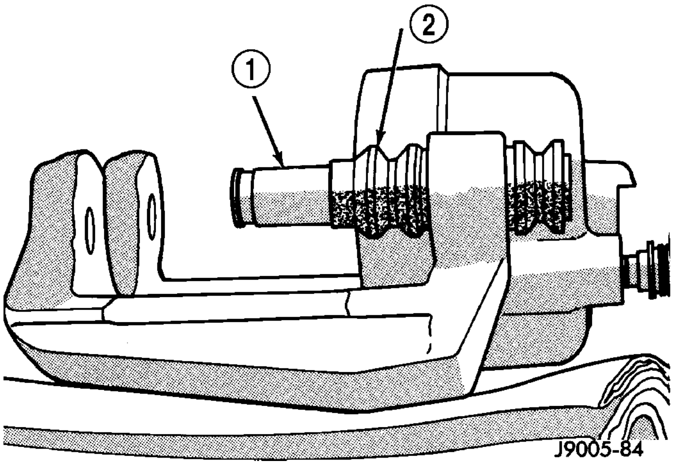


Fig. 18 Bushings And Boots Installation

1 - BUSHING
2 - BOOT

(4) Install new piston seal into seal groove with finger (Fig. 19).

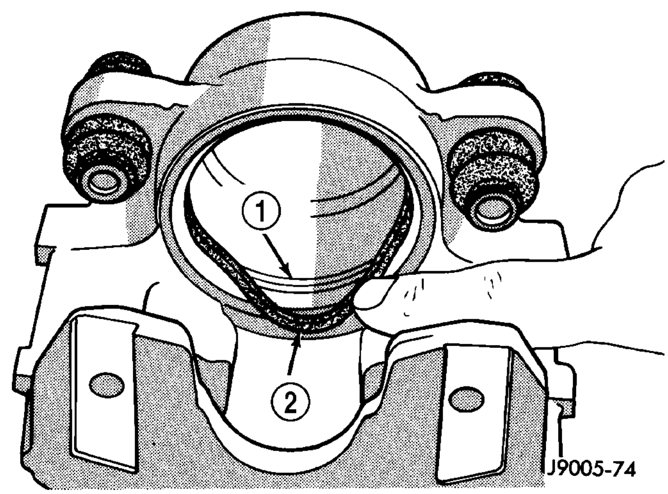


Fig. 19 Piston Seal Installation

1 - SEAL GROOVE
2 - PISTON SEAL

(5) Install new dust boot on caliper piston and seat boot in piston groove (Fig. 20).

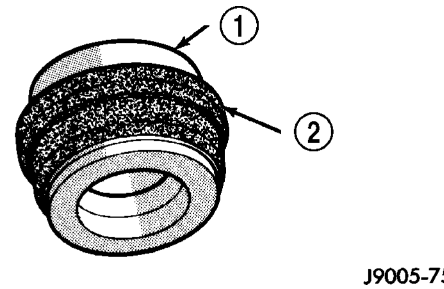


Fig. 20 Dust Boot On Piston

1 - PISTON
2 - DUST BOOT

(6) Press piston into caliper bore by hand, use a turn and push motion to work piston into seal (Fig. 21).

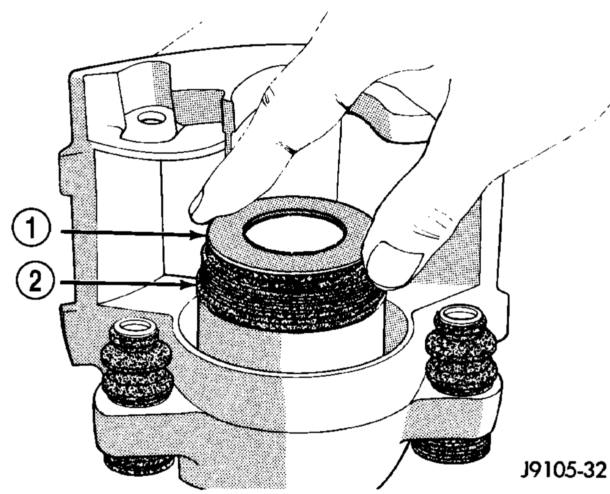


Fig. 21 Caliper Piston Installation

1 - PISTON
2 - BOOT

(7) Press caliper piston to bottom of bore.

(8) Seat dust boot in caliper with Installer Tool C-4842 and Tool Handle C-4171 (Fig. 22).

(9) Replace caliper bleed screw if removed.

DISC BRAKE CALIPERS (Continued)

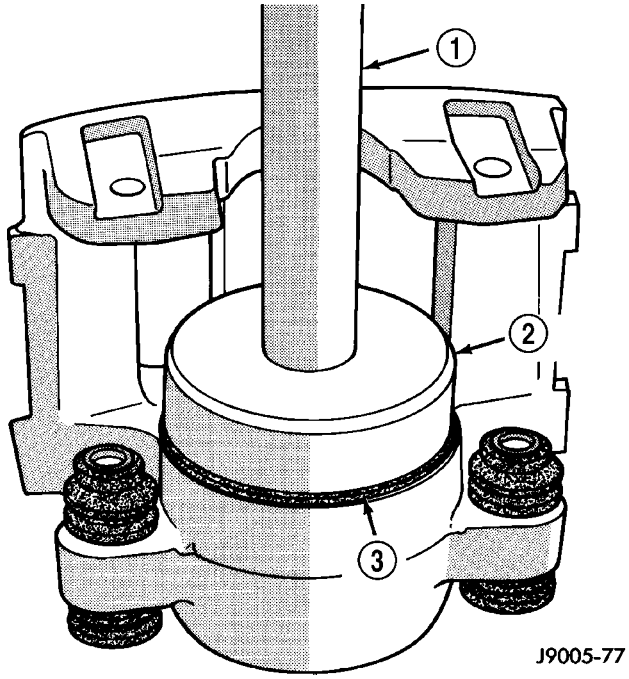


Fig. 22 Piston Dust Boot Installation

1 - HANDLE C-4171
2 - INSTALLER C-4842
3 - DUST BOOT

INSTALLATION

INSTALLATION - FRONT

(1) Clean brake shoe mounting ledges with wire brush and apply light coat of Mopar multi-mileage grease to surfaces (Fig. 23).

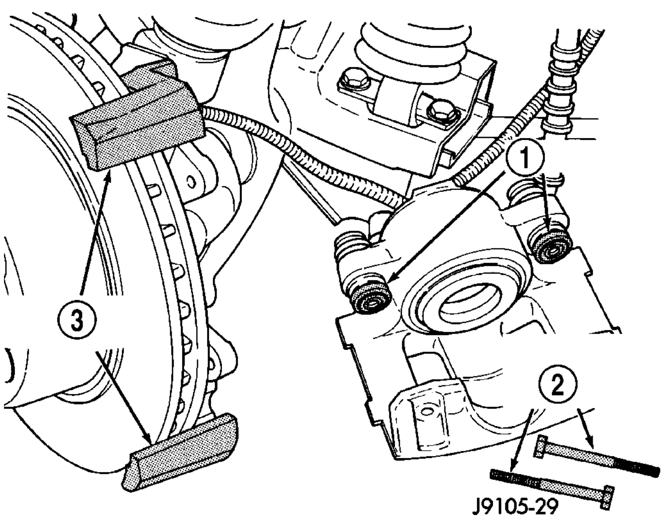


Fig. 23 Caliper Lubrication Points

1 - BUSHINGS
2 - CALIPER MOUNTING BOLTS
3 - MOUNTING LEDGES

(2) Install caliper by position notches at lower end of brake shoes on bottom mounting ledge. Then rotate caliper over rotor and seat notches at upper end of shoes on top mounting ledge (Fig. 24).

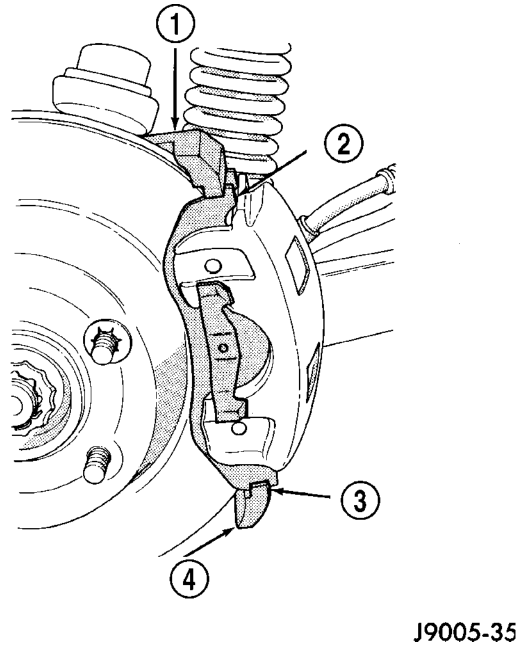


Fig. 24 Caliper Installation

1 - TOP LEDGE
2 - BRAKESHOE TAB ON LEDGE OUTER SURFACE
3 - LEDGE SEATED IN BRAKESHOE NOTCH
4 - BOTTOM LEDGE

(3) Coat caliper mounting bolts with silicone grease. Then install and tighten bolts to 15 N·m (11 ft. lbs.).

CAUTION: If new caliper bolts are being installed, or if the original reason for repair was a drag/pull condition, check caliper bolt length before proceeding. Bolts must not have a shank length greater than 67.6 mm (2.66 in.) (Fig. 25).

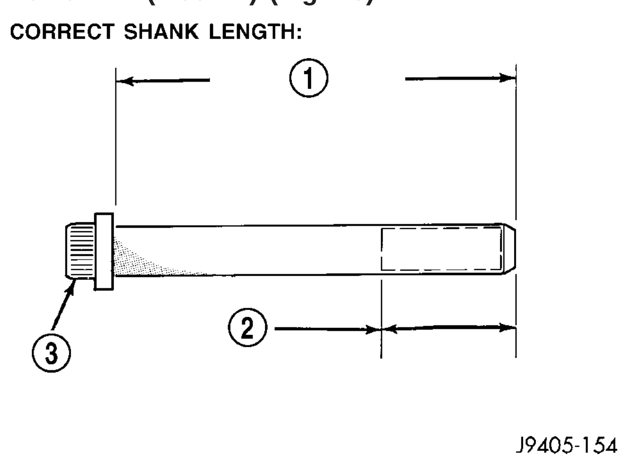


Fig. 25 Mounting Bolt Dimensions

1 - 67 mm (± 0.6 mm) 2.637 in. (± 0.0236 in.)
2 - 22 mm (0.866 in.) THREAD LENGTH
3 - CALIPER BOLT

DISC BRAKE CALIPERS (Continued)

(4) Install brake hose to caliper with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.

(5) Bleed base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).
(6) Install wheel and tire assemblies. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
(7) Remove supports and lower vehicle.
(8) Verify firm pedal before moving vehicle.

INSTALLATION - REAR

(1) Install the brake pads if removed.
(2) Lubricate ant-rattle clips for the disc brake pads (Fig. 26).

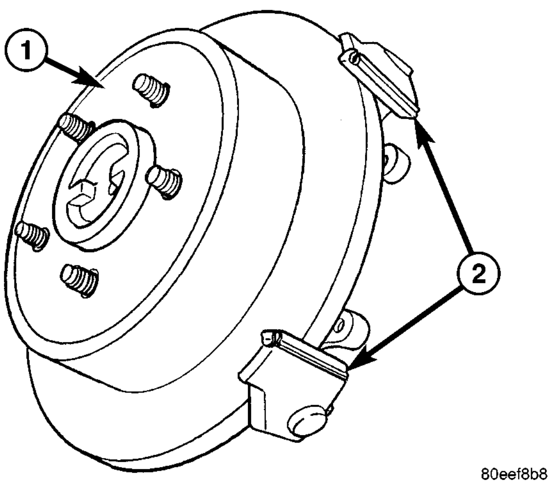


Fig. 26 ANTI-RATTLE CLIPS

1 - ROTOR
2 - ANTI-RATTLE CLIPS

(3) Install caliper to the caliper adapter.
(4) Coat the caliper mounting slide pin bolts with silicone grease. Then install and tighten the bolts to 15 N·m (11 ft. lbs.).
(5) Install the brake hose banjo bolt if removed (Fig. 27).
(6) Install the brake hose to the caliper with **new seal washers** and tighten fitting bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.

(7) Remove the prop rod from the vehicle.
(8) Bleed the base brake system, (Refer to 5 - BRAKES - STANDARD PROCEDURE) OR (Refer to 5 - BRAKES - STANDARD PROCEDURE).

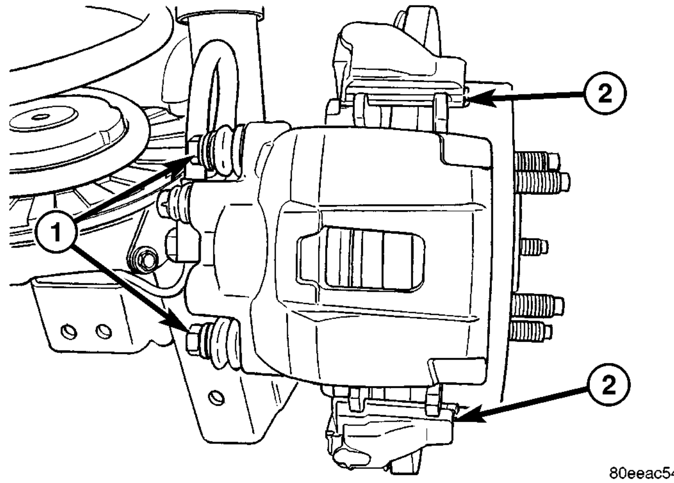


Fig. 27 CALIPER INSTALLED

1 - CALIPER MOUNTING BOLTS
2 - CALIPER SLIDES

(9) Install the wheel and tire assemblies (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
(10) Remove the supports and lower the vehicle.
(11) Verify a firm pedal before moving the vehicle.

BRAKE PADS/SHOES

REMOVAL

REMOVAL - FRONT PADS

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
(4) Pressing one end of outboard shoe inward to disengage shoe lug. Then rotate shoe upward until retainer spring clears caliper. Press opposite end of shoe inward to disengage shoe lug and rotate shoe up and out of caliper (Fig. 28).
(5) Grasp ends of inboard shoe and tilt shoe outward to release springs from caliper piston (Fig. 29) and remove shoe from caliper.

NOTE: If original brake shoes will be used, keep them in sets left and right. They are not interchangeable.

(6) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**
(7) Wipe caliper off with shop rags or towels.

BRAKE PADS/SHOES (Continued)

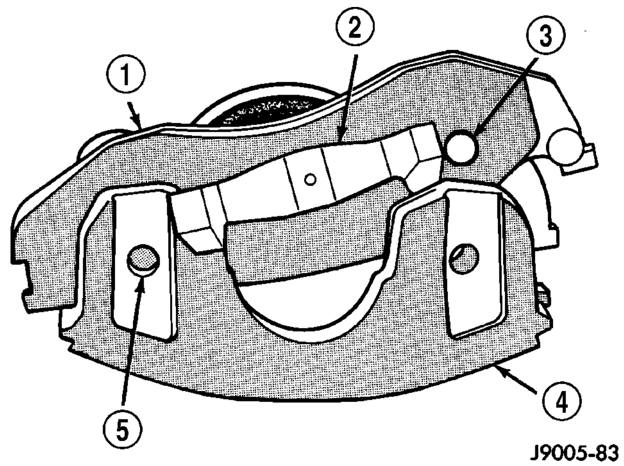


Fig. 28 Outboard Brake Shoe Removal

1 - OUTBOARD BRAKESHOE
2 - SHOE SPRING
3 - LOCATING LUG
4 - CALIPER
5 - LOCATING LUG

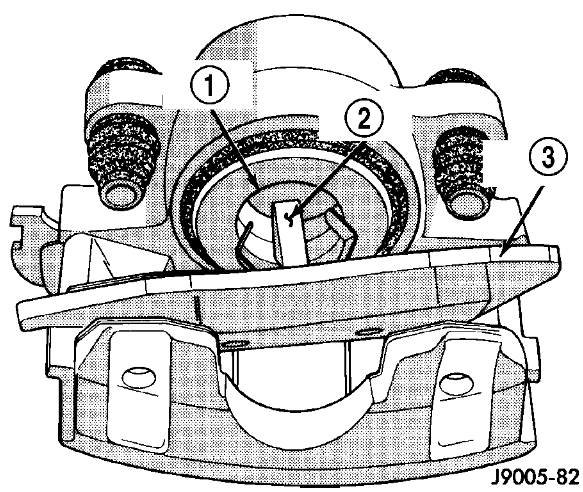


Fig. 29 Inboard Brake

1 - CALIPER PISTON
2 - SHOE SPRINGS
3 - INBOARD BRAKESHOE

CAUTION: Do not use compressed air, this can unseat dust boot and force dirt into piston bore.

REMOVAL - DRUM BRAKE SHOES

(1) Raise vehicle and remove rear wheels.

(2) Remove and discard spring nuts securing drums to wheel studs.

(3) Remove brake drums.

NOTE: If drums are difficult to remove, back off adjuster through support plate access hole with brake tool and screwdriver.

(4) Remove U-clip and washer securing adjuster cable to parking brake lever (Fig. 30).

(5) Remove primary and secondary return springs from anchor pin with brake spring pliers.

(6) Remove hold-down springs, retainers and pins with standard retaining spring tool.

(7) Install spring clamps on wheel cylinders to hold pistons in place.

(8) Remove adjuster lever, adjuster screw and spring.

(9) Remove adjuster cable and cable guide.

(10) Remove brake shoes and parking brake strut.

(11) Disconnect cable from parking brake lever and remove lever.

REMOVAL - REAR DISC BRAKE PADS

(1) Raise and support vehicle.

(2) Remove the wheel and tire assemblies.

(3) Compress the caliper.

(4) Remove the caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

(5) Remove the caliper by tilting the top up and off the caliper adapter.

NOTE: Do not allow brake hose to support caliper assembly.

(6) Support and hang the caliper.

(7) Remove the inboard brake pad from the caliper adapter.

(8) Remove the outboard brake pad from the caliper adapter.

INSTALLATION

INSTALLATION - FRONT PADS

(1) Install inboard shoe in caliper and verify shoe retaining is fully seated into the piston.

(2) Starting one end of outboard shoe in caliper and rotating shoe downward into place. Verify shoe locating lugs and shoe spring are seated.

(3) Install caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(4) Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(5) Remove support and lower vehicle.

(6) Pump brake pedal until caliper pistons and brake shoes are seated.

(7) Top off brake fluid level if necessary.

INSTALLATION - DRUM BRAKE SHOES

(1) Clean support plate with brake cleaner.

BRAKE PADS/SHOES (Continued)

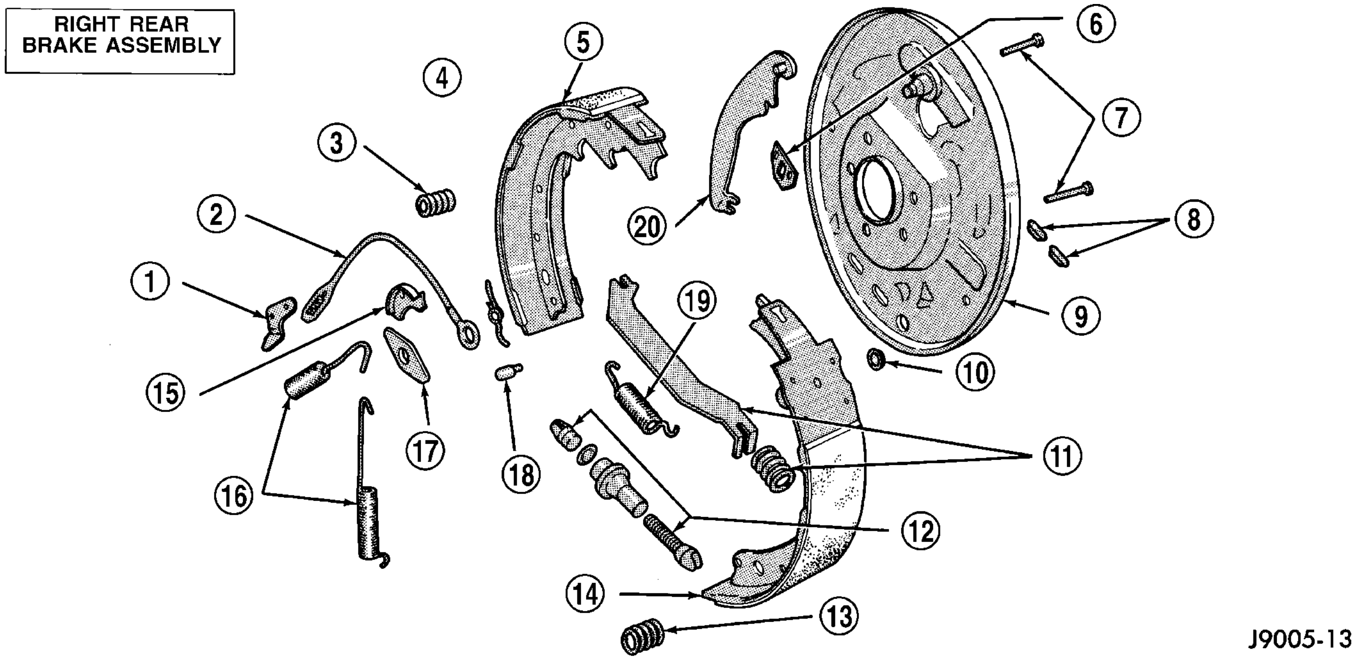


Fig. 30 Drum Brake Components—Typical

1 - ADJUSTER LEVER
2 - ADJUSTER CABLE
3 - HOLDDOWN SPRING AND RETAINERS
4 - ADJUSTER LEVER SPRING
5 - TRAILING SHOE
6 - CYLINDER-TO-SUPPORT SEAL
7 - HOLDDOWN PINS
8 - ACCESS PLUGS
9 - SUPPORT PLATE
10 - CABLE HOLE PLUG
11 - PARK BRAKE STRUT AND SPRING
12 - ADJUSTER SCREW ASSEMBLY
13 - HOLDDOWN SPRING AND RETAINERS
14 - LEADING SHOE
15 - CABLE GUIDE
16 - SHOE RETURN SPRINGS
17 - SHOE GUIDE PLATE
18 - PIN
19 - SHOE SPRING
20 - PARK BRAKE LEVER

(2) If new drums are being installed, remove protective coating with carburetor cleaner or brake cleaner.

(3) Apply multi-purpose grease to brake shoe contact surfaces of support plate (Fig. 31).

(4) Lubricate adjuster screw threads and pivot with spray lube.

(5) Attach parking brake lever to secondary brake shoe. Use new washer and U-clip to secure lever.

(6) Remove wheel cylinder clamps.

(7) Attach parking brake cable to lever.

(8) Install brake shoes on support plate. Secure shoes with new hold-down springs, pins and retainers.

(9) Install parking brake strut and spring.

(10) Install guide plate and adjuster cable on anchor pin.

(11) Install primary and secondary return springs.

(12) Install adjuster cable guide on secondary shoe.

(13) Lubricate and assemble adjuster screw.

(14) Install adjuster screw, spring and lever and connect to adjuster cable.

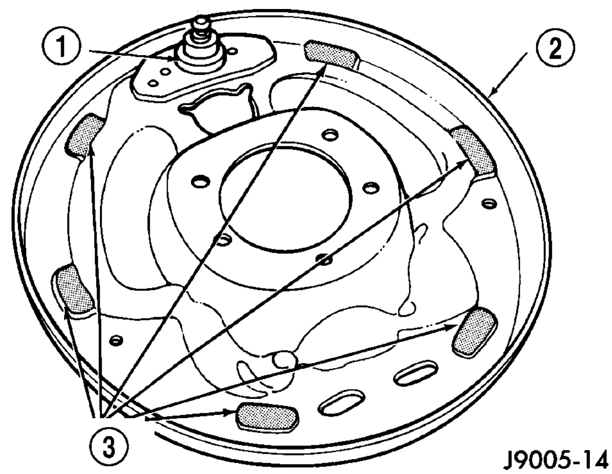


Fig. 31 Shoe Contact Surfaces

1 - ANCHOR PIN
2 - SUPPORT PLATE
3 - SHOE CONTACT SURFACES

(15) Adjust shoes to drum. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DRUM - ADJUSTMENTS).

BRAKE PADS/SHOES (Continued)

(16) Install wheel/tire assemblies and lower vehicle. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(17) Verify firm brake pedal before moving vehicle.

INSTALLATION - REAR DISC BRAKE PADS

(1) Bottom pistons in caliper bore with C-clamp. Place an old brake shoe between a C-clamp and caliper piston.

(2) Clean caliper mounting adapter and anti-rattle springs.

(3) Lubricate anti-rattle springs with Mopar brake grease.

(4) Install anti-rattle springs.

NOTE: Anti-rattle springs are not interchangeable.

(5) Install inboard brake pad in adapter.

(6) Install outboard brake pad in adapter.

(7) Tilt the top of the caliper over rotor and under adapter. Then push the bottom of the caliper down onto the adapter.

(8) Install caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(9) Install wheel and tire assemblies and lower vehicle, (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(10) Apply brakes several times to seat caliper pistons and brake shoes and obtain firm pedal.

(11) Top off master cylinder fluid level.

DRUM

DESCRIPTION

The brake systems use a leading shoe (primary) and trailing shoe (secondary). The mounting hardware is similar but not interchangeable (Fig. 30).

OPERATION

When the brake pedal is depressed hydraulic pressure pushes the rear brake wheel cylinder pistons outward. The wheel cylinder push rods then push the brake shoes outward against the brake drum. When the brake pedal is released return springs attached to the brake shoes pull the shoes back to there original position. (Fig. 30)

DIAGNOSIS AND TESTING - BRAKE DRUM RUNOUT

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Generally, a drum can be machined to a maximum of 1.52 mm (0.060 in.) oversize. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Variations in drum diameter should not exceed 0.069 mm (0.0028 in.). Drum runout should not exceed 0.18 mm (0.007 in.) out of round. Machine the drum if runout or variation exceed these values. Replace the drum if machining causes the drum to exceed the maximum allowable diameter.

STANDARD PROCEDURE - BRAKE DRUM MACHINING

The brake drums can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum outer edge.

CAUTION: Replace the drum if machining will cause the drum to exceed the maximum allowable diameter.

CLEANING

Clean the individual brake components, including the support plate and wheel cylinder exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION

As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

DRUM (Continued)

Inspect the adjuster screw assembly. Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

Discard the brake springs and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted (Fig. 32).

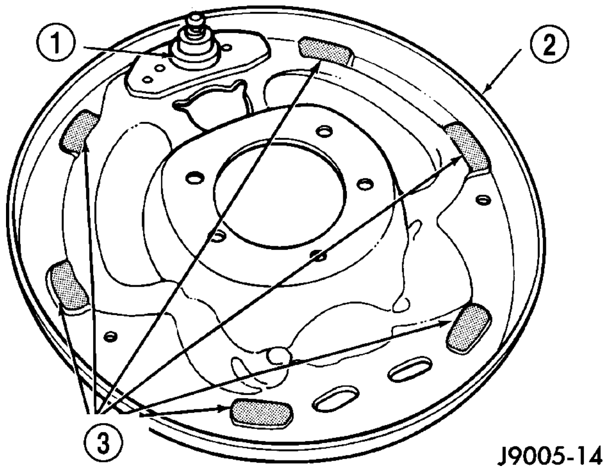


Fig. 32 Shoe Contact Surfaces

1 - ANCHOR PIN
2 - SUPPORT PLATE
3 - SHOE CONTACT SURFACES

ADJUSTMENTS - REAR DRUM BRAKE

The rear drum brakes are equipped with a self-adjusting mechanism. Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both drums are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

ADJUSTMENT WITH BRAKE GAUGE

(1) Be sure parking brakes are fully released.

(2) Raise rear of vehicle and remove wheels and brake drums.

(3) Verify that left and right automatic adjuster levers and cables are properly connected.

(4) Insert brake gauge in drum. Expand gauge until gauge inner legs contact drum braking surface. Then lock gauge in position (Fig. 33).

(5) Reverse gauge and install it on brake shoes. Position gauge legs at shoe centers as shown (Fig. 34). If gauge does not fit (too loose/too tight), adjust shoes.

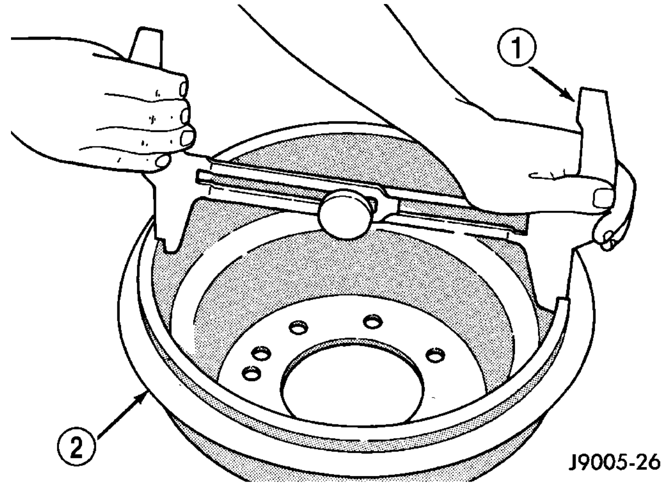


Fig. 33 Adjusting Gauge On Drum

1 - BRAKE GAUGE
2 - BRAKE DRUM

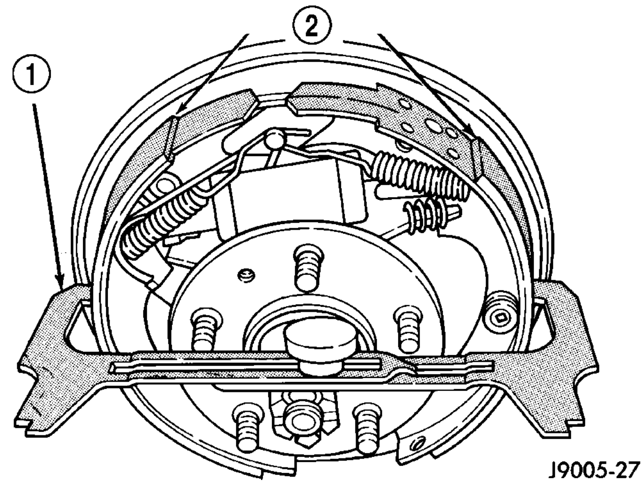


Fig. 34 Adjusting Gauge On Brake Shoes

1 - BRAKE GAUGE
2 - BRAKE SHOES

(6) Pull shoe adjuster lever away from adjuster screw star wheel.

(7) Turn adjuster screw star wheel (by hand) to expand or retract brake shoes. Continue adjustment until gauge outside legs are light drag-fit on shoes.

(8) Install brake drums and wheels and lower vehicle.

(9) Drive vehicle and make one forward stop followed by one reverse stop. Repeat procedure 8-10 times to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

DRUM (Continued)

ADJUSTMENT WITH ADJUSTING TOOL

(1) Be sure parking brake lever is fully released.

(2) Raise vehicle so rear wheels can be rotated freely.

(3) Remove plug from each access hole in brake support plates.

(4) Loosen parking brake cable adjustment nut until there is slack in front cable.

(5) Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel (Fig. 35).

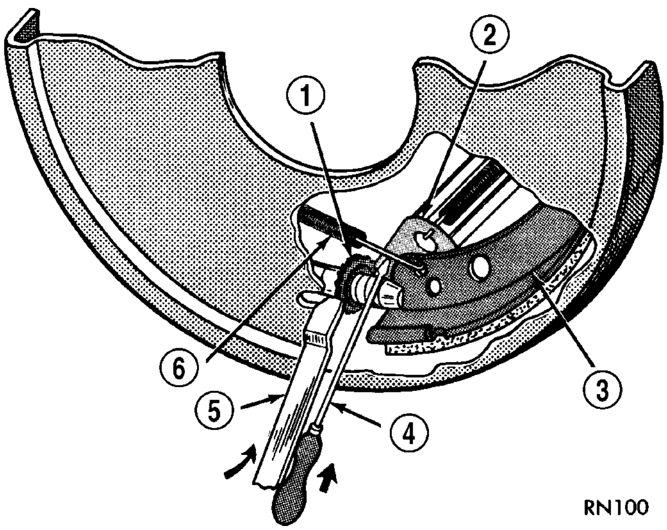


Fig. 35 Brake Adjustment

1 - STAR WHEEL
2 - LEVER
3 - BRAKE SHOE WEB
4 - SCREWDRIVER
5 - ADJUSTING TOOL
6 - ADJUSTER SPRING

(6) Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.

(7) Push and hold adjuster lever away from star wheel with thin screwdriver.

(8) Back off adjuster screw star wheel until brake drag is eliminated.

(9) Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.

(10) Install support plate access hole plugs.

(11) Adjust parking brake cable and lower vehicle.

(12) Drive vehicle and make one forward stop followed by one reverse stop. Repeat procedure 8-10 times to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

FLUID

DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

STANDARD PROCEDURE - BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and caps before checking fluid level. If not cleaned, dirt could enter the fluid.

The fluid fill level is indicated on the side of the master cylinder reservoir (Fig. 36).

The correct fluid level is to the FULL indicator on the side of the reservoir. If necessary, add fluid to the proper level.

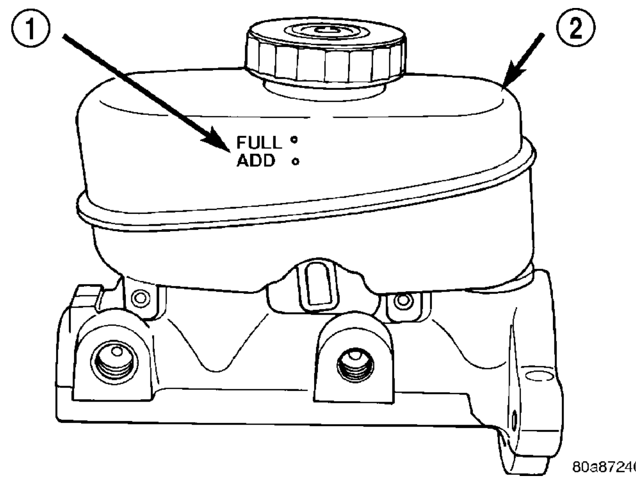


Fig. 36 Master Cylinder Fluid

1 - INDICATOR
2 - RESERVOIR

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use

FLUID (Continued)

only Mopar brake fluid or an equivalent from a tightly sealed container.

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

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

FLUID RESERVOIR

REMOVAL

(1) Remove reservoir cap and empty fluid into drain container.

(2) Remove pins that retain reservoir to master cylinder. Use hammer and pin punch to remove pins (Fig. 37).

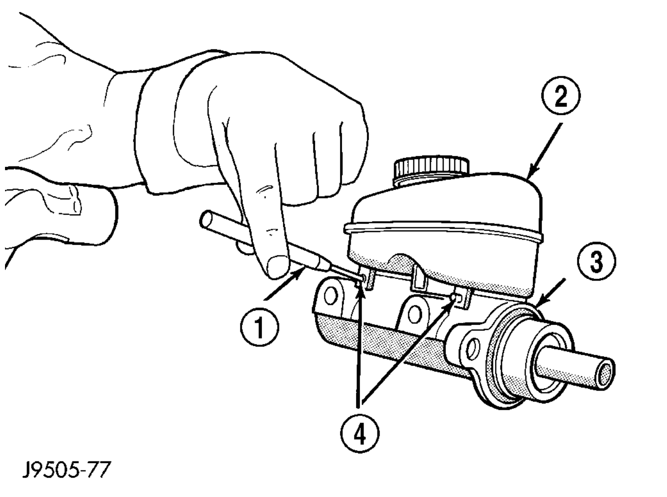


Fig. 37 Reservoir Retaining Pins

1 - PIN PUNCH
2 - RESERVOIR
3 - BODY
4 - ROLL PINS

(3) Clamp cylinder body in vise with brass protective jaws.

(4) Loosen reservoir from grommets with pry tool (Fig. 38).

(5) Remove reservoir by rocking it to one side and pulling free of grommets (Fig. 39).

(6) Remove old grommets from cylinder body (Fig. 40).

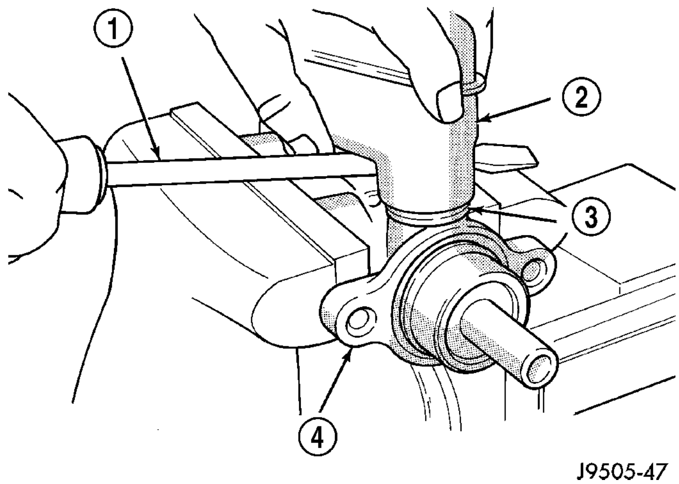


Fig. 38 Loosening Reservoir

1 - PRY TOOL
2 - RESERVOIR
3 - GROMMET
4 - MASTER CYLINDER BODY

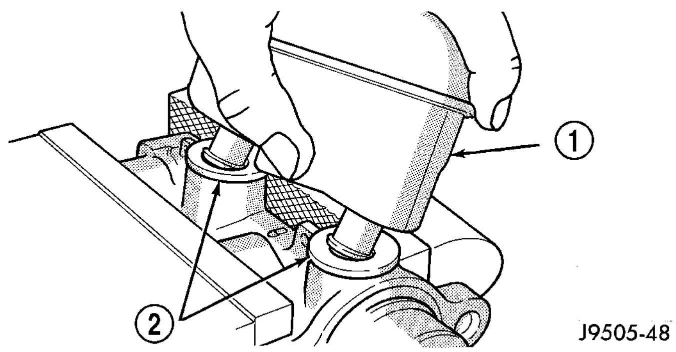


Fig. 39 Reservoir Removal

1 - RESERVOIR
2 - GROMMETS

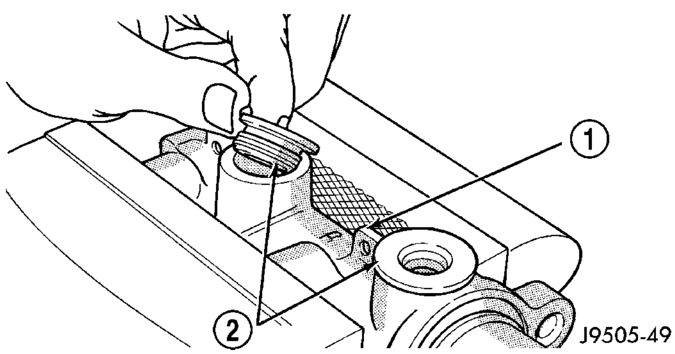


Fig. 40 Grommet Removal

1 - MASTER CYLINDER BODY
2 - GROMMETS

FLUID RESERVOIR (Continued)

INSTALLATION

CAUTION: Do not use any type of tool to install the grommets. Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.

(1) Lubricate new grommets with clean brake fluid and Install new grommets in cylinder body (Fig. 41). Use finger pressure to install and seat grommets.

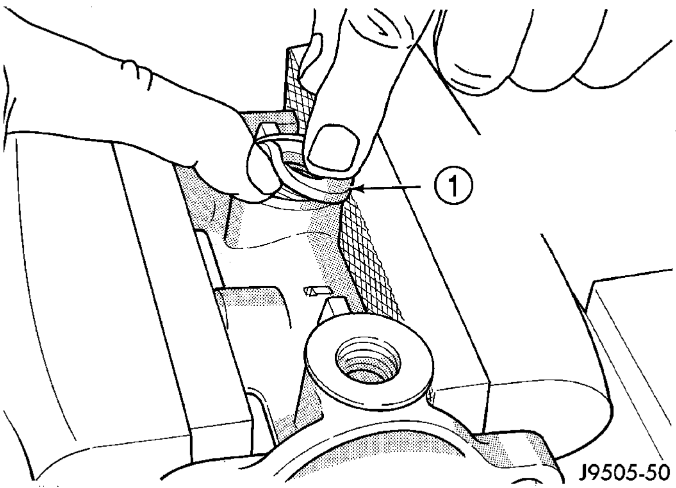


Fig. 41 Grommet Installation

1 - WORK NEW GROMMETS INTO PLACE USING FINGER PRESSURE ONLY

(2) Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.

(3) Install pins that retain reservoir to cylinder body.

(4) Fill and bleed master cylinder on bench before installation in vehicle.

MASTER CYLINDER

DESCRIPTION

The master cylinder has a removable nylon reservoir. The cylinder body is made of aluminum and contains a primary and secondary piston assembly. The cylinder body including the piston assemblies are not serviceable. If diagnosis indicates an internal problem with the cylinder body, it must be replaced as an assembly. The reservoir and grommets are the only replaceable parts on the master cylinder.

OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes. The master cylinder reservoir stores reserve brake fluid for the hydraulic brake circuits.

DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

(1) Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).

(5) Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.

(6) If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 42).

(2) Start and run engine at curb idle speed for one minute.

(3) Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

(4) Clamp hose shut between vacuum source and check valve.

(5) Stop engine and observe vacuum gauge.

(6) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and valve seal from booster.

(3) Use a hand operated vacuum pump for test.

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 43).

(5) Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

MASTER CYLINDER (Continued)

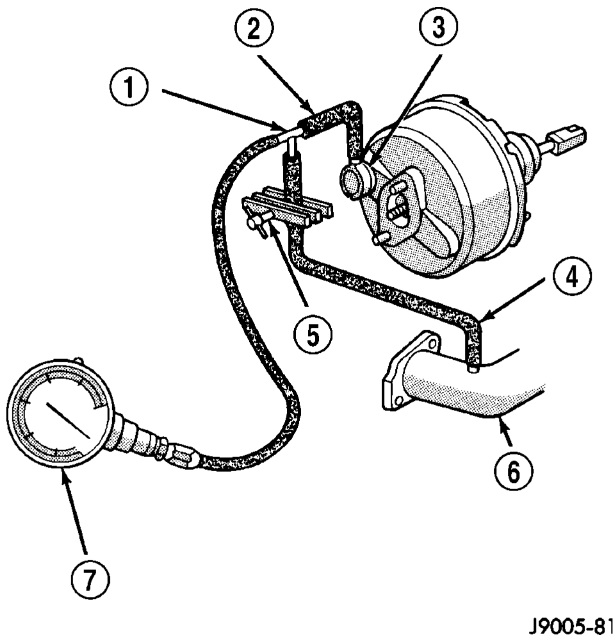


Fig. 42 Typical Booster Vacuum Test Connections

1 - TEE FITTING
2 - SHORT CONNECTING HOSE
3 - CHECK VALVE
4 - CHECK VALVE HOSE
5 - CLAMP TOOL
6 - INTAKE MANIFOLD
7 - VACUUM GAUGE

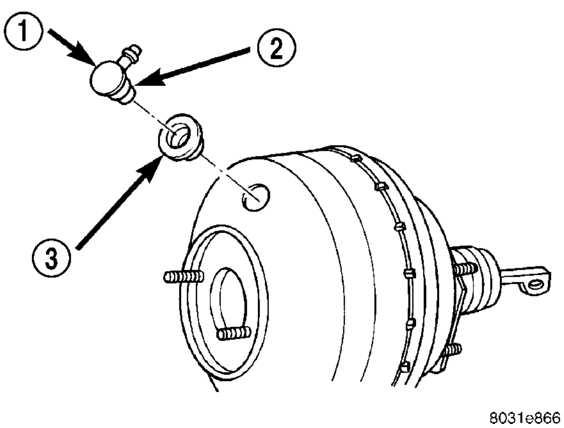


Fig. 43 Vacuum Check Valve And Seal

1 - BOOSTER CHECK VALVE
2 - APPLY TEST VACUUM HERE
3 - VALVE SEAL

STANDARD PROCEDURE - MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

(1) Mount master cylinder in vise.

(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into the reservoir (Fig. 44).

(3) Fill reservoir with fresh brake fluid.

(4) Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.

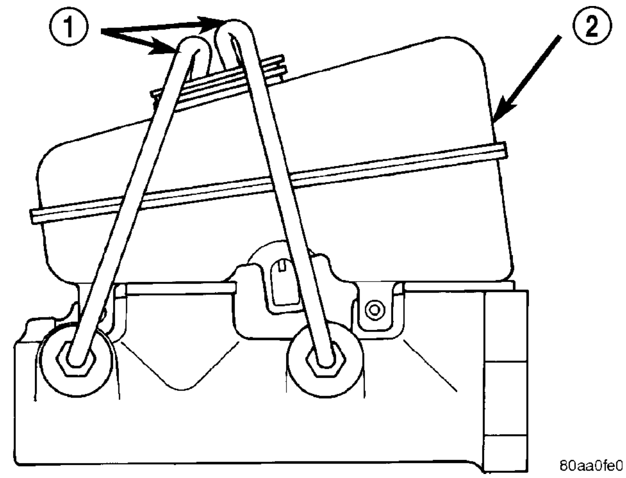


Fig. 44 Master Cylinder Bleeding

1 - BLEEDING TUBES
2 - RESERVOIR

REMOVAL

(1) Remove evaporative canister.

(2) Disconnect brake lines to master cylinder and combination valve (Fig. 45).

(3) Remove combination valve bracket mounting nuts and remove valve.

(4) Remove master cylinder mounting nuts and remove master cylinder.

(5) Remove cylinder cover and drain fluid.

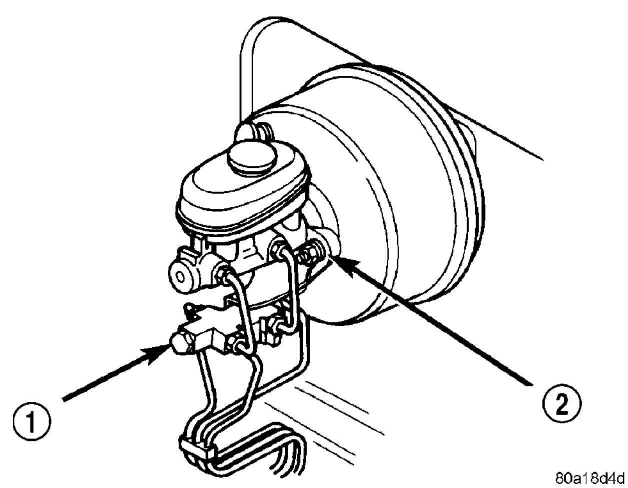


Fig. 45 Master

1 - COMBINATION VALVE
2 - MASTER CYLINDER

MASTER CYLINDER (Continued)

INSTALLATION

NOTE: If master cylinder is replaced, bleed cylinder before installation.

(1) Remove protective sleeve from primary piston shank on new master cylinder.

(2) Check condition of seal at rear of cylinder body. Reposition seal if dislodged. Replace seal if cut, or torn.

(3) Install master cylinder onto brake booster studs and tighten mounting nuts to 17 N·m (13 ft. lbs.).

NOTE: Use only original or factory replacement nuts.

(4) Install combination valve onto brake booster studs and tighten mounting nuts to 20 N·m (15 ft. lbs.).

(5) Install brake lines to master cylinder and combination valve by hand to avoid cross threading.

(6) Tighten master cylinder brake lines to 19 N·m (14 ft. lbs.).

(7) Tighten combination valve brake lines to 19 N·m (14 ft. lbs.).

(8) Install evaporative canister.

(9) Bleed base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

PEDAL

DESCRIPTION

A suspended-type brake pedal is used, the pedal pivots on a shaft mounted in the pedal support bracket. The bracket is attached to the dash panel.

The brake pedal assembly and pedal pad are the only serviceable component.

OPERATION

The brake pedal is attached to the booster push rod. When the pedal is depressed, the primary booster push rod is depressed which moves the booster secondary rod. The booster secondary rod depresses the master cylinder piston.

REMOVAL

(1) Remove negative battery cable.

(2) Remove brake lamp switch.

(3) Remove ABS controller if equipped.

(4) Remove retainer clip securing booster push rod to pedal (Fig. 46) and clutch rod retainer clip if equipped.

(5) Remove bolts from brake pedal support and booster mounting nuts. Remove mounting stud plate nuts or clutch cylinder mounting nuts if equipped.

(6) Slid brake booster/master cylinder assembly forward.

(7) Remove mounting stud plate or slid clutch cylinder forward if equipped.

(8) Tilt the pedal support down to gain shaft clearance.

(9) Remove pedal shaft C–clip from passenger side of the shaft.

(10) Slide the pedal shaft toward the drivers side and remove the remaining C-clip.

(11) Slid the shaft out of the pedal bracket and remove the pedal.

(12) Remove pedal bushings if they are to be replaced.

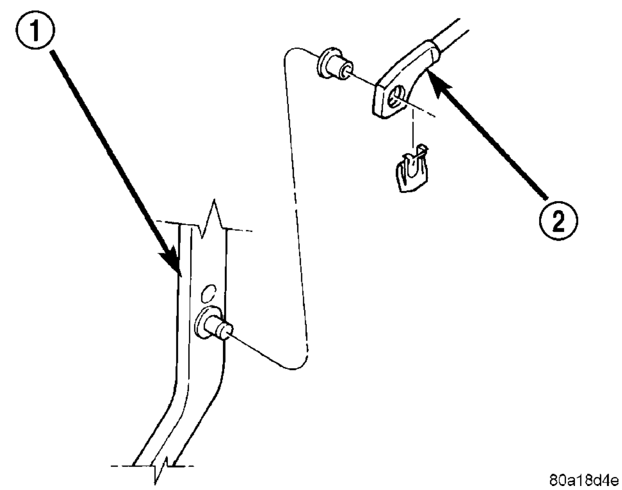


Fig. 46 Push Rod Attachment

1 - BRAKE PEDAL
2 - BOOSTER ROD

INSTALLATION

(1) Install new bushings in pedal. Lubricate bushings and shaft with multi-purpose grease.

(2) Position pedal in bracket and install shaft.

(3) Install new pivot pin C-clip.

(4) Position pedal support and install support bolts and tighten to 28 N·m (21 ft. lbs.).

(5) Slid the booster/master cylinder assembly into place, install mounting nuts and tighten to 39 N·m (29 ft. lbs.).

(6) Install stud plate or clutch cylinder if equipped and tighten mounting nut to 28 N·m (21 ft. lbs.).

Install retainer clip securing booster push rod to pedal (Fig. 46) and clutch rod retainer clip if equipped.

(7) Install ABS controller if equipped.

(8) Install and connect brake lamp switch.

(9) Install negative battery cable.

POWER BRAKE BOOSTER

DESCRIPTION

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms. The outer edge of each diaphragm is attached to the booster housing.

Two push rods are used in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

OPERATION

The atmospheric inlet valve is opened and closed by the primary push rod. Booster vacuum supply is through a hose attached to an intake manifold fitting at one end and to the booster check valve at the other. The vacuum check valve in the booster housing is a one-way device that prevents vacuum leak back.

Power assist is generated by utilizing the pressure differential between normal atmospheric pressure and a vacuum. The vacuum needed for booster operation is taken directly from the engine intake manifold. The entry point for atmospheric pressure is through a filter and inlet valve at the rear of the housing (Fig. 47).

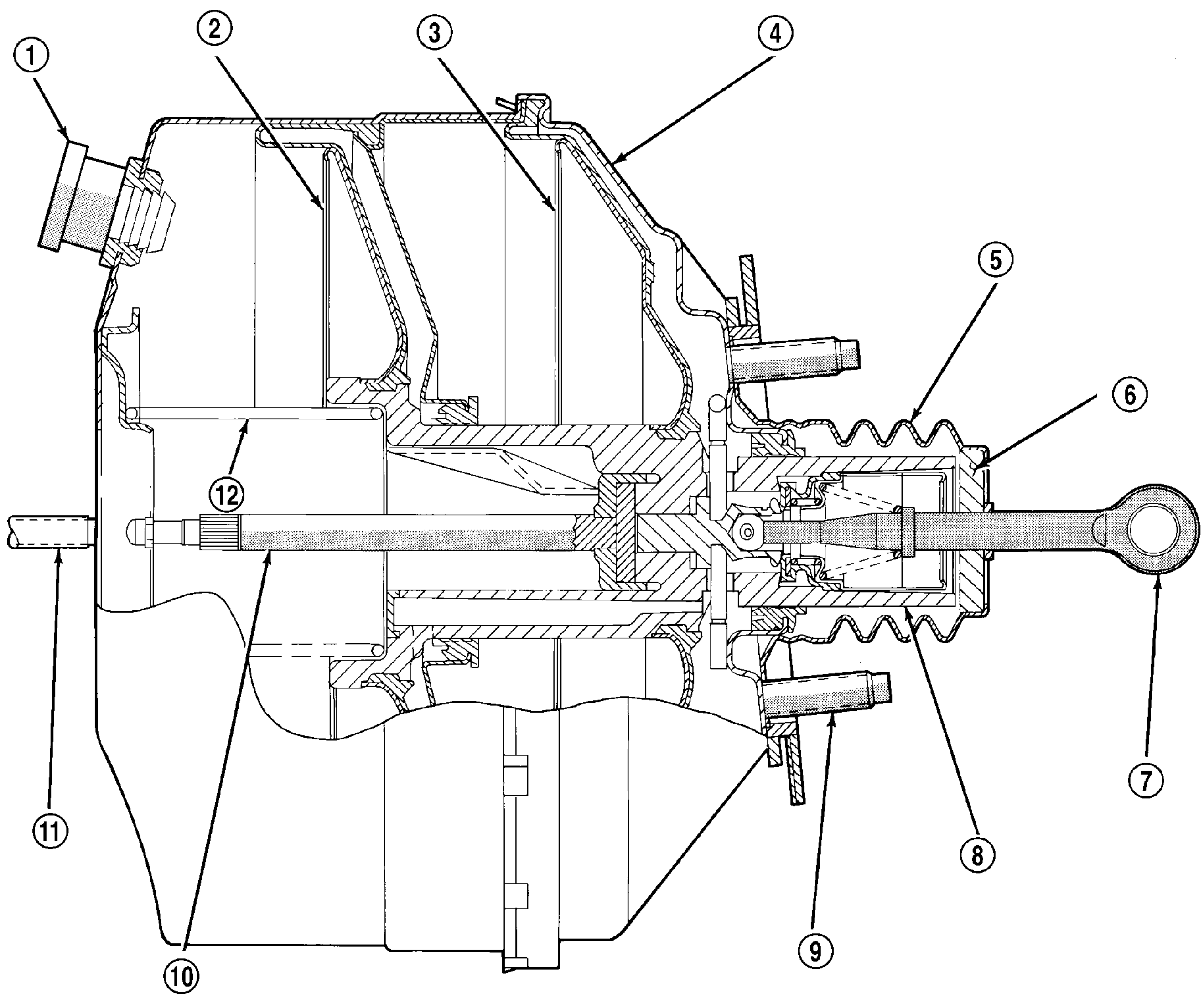


Fig. 47 Power Brake Booster–Typical

1 - VACUUM CHECK VALVE
2 - FRONT DIAPHRAGM
3 - REAR DIAPHRAGM
4 - HOUSING
5 - SEAL
6 - AIR FILTER
7 - PRIMARY PUSH ROD (TO BRAKE PEDAL)
8 - ATMOSPHERIC INLET VALVE ASSEMBLY
9 - BOOSTER MOUNTING STUDS (4)
10 - SECONDARY PUSH ROD (TO MASTER CYLINDER)
11 - MASTER CYLINDER MOUNTING STUD (2)
12 - SPRING

POWER BRAKE BOOSTER (Continued)

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply force for power assist.

The booster check valve, check valve grommet and booster seals are serviceable.

REMOVAL

(1) Remove combination valve and master cylinder.

(2) Disconnect vacuum hose from booster check valve.

(3) Remove retaining clip that secures booster push rod to brake pedal (Fig. 48) and slide the rod off the pin.

(4) Remove four nuts attaching booster to front cowl panel (Fig. 49).

(5) In engine compartment, slide booster studs out of cowl panel, and remove the booster from engine compartment.

(6) Remove dash seal from booster.

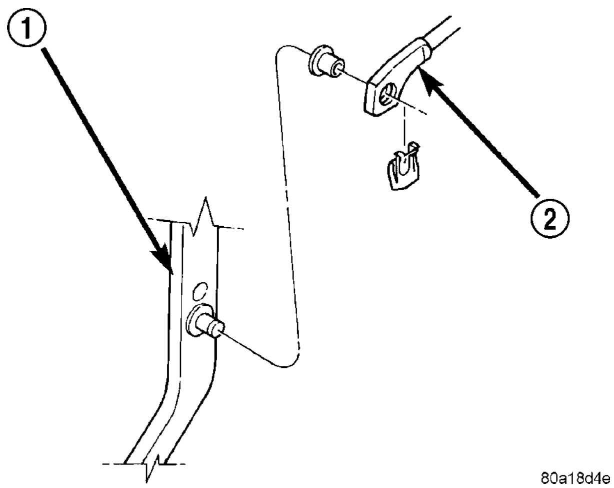


Fig. 48 Push Rod & Clip

1 - BRAKE PEDAL
2 - BOOSTER ROD

INSTALLATION

(1) Clean the booster mounting surface.

(2) Install dash seal on booster.

(3) Align and position booster on the front cowl panel.

(4) In passenger compartment, install nuts that attach booster to dash panel. Tighten nuts just enough to hold booster in place.

(5) Lubricate the pedal pin and bushing with Mopar multi-mileage grease. Then slid the booster

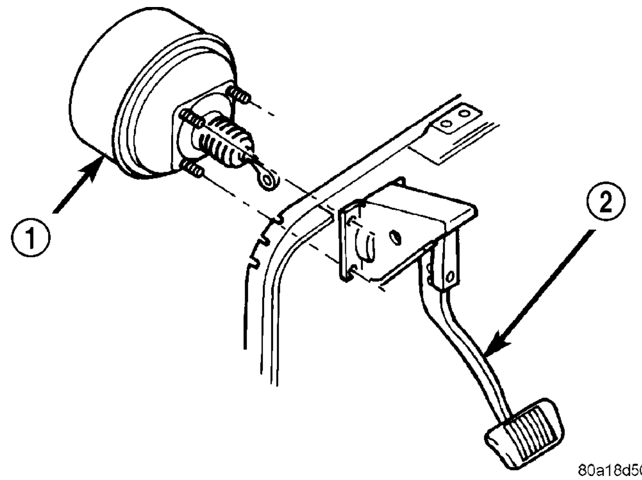


Fig. 49 Booster Mounting Nuts

1 - BOOSTER
2 - BRAKE PEDAL

push rod onto brake pedal pin and secure with retaining clip.

(6) Tighten booster mounting nuts to 39 N·m (29 ft. lbs.).

(7) Connect vacuum hose to booster check valve.

(8) Install master cylinder and combination valve.

(9) Top off master cylinder fluid level and bleed base brakes.

COMBINATION VALVE

DESCRIPTION

The combination valve contains a pressure differential valve and switch and a rear brake proportioning valve. The valve is not repairable and must be replaced as an assembly if diagnosis indicates this is necessary.

OPERATION

PRESSURE DIFFERENTIAL VALVE

The pressure differential switch is connected to the brake warning light. The switch is actuated by movement of the switch valve. The switch monitors fluid pressure in the separate front/rear brake hydraulic circuits.

A decrease or loss of fluid pressure in either hydraulic circuit will cause the switch valve to shuttle to the low pressure side. Movement of the valve pushes the switch plunger upward. This action closes the switch internal contacts completing the electrical circuit to the red warning light. The switch valve will remain in an actuated position until repairs to the brake system are made.

COMBINATION VALVE (Continued)

PROPORTIONING VALVE

The proportioning valve is used to balance front-rear brake action at high decelerations. The valve allows normal fluid flow during moderate braking. The valve only controls fluid flow during high decelerations brake stops.

DIAGNOSIS AND TESTING - COMBINATION VALVE

Pressure Differential Switch

(1) Have helper sit in drivers seat to apply brake pedal and observe red brake warning light.

(2) Raise vehicle on hoist.

(3) Connect bleed hose to a rear wheel cylinder and immerse hose end in container partially filled with brake fluid.

(4) Have helper press and hold brake pedal to floor and observe warning light.

(a) If warning light illuminates, switch is operating correctly.

(b) If light fails to illuminate, check circuit fuse, bulb, and wiring. The parking brake switch can be used to aid in identifying whether or not the brake light bulb and fuse is functional. Repair or replace parts as necessary and test differential pressure switch operation again.

(5) If warning light still does not illuminate, switch is faulty. Replace combination valve assembly, bleed brake system and verify proper switch and valve operation.

REMOVAL

(1) Remove brake lines that connect master cylinder to combination valve (Fig. 50).

(2) Disconnect brake lines that connect combination valve to front and rear brakes.

(3) Disconnect wire from combination valve switch terminal. Be careful when separating wire connector as lock tabs are easily damaged if not fully disengaged.

(4) Remove nuts attaching combination valve bracket to booster studs and remove valve bracket off booster studs (Fig. 51).

INSTALLATION

(1) Position valve bracket on booster studs and tighten bracket attaching nuts to 20 N·m (15 ft. lbs.).

(2) Align and start brake line fittings in combination valve and master cylinder by hand to avoid cross threading.

(3) Tighten brake line fittings at combination valve to 19 N·m (14 ft. lbs.).

(4) Tighten brake line fittings at master cylinder to 19 N·m (14 ft. lbs.).

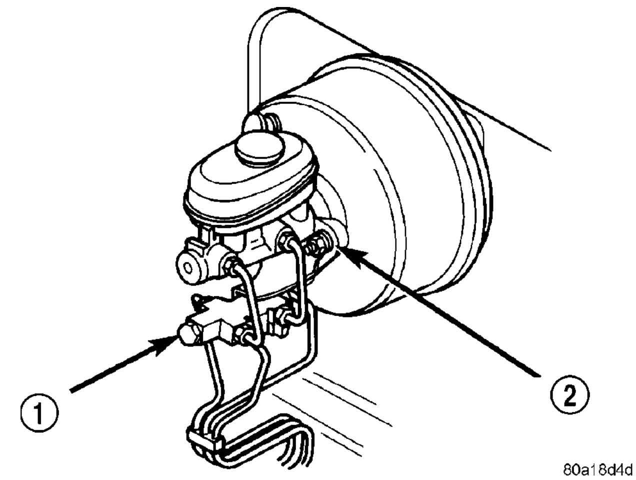


Fig. 50 Combination Valve/Master Cylinder

1 - COMBINATION VALVE
2 - MASTER CYLINDER

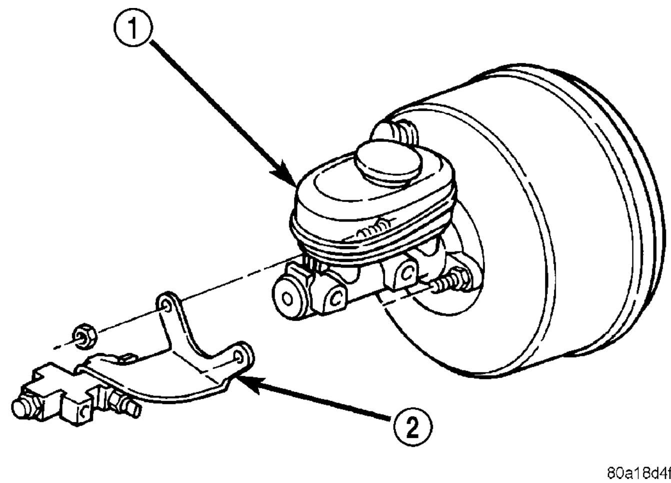


Fig. 51 Combination Valve Bracket

1 - MASTER CYLINDER
2 - COMBINATION VALVE BRACKET

(5) Connect wire to differential pressure switch in combination valve.

(6) Bleed base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

ROTORS

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor

ROTORS (Continued)

surfaces can be restored by machining in a disc brake lathe if surface scoring and wear are light.

Replace the rotor under the following conditions:

- Severely Scored
- Tapered
- Hard Spots
- Cracked
- Below Minimum Thickness

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

ROTOR RUNOUT

Check rotor lateral runout with dial indicator C-3339 (Fig. 52). Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brake shoes. Position the dial indicator plunger approximately 25.4 mm (1 in.) inward from the rotor edge.

NOTE: Be sure wheel bearing has zero end play before checking rotor runout.

Maximum allowable rotor runout is 0.102 mm (0.004 in.).

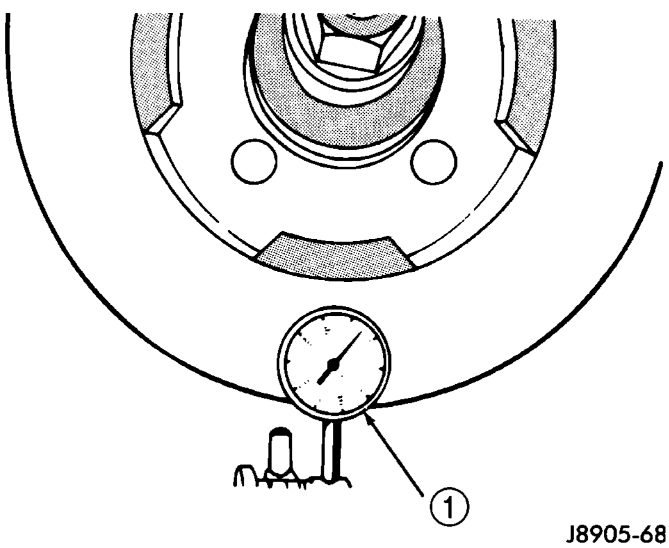


Fig. 52 Checking Rotor Runout And Thickness Variation

1 - DIAL INDICATOR

ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at 6-to-12 points around the rotor face (Fig. 53).

Position the micrometer approximately 25.4 mm (1 in.) from the rotor outer circumference for each measurement.

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point-to-point on the rotor. Machine or replace the rotor if necessary.

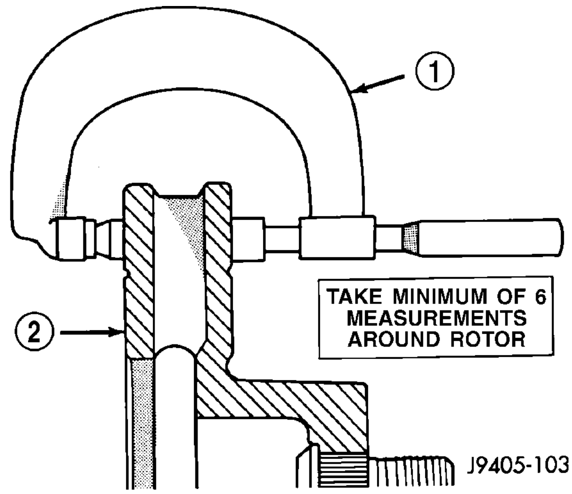


Fig. 53 Measuring Rotor Thickness

1 - MICROMETER
2 - ROTOR

DIAGNOSIS AND TESTING - BRAKE DRUM IN HAT ROTOR

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum in hat.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Machine the drum if runout or variation exceed values. Replace the drum in hat rotor if machining causes the drum in hat rotor to exceed the maximum allowable diameter.

STANDARD PROCEDURE

STANDARD PROCEDURE - DISC ROTOR MACHINING

The disc brake rotor can be machined if scored or worn. The lathe must machine both sides of the rotor

ROTORS (Continued)

simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the lathe. Equipment capable of machining only one side at a time may produce a tapered rotor.

NOTE: A hub mounted on-vehicle lathe is recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.

STANDARD PROCEDURE - BRAKE DRUM IN HAT ROTOR MACHINING

The brake drum in hat rotor can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum in hat rotor is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum in hat rotor.

CAUTION: Replace the drum in hat rotor if machining will cause the drum to exceed the maximum allowable diameter.

REMOVAL

REMOVAL - FRONT

(1) Remove wheel and tire assemble.

(2) Remove caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

(3) Remove retainers securing rotor to hub studs (Fig. 54).

(4) Remove rotor from hub.

(5) If rotor shield requires service, remove front hub and bearing assembly.

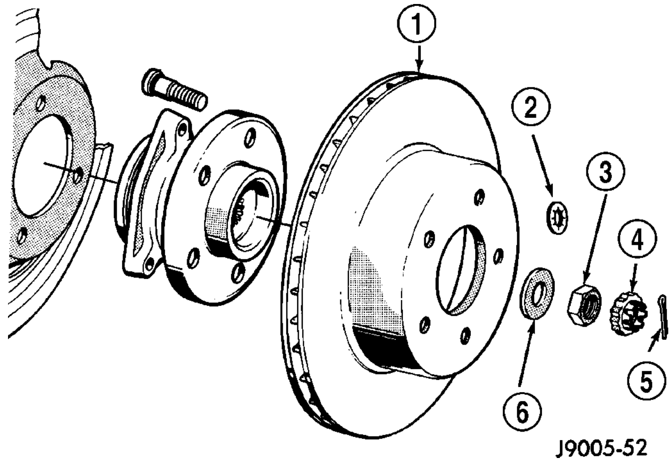


Fig. 54 Rotor & Hub

1 - ROTOR
2 - RETAINER
3 - BEARING NUT
4 - NUT LOCK
5 - COTTER PIN
6 - WASHER

REMOVAL - REAR

(1) Raise and support the vehicle

(2) Remove the tire and wheel assembly (Fig. 55).

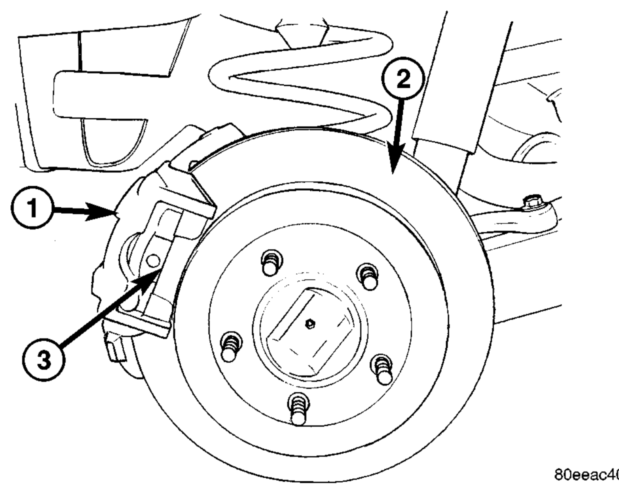


Fig. 55 ROTOR/CALIPER

1 - CALIPER
2 - ROTOR
3 - OUTBOARD DISC BRAKE PAD

(3) Remove the disc brake caliper and pads, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL) (Fig. 56).

(4) Remove the retianing clips and rotor assembly.

ROTORS (Continued)

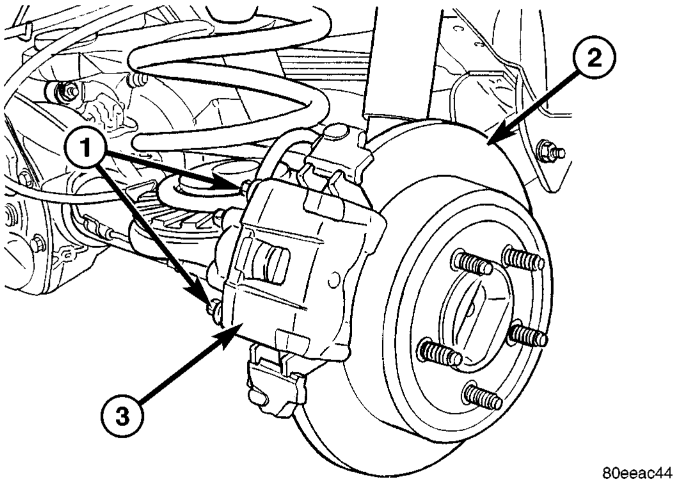


Fig. 56 ROTOR

1 - CALIPER MOUNTING BOLTS
2 - ROTOR
3 - CALIPER

INSTALLATION

INSTALLATION - FRONT

(1) If new rotor is being installed, remove protective coating from rotor surfaces with carburetor cleaner.

(2) Install rotor on hub.

(3) Install caliper. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(4) Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

INSTALLATION - REAR

(1) Install the rotor to the axleshaft.

(2) Install the disc brake caliper and pads (Fig. 56), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(3) Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(4) Lower the vehicle.

WHEEL CYLINDERS

REMOVAL

(1) Remove wheel and tire assembly.

(2) Remove brake drum.

(3) Remove wheel cylinder brake line.

(4) Remove brake shoe return springs and move shoes out of engagement with cylinder push rods.

(5) Remove cylinder attaching bolts and remove cylinder from support plate.

DISASSEMBLY

(1) Remove push rods and boots (Fig. 57).

(2) Press pistons, cups and spring and expander out of cylinder bore.

(3) Remove bleed screw.

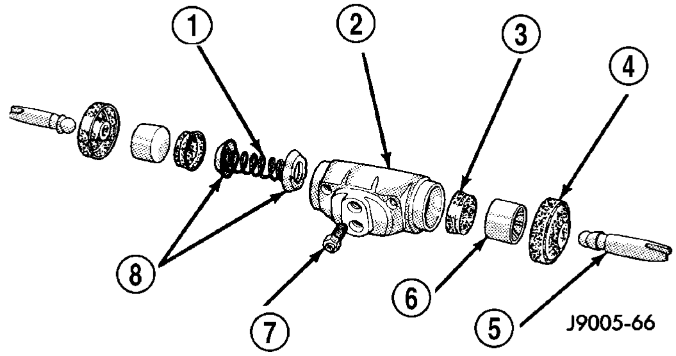


Fig. 57 Wheel Cylinder Components–Typical

1 - SPRING
2 - CYLINDER
3 - PISTON CLIP
4 - BOOT
5 - PUSH ROD
6 - PISTON
7 - BLEED SCREW
8 - CUP EXPANDERS

CLEANING

Clean the cylinder and pistons with clean brake fluid or brake cleaner only. Do not use any other cleaning agents.

Dry the cylinder and pistons with compressed air. Do not use rags or shop towels to dry the cylinder components. Lint from cloth material will adhere to the cylinder bores and pistons.

INSPECTION

Inspect the cylinder bore. Light discoloration and dark stains in the bore are normal and will not impair cylinder operation.

The cylinder bore can be lightly polished but only with crocus cloth. Replace the cylinder if the bore is scored, pitted or heavily corroded. Honing the bore to restore the surface is not recommended.

Inspect the cylinder pistons. The piston surfaces should be smooth and free of scratches, scoring and corrosion. Replace the pistons if worn, scored, or corroded. Do attempt to restore the surface by sanding or polishing.

Discard the old piston cups and the spring and expander. These parts are not reusable. The original dust boots may be reused but only if they are in good condition.

ASSEMBLY

(1) Lubricate wheel cylinder bore, pistons, piston cups and spring and expander with clean brake fluid.

WHEEL CYLINDERS (Continued)

(2) Install first piston in cylinder bore. Then install first cup in bore and against piston. **Be sure lip of piston cup is facing inward (toward spring and expander) and flat side is against piston.**

(3) Install spring and expander followed by remaining piston cup and piston.

(4) Install boots on each end of cylinder and insert push rods in boots.

(5) Install cylinder bleed screw.

INSTALLATION

(1) Apply bead of silicone sealer around cylinder mounting surface of support plate.

(2) Install cylinder mounting bolts and tighten to 10 N·m (7 ft. lbs.).

(3) Install brake line to cylinder and tighten to 16 N·m (12 ft. lbs.).

(4) Install brake shoe return spring.

(5) Install brake drum.

(6) Install wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(7) Bleed base brake system. (Refer to 5 - BRAKES - STANDARD PROCEDURE).

SUPPORT PLATE

REMOVAL

(1) Remove wheel and tire assembly.

(2) Remove the disc brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

(3) Remove the rotor (Fig. 58), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

(4) Remove the axle shaft (Fig. 59), (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - AXLE SHAFTS - REMOVAL).

(5) Remove the park brake shoes (Fig. 59), (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - REMOVAL).

(6) Remove the parking brake cable from the brake lever.

(7) Remove the bolts attaching the support plate to the axle and remove the support plate.

INSTALLATION

(1) Install support plate on axle flange. Tighten attaching bolts to 115 N·m (85 ft. lbs.).

(2) Install the park brake shoes (Fig. 59), (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - INSTALLATION).

(3) Install parking brake cable in the brake lever.

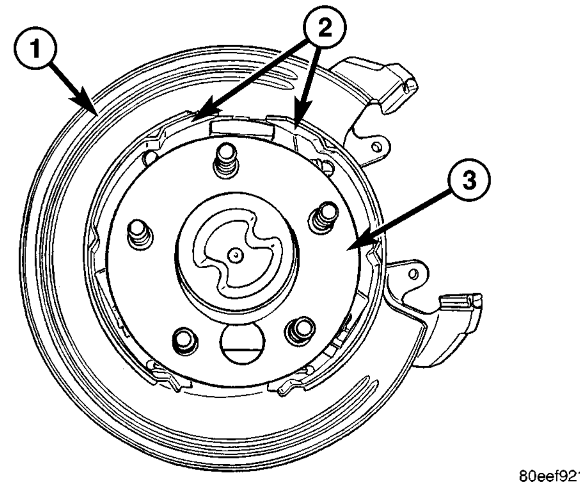


Fig. 58 PARK BRAKE SHOES INSTALLED

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - AXLE

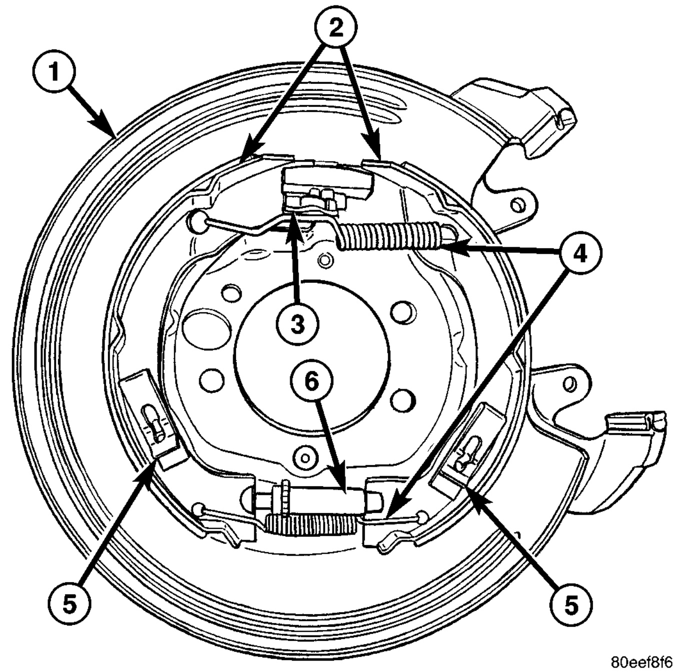


Fig. 59 BRAKE SHOES

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - EQUALIZER
4 - SPRINGS
5 - HOLD DOWN CLIPS
6 - ADJUSTER

(4) Install axle shaft, (Fig. 58), (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE - AXLE SHAFTS - INSTALLATION).

(5) Adjust brake shoes to drum with brake gauge (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

SUPPORT PLATE (Continued)

(6) Install the rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(7) Install the caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(8) Install the wheel and tire assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

PARKING BRAKE

DESCRIPTION

The parking bake is a hand lever and cable operated system used to apply the rear brakes.

OPERATION

A hand operated lever in the passenger compartment is the main application device. The front cable is connected between the hand lever and the tensioner. The tensioner rod is attached to the equalizer which is the connecting point for the rear cables (Fig. 60).

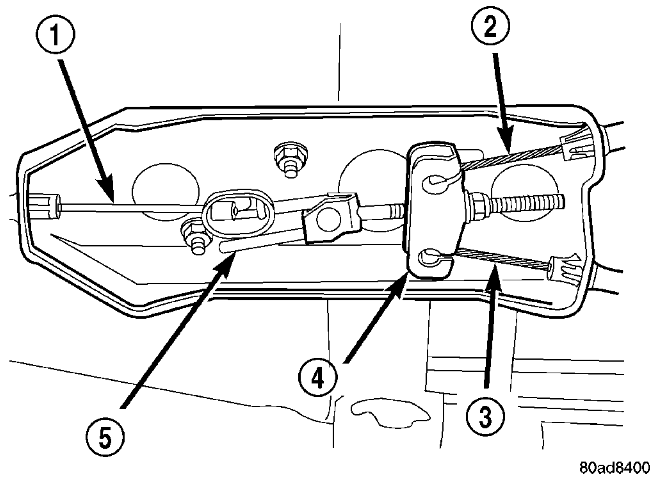


Fig. 60 Parking Brake Components

1 - FRONT CABLE
2 - L.R. CABLE
3 - R.R. CABLE
4 - EQUALIZER
5 - TENSIONER ROD

The rear cables are connected to the actuating lever on each secondary brake shoe. The levers are attached to the brake shoes by a pin either pressed into, or welded to the lever. A clip is used to secure the pin in the brake shoe. The pin allows each lever to pivot independently of the brake shoe.

To apply the parking brakes, the hand lever is pulled upward. This pulls the rear brake shoe actuating levers forward, by means tensioner and cables. As the actuating lever is pulled forward, the parking brake strut (which is connected to both shoes), exerts a linear force against the primary brake shoe. This action presses the primary shoe into contact with the drum. Once the primary shoe contacts the drum, force is exerted through the strut. This force is transferred through the strut to the secondary brake shoe causing it to pivot into the drum as well.

A gear type ratcheting mechanism is used to hold the lever in an applied position. Parking brake release is accomplished by the hand lever release button.

A parking brake switch is mounted on the parking brake lever and is actuated by movement of the lever. The switch, which is in circuit with the red warning light in the dash, will illuminate the warning light whenever the parking brakes are applied.

Parking brake adjustment is controlled by a cable tensioner mechanism. The cable tensioner, once adjusted at the factory, should not need further adjustment under normal circumstances. Adjustment may be required if a new tensioner, or cables are installed, or disconnected.

DIAGNOSIS AND TESTING - PARKING BRAKE

NOTE: Parking brake adjustment is controlled by a cable tensioner. Once the tensioner is adjusted at the factory, it should not require further attention. However, there are two instances when adjustment will be required. The first is when a new tensioner, or cables have been installed. And the second, is when the tensioner and cables are disconnected for access to other brake components.

The parking brake switch is in circuit with the red warning lamp in the dash. The switch will cause the lamp to illuminate only when the parking brakes are applied. If the lamp remains on after parking brake release, the switch or wires are faulty, or cable tensioner adjustment is incorrect.

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/won't hold), can be traced to a parking brake component.

The leading cause of improper parking brake operation, is excessive clearance between the parking brake shoes and the shoe braking surface. Excessive clearance is a result of lining and/or drum wear, drum surface machined oversize, or inoperative adjuster components.

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), is the result of worn brake shoes, improper brake shoe adjustment, or improperly assembled brake parts.

A condition where the parking brakes do not hold, will most probably be due to a wheel brake component.

PARKING BRAKE (Continued)

Items to look for when diagnosing a parking brake problem, are:

- Rear brake shoe wear.
- Drum surface machined oversize.
- Front cable not secured to lever.
- Rear cable not attached to lever.
- Rear cable seized.
- Brake shoes reversed.
- Parking brake strut not seated in shoes.
- Parking brake lever not seated.
- Parking brake lever bind.
- Adjuster screws seized.
- Adjuster screws reversed.

Parking brake adjustment and parts replacement procedures are described in the Parking Brake section.

SHOES

DESCRIPTION

Drum in hat park brakes are dual shoe, internal expanding units with an automatic self adjusting mechanism (Fig. 61).

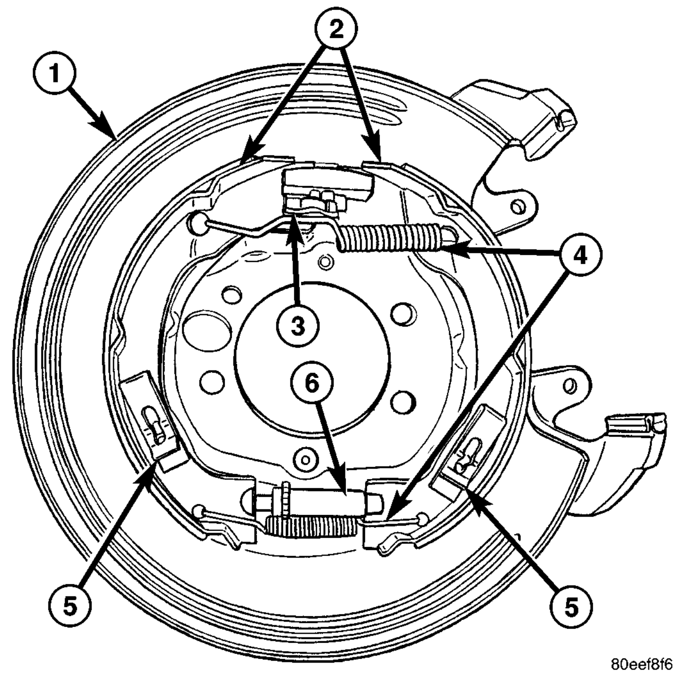


Fig. 61 BRAKE SHOES

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - EQUALIZER
4 - SPRINGS
5 - HOLD DOWN CLIPS
6 - ADJUSTER

OPERATION

When the parking brake pedal is depressed the brake cable pulls the brake shoes outward against the brake drum. When the brake pedal is released the return springs attached to the brake shoes pull the shoes back to there original position.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the tire and wheel assembly.

(3) Remove the disc brake caliper, (Fig. 62), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).

(4) Remove the disc brake rotor, (Fig. 62), (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

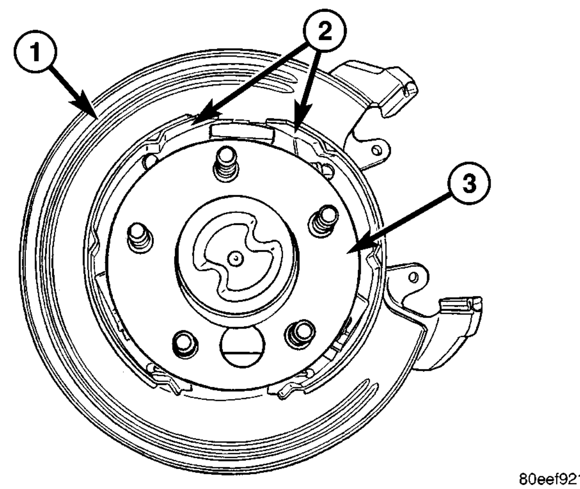


Fig. 62 PARK BRAKE SHOES INSTALLED

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - AXLE

(5) Disassemble the rear park brake shoes (Fig. 63).

CLEANING - REAR DRUM IN HAT BRAKE

Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION - REAR DRUM IN HAT BRAKE

As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper (Fig. 64).

SHOES (Continued)

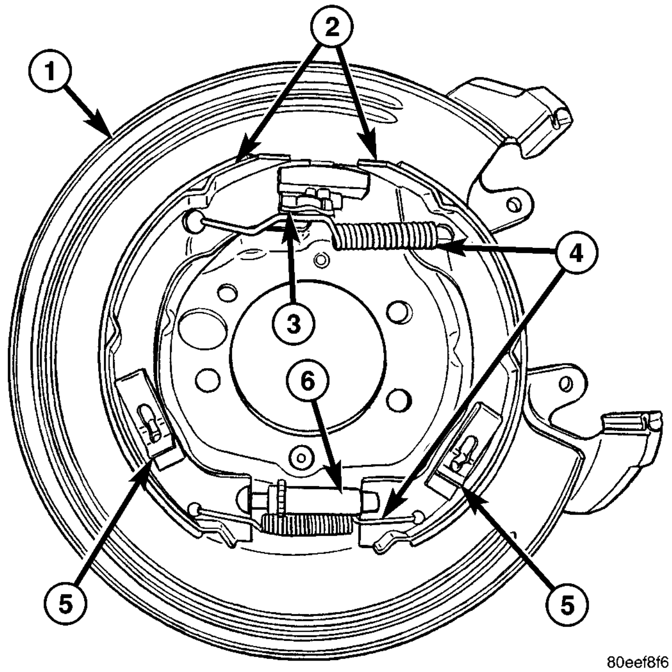


Fig. 63 BRAKE SHOES

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - EQUALIZER
4 - SPRINGS
5 - HOLD DOWN CLIPS
6 - ADJUSTER

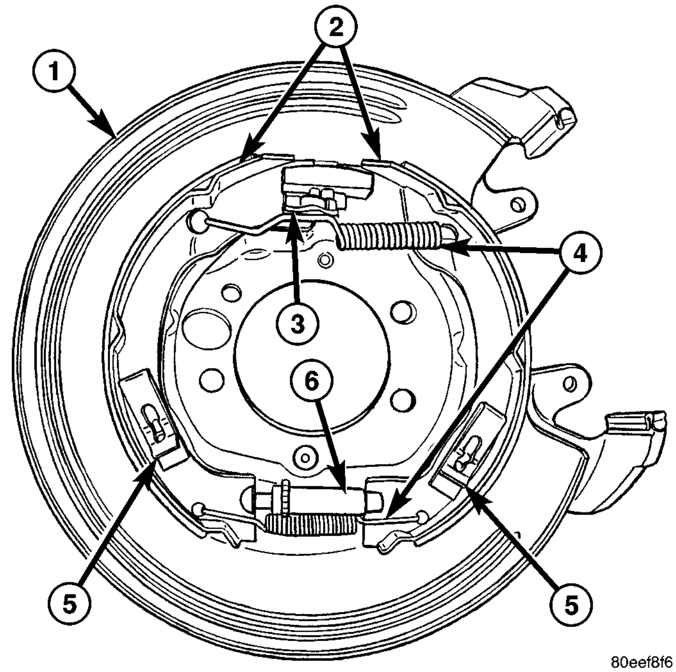


Fig. 64 BRAKE SHOES

1 - SUPPORT PLATE
2 - PARK BRAKE SHOES
3 - EQUALIZER
4 - SPRINGS
5 - HOLD DOWN CLIPS
6 - ADJUSTER

Inspect the adjuster screw assembly. Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded (Fig. 64).

Discard the brake springs and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted (Fig. 64).

INSTALLATION

NOTE: On a new vehicle or after parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake lever.

(1) Reassemble the rear park brake shoes (Fig. 63).

(2) Adjust the rear brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

(3) Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(4) Install the disc brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(5) Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(6) Lower the vehicle.

ADJUSTMENTS

ADJUSTMENT - REAR DRUM IN HAT PARK BRAKE (ROTOR REMOVED)

Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both rotors are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

CAUTION: Before adjusting the park brake shoes be sure that the park brake pedal is in the fully released position. If park brake pedal is not in the fully released position, the park brake shoes can not be accurately adjusted.

SHOES (Continued)

(1) Raise vehicle.

(2) Remove tire and wheel.

(3) Remove disc brake caliper from caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ DISC BRAKE CALIPERS - REMOVAL).

(4) Remove rotor from the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

NOTE: When measuring the brake drum diameter, the diameter should be measured in the center of the area in which the park brake shoes contact the surface of the brake drum.

(5) Using Brake Shoe Gauge, Special Tool C-3919, or equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor (Fig. 65).

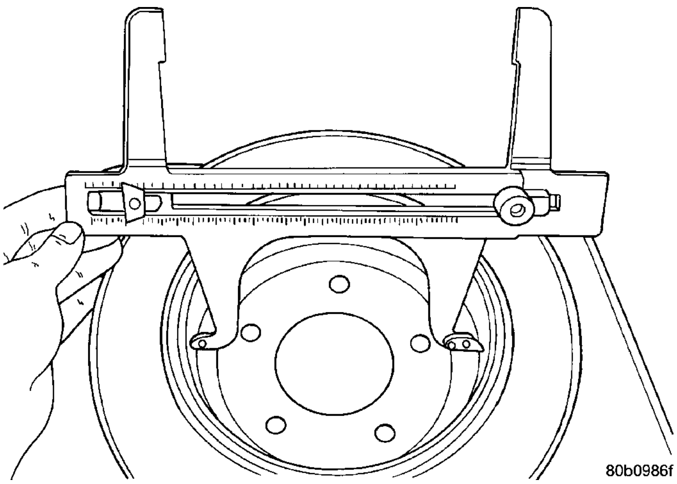


Fig. 65 MEASURING PARK BRAKE DRUM DIAMETER

(6) Using a ruler that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool (Fig. 66).

(7) Reduce the inside diameter measurement of the brake drum that was taken using Special Tool C-3919 by 1/64 of an inch. Reset Gauge, Brake Shoe, Special Tool C-3919 or the equivalent used, so that the outside measurement jaws are set to the reduced measurement (Fig. 67).

(8) Place Gauge, Brake Shoe, Special Tool C-3919, or equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.

(9) Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.

(10) Repeat step 8 above and measure shoes in both directions.

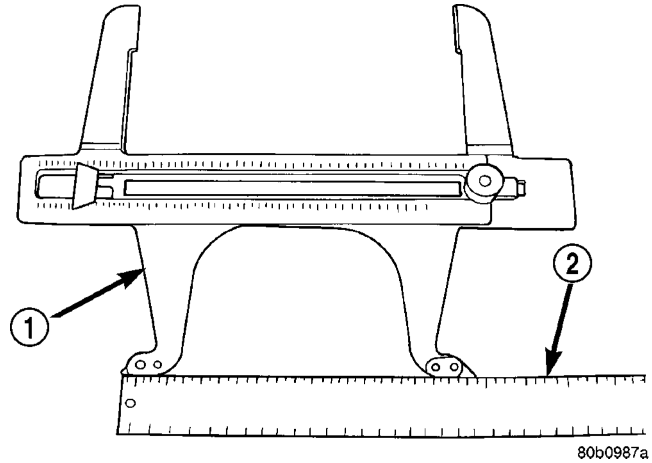


Fig. 66 READING PARK BRAKE DRUM DIAMETER

1 - SPECIAL TOOL C-3919
2 - RULER

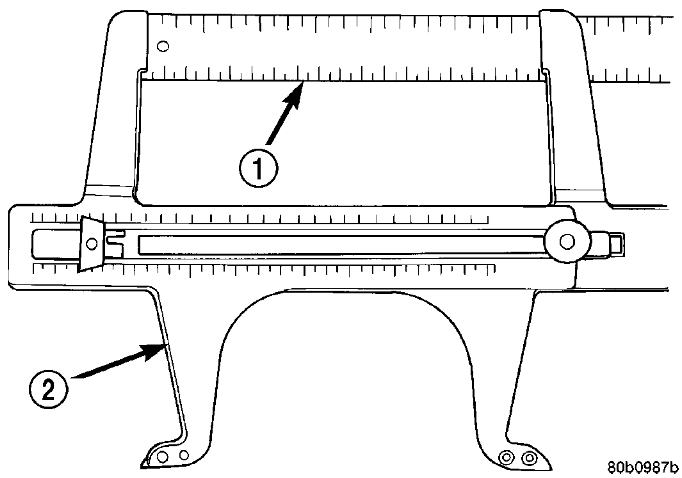


Fig. 67 SETTING GAUGE TO PARK BRAKE SHOE MEASUREMENT

1 - RULER
2 - SPECIAL TOOL C-3919

(11) Install brake rotor on the axleshaft (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(12) Rotate rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.

(13) Install disc brake caliper on caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ DISC BRAKE CALIPERS - INSTALLATION).

(14) Install wheel and tire.

(15) Tighten the wheel mounting nuts in the proper sequence until all nuts are torqued to half the specified torque. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(16) Lower vehicle.

SHOES (Continued)

CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.

NOTE: After parking brake lining replacement, it is recommended that the parking brake system be conditioned prior to use. This is done by making one stop from 25 mph on dry pavement or concrete using light to moderate force on the parking brake hand lever.

(17) Road test the vehicle to ensure proper function of the vehicle's brake system.

ADJUSTMENT - WITH ADJUSTING TOOL

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

(1) Be sure parking brake lever is fully released.

(2) Raise vehicle so rear wheels can be rotated freely.

(3) Remove plug from each access hole in brake support plates.

(4) Loosen parking brake cable adjustment nut until there is slack in front cable.

(5) Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel (Fig. 68).

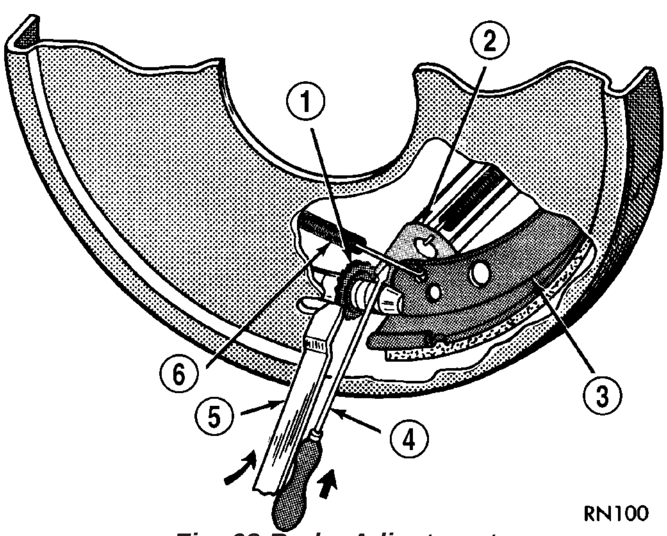


Fig. 68 Brake Adjustment

1 - STAR WHEEL
2 - LEVER
3 - BRAKE SHOE WEB
4 - SCREWDRIVER
5 - ADJUSTING TOOL
6 - ADJUSTER SPRING

(6) Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.

(7) Push and hold adjuster lever away from star wheel with thin screwdriver.

(8) Back off adjuster screw star wheel until brake drag is eliminated.

(9) Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.

(10) Install support plate access hole plugs.

(11) Adjust parking brake cable and lower vehicle.

(12) Depress park brake lever and make sure park brakes hold the vehicle staionary.

(13) Release park brake lever.

CABLES

REMOVAL

REMOVAL - DRUM BRAKES

(1) Raise vehicle and loosen equalizer nuts until rear cables are slack.

(2) Disengage cable from equalizer and remove cable.

(3) Remove cable bracket from upper suspension arm (Fig. 69).

(4) Remove rear wheel and brake drum.

(5) Remove secondary brake shoe and disconnect cable from lever on brake shoe.

(6) Compress cable retainer with worm drive hose clamp (Fig. 70) and remove cable from backing plate.

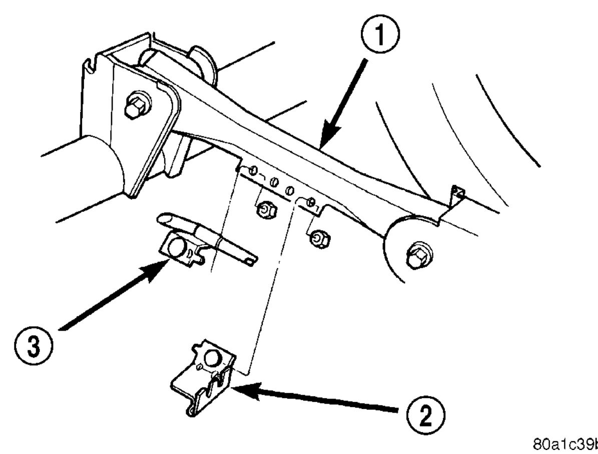


Fig. 69 Parking Brake Cable Bracket

1 - UPPER SUSPENSION ARM
2 - WIRING BRACKET
3 - PARKING BRAKE CABLE BRACKET

CABLES (Continued)

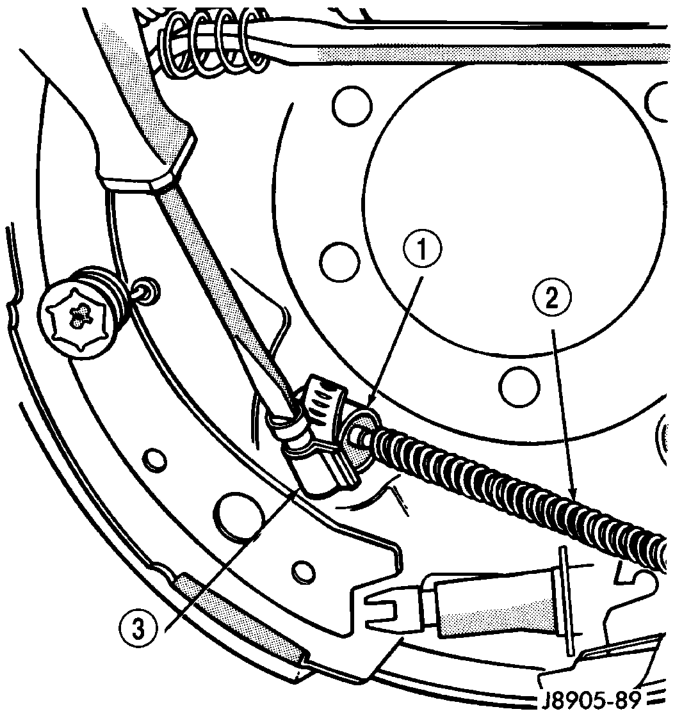


Fig. 70 Cable Retainer

1 - CABLE RETAINER
2 - REAR CABLE
3 - WORM DRIVE HOSE CLAMP

REMOVAL - DISC BRAKES

(1) Raise and support the vehicle.
(2) Lockout the parking brake cable.
(3) Loosen the brake cable at the equalizer and adjuster nut.
(4) Remove the cable from the front cable.
(5) Remove the cable from the equalizer.
(6) Remove the cable from the frame bracket.
(7) Remove the cable from the axle bracket.
(8) Remove the brake cable from the brake lever. (Fig. 71)

INSTALLATION

INSTALLATION - DRUM BRAKES

(1) Install new cable in backing plate. Be sure cable retainer is seated.
(2) Attach cable to lever on brake shoe and install brake shoe on backing plate.
(3) Adjust brake shoes to drum with brake gauge.
(4) Install brake drum and wheel.
(5) Install cable/bracket on upper suspension arm.
(6) Engage cable in equalizer and install equalizer nuts.
(7) Adjust parking brakes.

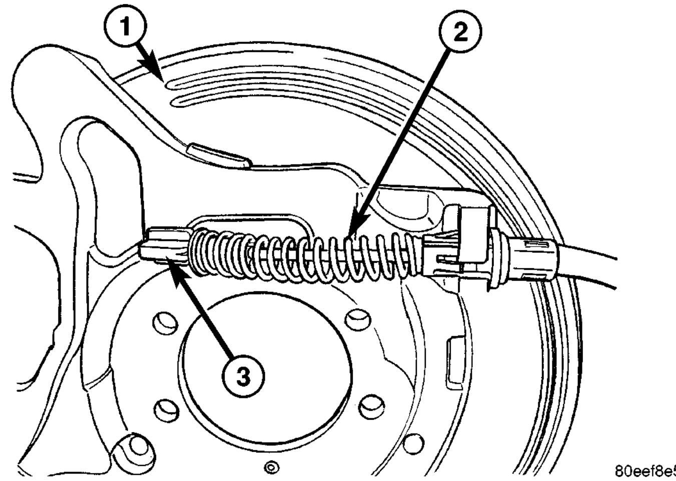


Fig. 71 CABLE REMOVAL/INSTALLATION

1 - SUPPORT PLAT
2 - PARK BRAKE CABLE
3 - EQUALIZER

INSTALLATION - DISC BRAKES

(1) Install the brake cable to the brake lever.
(2) Install the cable to the axle bracket (Fig. 72).
(3) Install the cable to the equalizer (Fig. 72).
(4) Install the cable to the front cable.
(5) Adjust the brake cable at the equalizer and using the adjuster nut.

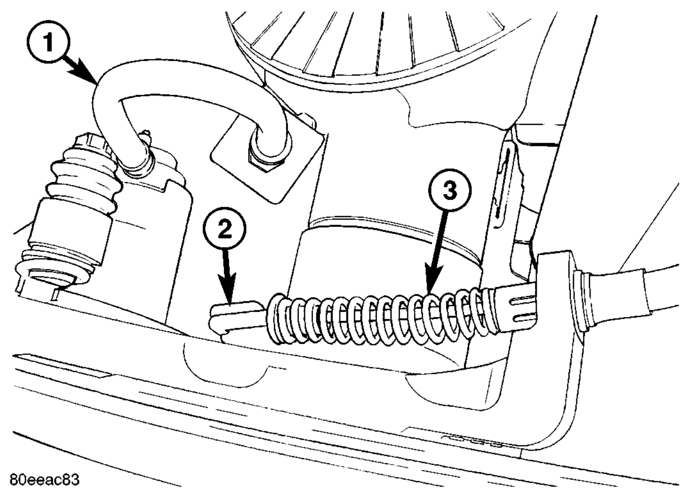


Fig. 72 REAR CABLE CONNECTED

1 - BRAKE HOSE
2 - ACTUATOR LEVER
3 - PARK BRAKE CABLE

BRAKES - ABS

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BRAKES - ABS

DESCRIPTION

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The antilock CAB activates the system whenever sensor signals indicate periods of high wheel slip. High wheel slip can be described as the point where wheel rotation begins approaching 20 to 30 percent of actual vehicle speed during braking. Periods of high wheel slip occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

Battery voltage is supplied to the CAB ignition terminal when the ignition switch is turned to Run position. The CAB performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static check occurs after the ignition switch is turned to Run position. The dynamic check occurs when vehicle road speed reaches approximately 30 kph (18 mph). During the dynamic check, the CAB briefly cycles the pump and solenoids to verify operation.

If an ABS component exhibits a fault during initialization, the CAB illuminates the amber warning light and registers a fault code in the microprocessor memory.

OPERATION

During normal braking, the master cylinder, power booster and wheel brake units all function as they would in a vehicle without ABS. The HCU components are not activated.

During antilock braking fluid pressure is modulated according to wheel speed, degree of slip and rate of deceleration. A sensor at each wheel converts wheel speed into electrical signals. These signals are transmitted to the CAB for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem. A speed sensor input signal indicating a high slip condition activates the CAB antilock program. Two solenoid valves are used in each antilock control channel. The valves are all located within the HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels. The solenoid valves are not static during antilock braking. They are cycled continuously to modulate pressure. Solenoid cycle time in antilock mode can be measured in milliseconds.

DIAGNOSIS AND TESTING - ANTILOCK BRAKES

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is oper-

BRAKES - ABS (Continued)

ating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.

NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Antilock Brake section in Group 8W. For test procedures refer to the Chassis Diagnostic Manual.

STANDARD PROCEDURE - BLEEDING ABS BRAKE SYSTEM

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

(1) Perform base brake bleeding. Refer to base brake section for procedure.

(2) Connect scan tool to the Data Link Connector.

(3) Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.

(4) Perform base brake bleeding a second time. Refer to base brake section for procedure.

(5) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
G-Sensor Sensor Bolt	4-5	—	35-45
G-Sensor Bracket Bolt	8-13	—	75-115
Hydraulic Control Unit Bracket to HCU Bolts	6.5	—	57
Hydraulic Control Unit Body Bracket Bolts	16-24	—	142-212
Hydraulic Control Unit HCU to Body Bracket Bolts	9-13	—	80-115
Hydraulic Control Unit Brake Lines	15-18	—	130-160
Controller Anitlock Brakes Mounting Bolt	7-9	—	60-80
Wheel Speed Sensors Front Mounting Bolt	4-6	—	34-50
Wheel Speed Sensors Rear Mounting Bolt	12-14	—	106-124

FRONT WHEEL SPEED SENSOR

DESCRIPTION

A speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted to the rear brake backing plate.

OPERATION

The sensors convert wheel speed into a small AC electrical signal. This signal is transmitted to the CAB. The CAB convert the AC signal into a digital signal for each wheel. This voltage is generated by magnetic induction when a tone wheel passes by the stationary magnetic of the wheel speed sensor.

A gear type tone ring serves as the trigger mechanism for each sensor. The tone rings are mounted at the outboard ends of the front and rear axle shafts.

Different sensors are used at the front and rear wheels (Fig. 1). The front/rear sensors have the same electrical values but are not interchangeable. The sensors have a resistance between 900 and 1300 ohms.

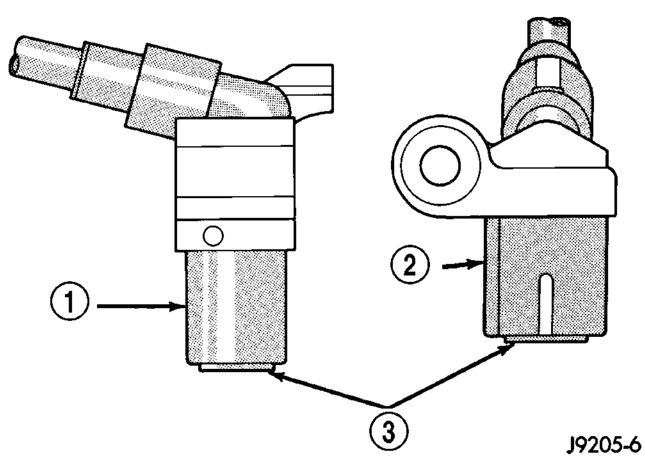

Fig. 1 Typical Wheel Speed Sensors

1 - FRONT SENSOR
2 - REAR SENSOR
3 - PICKUP FACE

FRONT SENSOR AIR GAP

Front sensor air gap is fixed and not adjustable. Only rear sensor air gap is adjustable.

Although front air gap is not adjustable, it can be checked if diagnosis indicates this is necessary. Front air gap should be 0.40 to 1.3 mm (0.0157 to 0.051 in.). If gap is incorrect, the sensor is either loose, or damaged.

REAR SENSOR AIR GAP

A rear sensor air gap adjustment is only needed when reinstalling an original sensor. Replacement sensors have an air gap spacer attached to the sensor pickup face. The spacer establishes correct air gap when pressed against the tone ring during installation. As the tone ring rotates, it peels the spacer off the sensor to create the required air gap. Rear sensor air gap is 0.28-1.5 mm (0.011-0.059 in.).

Sensor air gap measurement, or adjustment procedures are provided in this section. Refer to the front, or rear sensor removal and installation procedures as required.

REMOVAL

(1) Raise vehicle and turn wheel outward to access the sensor.

(2) Disconnect sensor wire connector at harness plug.

(3) Remove sensor wire from mounting retainers.

(4) Clean sensor and surrounding area with shop towel before removal.

(5) Remove bolt attaching sensor to steering knuckle and remove sensor (Fig. 2).

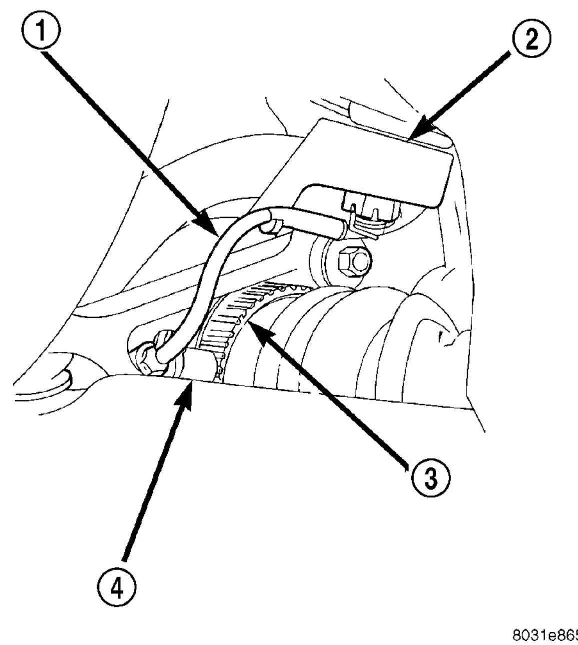

Fig. 2 Front Wheel Speed Sensor

1 - WHEEL SPEED SENSOR PIGTAIL
2 - STEERING KNUCKLE
3 - TONE WHEEL
4 - FRONT WHEEL SPEED SENSOR

INSTALLATION

(1) If **original** sensor will be installed, wipe all traces of old spacer material off sensor pickup face. Use a dry shop towel for this purpose.

(2) Apply Mopar Lock N' Seal or Loctite ® 242 on bolt that secures sensor in steering knuckle. Use new sensor bolt if original bolt is worn or damaged.

FRONT WHEEL SPEED SENSOR (Continued)

(3) Position sensor on steering knuckle. Seat sensor locating tab in hole in knuckle and install sensor attaching bolt finger tight.

(4) Tighten sensor attaching bolt to 4-6 N·m (34-50 in. lbs.).

(5) If original sensor has been installed, check sensor air gap. Air gap should be 0.40 to 1.3 mm (0.0157 to 0.051 in.). If gap is incorrect, sensor is either loose, or damaged.

(6) Route sensor wire and install into mounting retainers.

(7) Connect sensor wire to harness.

G-SWITCH

DESCRIPTION

The G-switch is located in front of the console/shifter mounted to a bracket on the floor pan. The switch has directional arrow and must be mounted with the arrow pointing towards the front of the vehicle.

OPERATION

The switch (Fig. 3) , provides an additional vehicle deceleration reference during 4-wheel drive operation. The switch is monitored by the CAB at all times. The switch reference signal is utilized by the CAB when all wheels are decelerating at the same speed.

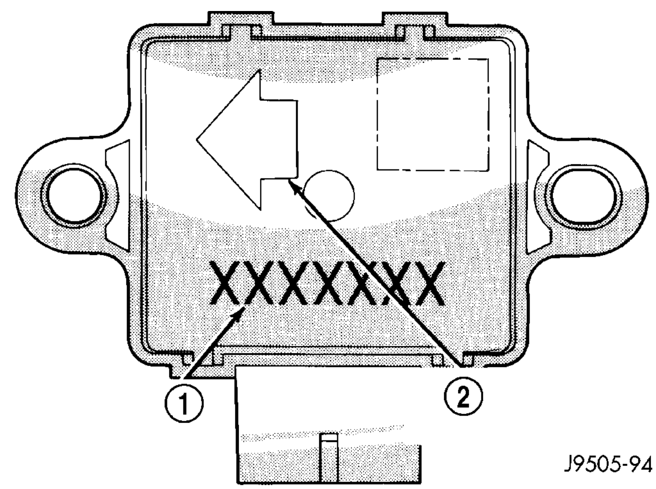

Fig. 3 G-Switch

1 - SWITCH PART NUMBER
2 - ARROW INDICATES FRONT OF SWITCH FOR PROPER MOUNTING

REMOVAL

(1) From the drivers side lift carpet back in front of the console/shifter.

(2) Disconnect harness for switch.

(3) Remove mounting bolts and remove switch (Fig. 4).

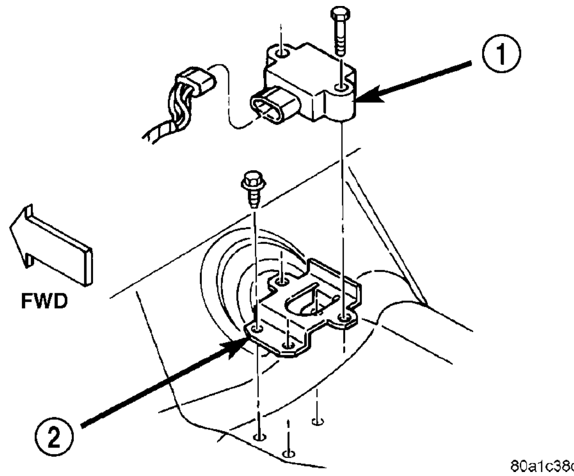

Fig. 4 G-Switch

1 - ACCELERATION SWITCH
2 - MOUNTING BRACKET

INSTALLATION

CAUTION: The mercury switch (inside the G-switch), will not function properly if the switch is installed incorrectly. Verify that the switch locating arrow is pointing to the front of the vehicle (Fig. 3).

(1) Position switch on mounting bracket.

(2) Install mounting bolts and tighten to 4-5 N·m (35-45 in. lbs.)

(3) Connect harness to switch.

(4) Place carpet back into position.

REAR WHEEL SPEED SENSOR

DESCRIPTION

A speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted to the rear brake backing plate.

OPERATION

The sensors convert wheel speed into a small AC electrical signal. This signal is transmitted to the CAB. The CAB convert the AC signal into a digital signal for each wheel. This voltage is generated by magnetic induction when a tone wheel passes by the stationary magnetic of the wheel speed sensor.

A gear type tone ring serves as the trigger mechanism for each sensor. The tone rings are mounted at the outboard ends of the front and rear axle shafts.

Different sensors are used at the front and rear wheels (Fig. 1). The front/rear sensors have the same electrical values but are not interchangeable. The

REAR WHEEL SPEED SENSOR (Continued)

sensors have a resistance between 900 and 1300 ohms.

REMOVAL

(1) Disconnect sensors at rear harness connectors.
(2) Remove wheel and tire assembly.
(3) Remove brake drum.
(4) Remove clips securing sensor wires to brake lines, rear axle and, brake hose.
(5) Unseat sensor wire support plate grommet.
(6) Remove bolt attaching sensor to bracket (Fig. 5) and remove sensor.

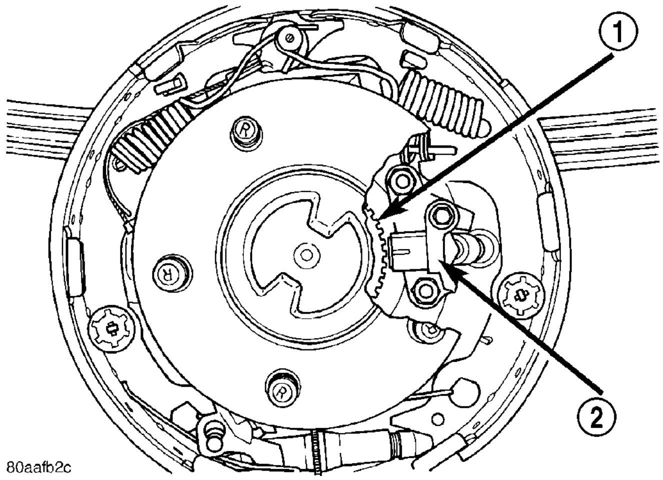

Fig. 5 Wheel Speed Sensor

1 - TONE WHEEL
2 - WHEEL SPEED SENSOR

INSTALLATION

(1) If **original sensor** is being installed, remove any remaining pieces of cardboard spacer from sensor pickup face. Use dry shop towel only to remove old spacer material.
(2) Insert sensor wire through support plate hole. Then seat sensor grommet in support plate.
(3) Apply Mopar Lock N' Seal or Loctite ® 242 to original sensor bolt. Use new bolt if original is worn or damaged.
(4) Install sensor bolt finger tight only at this time.
(5) If **original** rear sensor was installed, adjust sensor air gap to 0.28-1.5 mm (0.011-0.059 in.). Use feeler gauge to measure air gap (Fig. 6). Tighten sensor bolt to 12-14 N·m (106-124 in. lbs.).
(6) If **new** sensor was installed, push cardboard spacer on sensor face against tone ring (Fig. 7). Then tighten sensor bolt to 12-14 N·m (106-124 in. lbs.). Correct air gap will be established as tone ring rotates and peels spacer off sensor face.
(7) Secure the rear sensor wires to the retainer clips. Verify that wire is clear of rotating components.
(8) Connect sensor wire to harness connector.

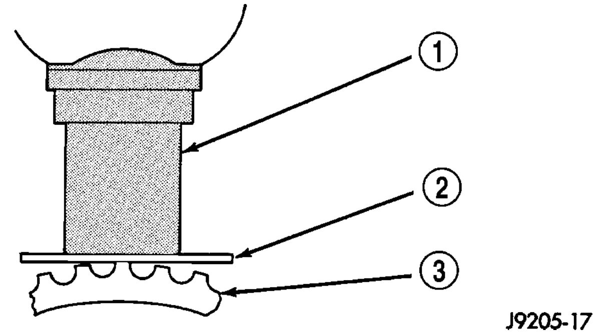

Fig. 6 Setting Air Gap On Original Rear Sensor

1 - WHEEL SPEED SENSOR
2 - BRASS FEELER GAUGE
3 - TONE RING

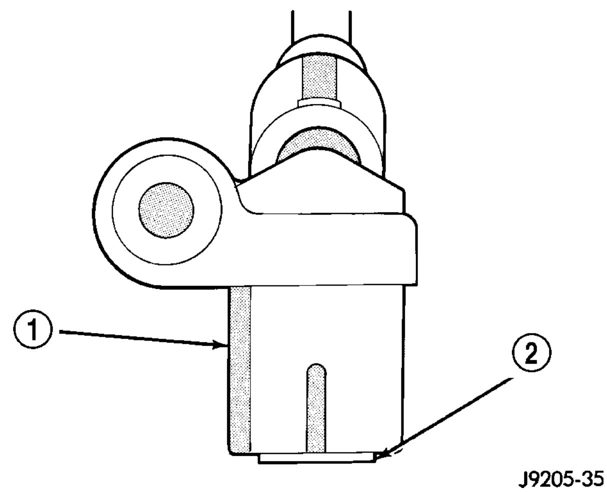

Fig. 7 New Rear Sensor

1 - REAR SENSOR
2 - AIR GAP SPACER ATTACHED TO SENSOR FACE

(9) Install brake drum and wheel and tire assembly. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).
(10) Lower vehicle.
(11) Connect sensor wire to harness connector.

HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The HCU consists of a valve body, pump motor, and wire harness.

OPERATION

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the CAB.

HCU (HYDRAULIC CONTROL UNIT) (Continued)

The valves modulate brake pressure during antilock braking and are controlled by the CAB.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure increase, pressure hold, and pressure decrease. The valves are all contained in the valve body portion of the HCU.

PRESSURE DECREASE

The outlet valve is opened and the inlet valve is closed during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the CAB closes the inlet then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the CAB closes the outlet valve and begins a pressure increase or hold cycle as needed.

PRESSURE HOLD

Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE INCREASE

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

REMOVAL

(1) Install prop rod on the brake pedal to keep pressure on the brake system.

(2) Remove negative battery cable from the battery.

(3) Pull up on the CAB harness connector release (Fig. 8)and remove connector.

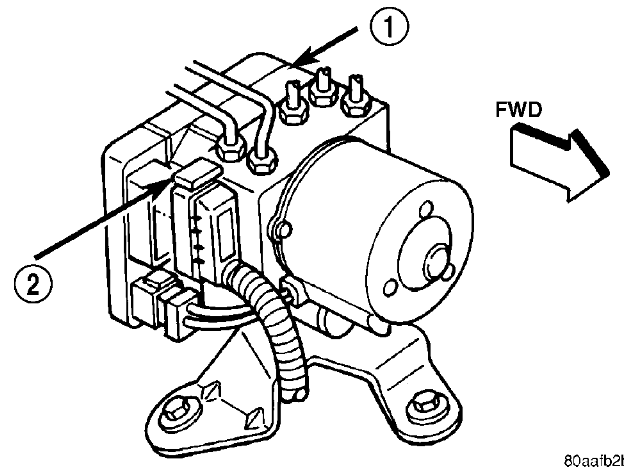

Fig. 8 CAB Harness Connector Release

1 - CAB
2 - CAB HARNESS RELEASE

(4) Remove brake lines from the HCU.

(5) Remove HCU/CAB mounting nuts and bolt (Fig. 9) and remove HCU/CAB.

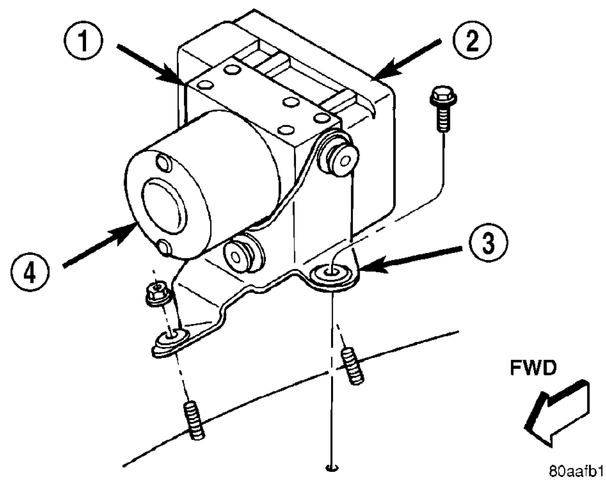

Fig. 9 HCU/CAB Mounting

1 - HCU
2 - CAB
3 - HCU/CAB BRACKET
4 - MOTOR

INSTALLATION

NOTE: If the CAB is being replaced with a new CAB is must be reprogrammed with the use of a DRB III.

(1) Install HCU/CAB on the mounting studs.

(2) Install mounting nuts and bolt. Tighten to 11.5 N·m (102 in. lbs.).

(3) Install brake lines to the HCU and tighten to 19 N·m (170 in. lbs.).

(4) Install wiring harness connector to the CAB and push down on the release to secure the connector.

(5) Install negative battery cable to the battery.

(6) Bleed ABS brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

CLUTCH

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CLUTCH

WARNING

WARNING: Exercise care when servicing clutch components. Factory installed clutch discs do not contain asbestos fibers. Dust and dirt on clutch parts may contain asbestos fibers from aftermarket components. Breathing excessive concentrations of these fibers can cause serious bodily harm. Wear a respirator during service and never clean clutch components with compressed air or with a dry brush. Either clean the components with water dampened rags or use a vacuum cleaner specifically designed to remove asbestos fibers and dust. Do not create dust by sanding a clutch discs. Replace the disc if the friction material is damaged. Dispose of all dust and dirt containing asbestos fibers in sealed bags or containers. This will minimize exposure to yourself and to others. Follow all recommended safety practices prescribed by the occupational safety and health administration (OSHA) and the environmental safety agency (EPA), for the handling and disposal of products containing asbestos. Failure to follow these instructions may result in personal injury or death

DIAGNOSIS AND TESTING

Drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If the clutch chatters, grabs, slips or does not release properly, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed as the transmission or another driveline component may be at fault.

NOTE: Vehicles equipped with a Dual Mass Flywheel may produce a rattle when the engine is shut off. This noise is considered normal.

CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, water or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab. Inspect components for oil, hydraulic fluid or water/road splash contamination.

Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Clutch fluid leaks are usually from damaged slave cylinder push rod seals. Heat buildup caused by slippage between the pressure plate, disc and flywheel can bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination is dirt/water entering the clutch housing due to loose bolts, housing cracks. Driving through deep water puddles can force water/road splash into the housing through such openings.

IMPROPER RELEASE OR CLUTCH ENGAGEMENT

Clutch release or engagement problems are caused by wear or damage clutch components. A visual inspection of the release components will usually reveal the problem part.

CLUTCH (Continued)

Release problems can result in hard shifting and noise. Look for leaks at the clutch cylinders and interconnecting line and loose slave cylinder bolts. Also worn/loose release fork, pivot stud, clutch disc, pressure plate or release bearing.

Engagement problems can result in slip, chatter/ shudder and noisy operation. The causes may be clutch disc contamination, wear, distortion or flywheel damage. Visually inspect to determine the actual cause of the problem.

CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

PRESSURE PLATE AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if runout is excessive.

Check condition of the clutch before installation. A warped cover or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc.

Use an alignment tool when positioning the disc on the flywheel. The tool prevents accidental misalignment which could result in cover distortion and disc damage.

A frequent cause of clutch cover distortion (and consequent misalignment) is improper bolt tightening.

FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

DIAGNOSIS CHART

The diagnosis charts Diagnosis Chart describe common clutch problems, causes and correction. Conditions, causes and corrective action are outlined in the indicated columns.

CLUTCH (Continued)

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc facing worn out	1. Normal wear.	1. Replace cover and disc.
	2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear.	2. Replace cover and disc.
	3. Insufficient clutch cover diaphragm spring tension.	3. Replace cover and disc.
Clutch disc facing contaminated with oil, grease, or clutch fluid.	1. Leak at rear main engine seal or transmission input shaft seal.	1. Replace appropriate seal.
	2. Excessive amount of grease applied to the input shaft splines.	2. Remove grease and apply the correct amount of grease.
	3. Road splash, water entering housing.	3. Replace clutch disc. Clean clutch cover and reuse if in good condition.
	4. Slave cylinder leaking.	4. Replace hydraulic clutch linkage.
Clutch is running partially disengaged.	1. Release bearing sticking or binding and does not return to the normal running position.	1. Verify failure. Replace the release bearing and transmission front bearing retainer as necessary.
Flywheel below minimum thickness specification.	1. Improper flywheel machining. Flywheel has excessive taper or excessive material removal.	1. Replace flywheel.
Clutch disc, cover and/or diaphragm spring warped or distorted.	1. Rough handling. Impact bent cover, spring, or disc.	1. Replace disc or cover as necessary.
	2. Improper bolt tightening procedure.	2. Tighten clutch cover using proper procedure.
Facing on flywheel side of disc torn, gouged, or worn.	1. Flywheel surface scored or nicked.	2. Correct surface condition if possible. Replace flywheel and disc as necessary.
	2. Clutch disc sticking or binding on transmission input shaft.	2. Lubricate splines with high temperature graese.
Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed.	1. Frequent operation under high loads or hard acceleration conditions.	1. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
	2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	2. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.

CLUTCH (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Clutch disc binds on input shaft splines.	1. Clutch disc hub splines damaged during installation.	1. Clean, smooth, and lubricate hub splines if possible. Replace disc if necessary.
	2. Input shaft splines rough, damaged, or corroded.	2. Clean, smooth, and lubricate shaft splines if possible. Replace input shaft if necessary.
Clutch disc rusted to flywheel and/or pressure plate.	1. Clutch not used for and extended period of time (e.g. long term vehicle storage).	1. Sand rusted surfaces with 180 grit sanding paper. Replace clutch cover and flywheel if necessary.
Pilot bearing seized, loose, or rollers are worn.	1. Bearing cocked during installation.	1. Install and lubricate a new bearing.
	2. Bearing defective.	2. Install and lubricate a new bearing.
	3. Bearing not lubricated.	3. Install and lubricate a new bearing.
	4. Clutch misalignment.	4. Inspect clutch and correct as necessary. Install and lubricate a new bearing.
Clutch will not disengage properly.	1. Low clutch fluid level.	1. Replace hydraulic linkage assembly.
	2. Clutch cover loose.	2. Follow proper bolt tightening procedure.
	3. Clutch disc bent or distorted.	3. Replace clutch disc.
	4. Clutch cover diaphragm spring bent or warped.	4. Replace clutch cover.
	5. Clutch disc installed backwards.	5. Remove and install clutch disc correctly.
	6. Release fork bent or fork pivot loose or damaged.	6. Replace fork or pivot as necessary.
	7. Clutch master or slave cylinder failure.	7. Replace hydraulic linkage assembly.
Clutch pedal squeak.	1. Pivot pin loose.	1. Tighten pivot pin if possible. Replace clutch pedal if necessary.
	2. Master cylinder bushing not lubricated.	2. Lubricate master cylinder bushing.
	3. Pedal bushings worn out or cracked.	3. Replace and lubricate bushings.
Clutch master or slave cylinder plunger dragging andør binding	1. Master or slave cylinder components worn or corroded.	1. Replace clutch hydraulic linkage assembly.
Release bearing is noisy.	1. Release bearing defective or damaged.	1. Replace release bearing.

CLUTCH (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Contact surface of release bearing damaged.	1. Clutch cover incorrect or release fingers bent or distorted. 2. Release bearing defective or damaged. 3. Release bearing misaligned.	1. Replace clutch cover and release bearing. 2. Replace the release bearing. 3. Check and correct runout of clutch components. Check front bearing sleeve for damage/ alignment. Repair as necessary.
Partial engagement of clutch disc. One side of disc is worn and the other side is glazed and lightly worn.	1. Clutch pressure plate position incorrect. 2. Clutch cover, spring, or release fingers bent or distorted. 3. Clutch disc damaged or distorted. 4. Clutch misalignment.	1. Replace clutch disc and cover. 2. Replace clutch disc and cover. 2. Replace clutch disc. 4. Check alignment and runout of flywheel, disc, pressure plate, andør clutch housing. Correct as necessary.

SPECIFICATIONS

CLUTCH

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Clutch Cover Bolts - 2.4L	31	23	-
Clutch Cover Bolts - 4.0L	50	37	-
Clutch Cylinder Bolts	23	-	200
Clutch Housing to Engine Bolts	75	55	-
Clutch Housing to Trans Bolts	46	34	-
Dust Shield Bolts	50	37	-
Flywheel Bolts - 2.4L	95	70	-
Flywheel Bolts - 4.0L	142	105	-
Crossmember Frame Bolts	41	30	-

CLUTCH DISC

REMOVAL

(1) Remove transmission.
(2) Mark position of pressure plate on flywheel for installation reference, if original pressure plate will be reused.
(3) Remove pressure plate bolts and remove cover and disc (Fig. 1).

CAUTION: If original pressure plate will be reused, loosen cover bolts evenly in rotation to relieve spring tension equally. Failure to heed caution may result in damage.

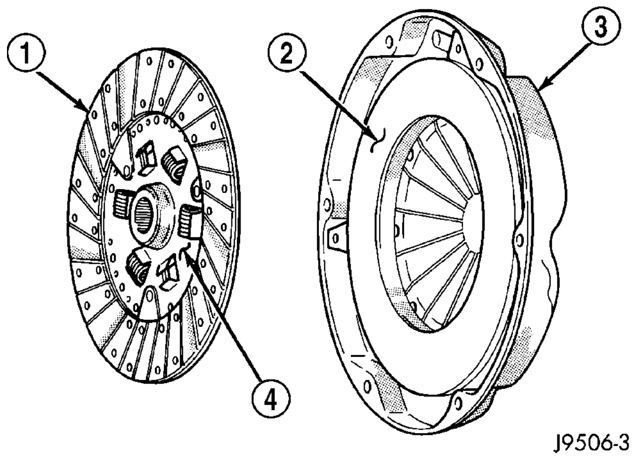


Fig. 1 CLUTCH DISC AND PRESSURE PLATE

1 - DISC
2 - PRESSURE PLATE
3 - PRESSURE PLATE COVER
4 - "FLYWHEEL SIDE" STAMPED ON THIS SURFACE

INSTALLATION

(1) Lightly sand flywheel face with 180 grit emery cloth. Then clean surface with a wax and grease remover.
(2) Lubricate pilot bearing with Mopar high temperature bearing grease.
(3) Position clutch disc on flywheel with side marked flywheel positioned against flywheel.

NOTE: If disc is not marked, flat side of disc hub goes towards the flywheel.

(4) Insert alignment tool through disc and into the pilot bearing on the flywheel (Fig. 2).

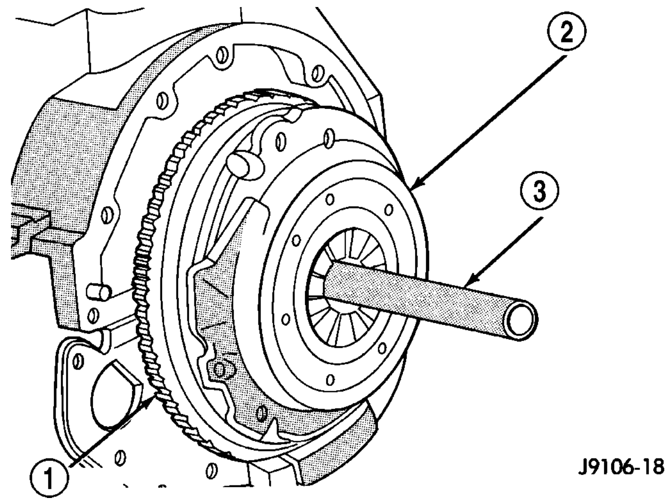


Fig. 2 ALIGNING CLUTCH DISC

1 - FLYWHEEL
2 - PRESSURE PLATE AND DISC
3 - ALIGNMENT TOOL

(5) Position pressure plate over disc and on flywheel (Fig. 2).

NOTE: Align reference marks if pressure plate is reused.

(6) Install clutch cover bolts finger tight.
(7) Tighten cover bolts evenly and in rotation a few threads at a time. Tightening bolts to:
- 2.5L Engine - 31 N·m (23 ft. lbs.)
- 4.0L Engine - 50 N·m (37 ft. lbs.)

CAUTION: Cover bolts must be tightened evenly and to specified torque. Failure to heed caution may result in damage.

(8) Lightly coat clutch disc hub and transmission input shaft splines with Mopar high temperature bearing grease or equivalent.

CAUTION: Over lubricating shaft splines will result in grease contamination of disc. Failure to heed caution may result in damage.

(9) Install transmission.

CLUTCH RELEASE BEARING

REMOVAL

(1) Remove transmission.

(2) Disconnect release bearing from release lever and remove bearing (Fig. 3).

(3) Inspect bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn or cracked.

(4) Inspect release fork and fork pivot. Verify pivot is secure and in good condition, fork is not distorted or worn and retainer spring is not bent or damaged.

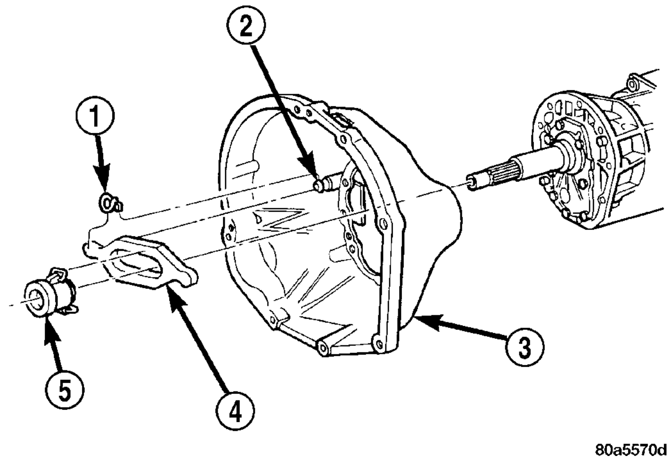


Fig. 3 RELEASE BEARING

1 - RETAINER SPRING
2 - PIVOT BALL STUD
3 - CLUTCH HOUSING
4 - RELEASE FORK
5 - RELEASE BEARING

INSTALLATION

(1) Lubricate crankshaft pilot bearing, input shaft splines, bearing retainer slide surface, fork pivot and release fork pivot surface. Lubricate with Mopar high temperature bearing grease or equivalent.

(2) Install new release bearing. Verify bearing is properly secured to release fork.

(3) Install transmission.

FLYWHEEL

DESCRIPTION

STANDARD FLYWHEEL

The standard flywheel is used on the 4.0L engine. The flywheel (Fig. 4) is a heavy plate bolted to the rear of the crankshaft. The flywheel incorporates the ring gear to mesh with the starter. The rear face of the flywheel serves as the driving member to the clutch disc.

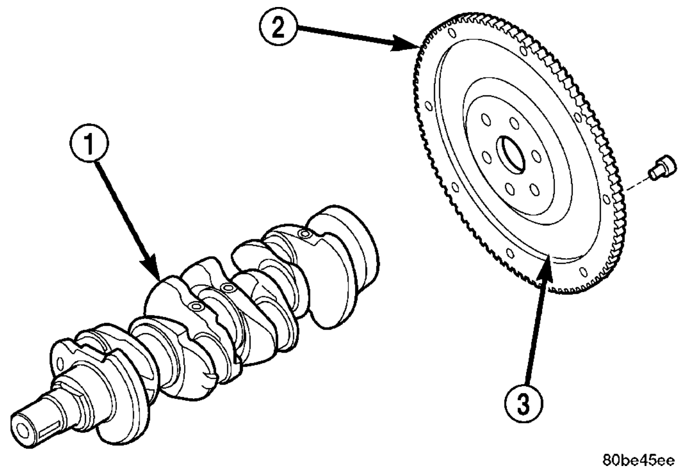


Fig. 4 FLYWHEEL

1 - CRANKSHAFT
2 - RING GEAR
3 - FLYWHEEL

DUAL MASS FLYWHEEL

The Dual Mass Flywheel is used on the 2.4L engine (Fig. 5). The flywheel incorporates the ring gear to mesh with the starter. The primary flywheel side is bolted to the crankshaft. The secondary flywheel face serves as the driving member to the clutch disc. Internal springs between the flywheels are use to dampen energy.

OPERATION

The flywheel serves to dampen the engine firing pulses. The heavy weight of the flywheel relative to the rotating mass of the engine components serves to stabilize the flow of power to the remainder of the drivetrain. The crankshaft has the tendency to attempt to speed up and slow down in response to the cylinder firing pulses. The flywheel dampens these impulses by absorbing energy when the crankshaft speeds and releasing the energy back into the system when the crankshaft slows down.

On a Dual Mass Flywheel the additional secondary mass coupled to the transmission lowers the natural frequency of the transmission rotating elements. This decreases the transmission gear rattle. The damper springs between the two flywheel masses replace the clutch disc damper springs and assist in a smooth transfer of torque to the transmission.

CAUTION: The Dual Mass Flywheel is serviced as an assembly only and should never be taken apart. Failure to heed caution may result in damage.

DIAGNOSIS AND TESTING

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of

FLYWHEEL (Continued)

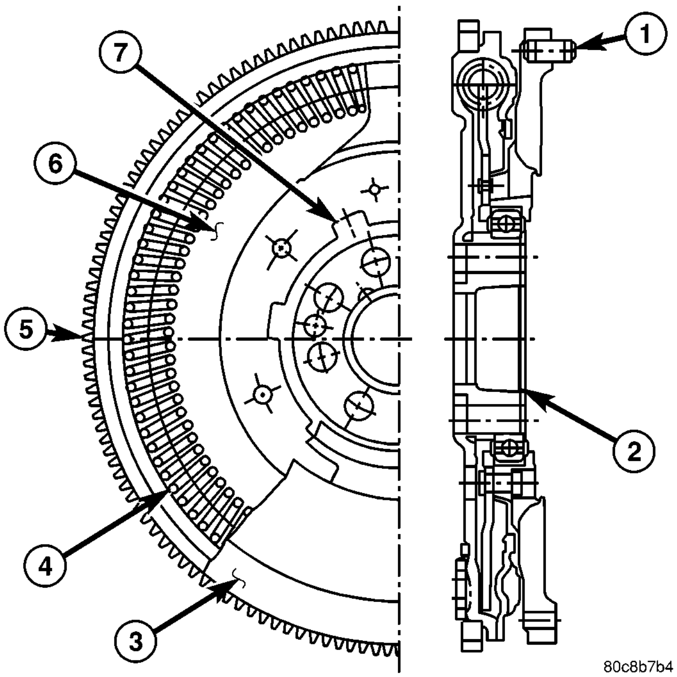


Fig. 5 DUAL MASS FLYWHEEL

1 - LOCATING STUD
2 - BEARING
3 - SECONDARY FLYWHEEL
4 - DAMPER SPRING
5 - RING GEAR
6 - PRIMARY FLYWHEEL
7 - FRICTION DISC

the flywheel face with a dial indicator. Mount the indicator on a stud installed in place of one of the flywheel bolts.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. Minor flywheel scoring can be cleaned up by hand with 180 grit emery or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar Lock And Seal or equivalent. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

PILOT BEARING

REMOVAL

(1) Remove transmission.
(2) Remove pressure plate and clutch disc.
(3) Remove pilot bearing with an internal (blind hole) puller.

INSTALLATION

(1) Lubricate new bearing with Mopar high temperature bearing grease or equivalent.
(2) Start new bearing into crankshaft by hand. Then seat bearing with clutch alignment tool (Fig. 6).

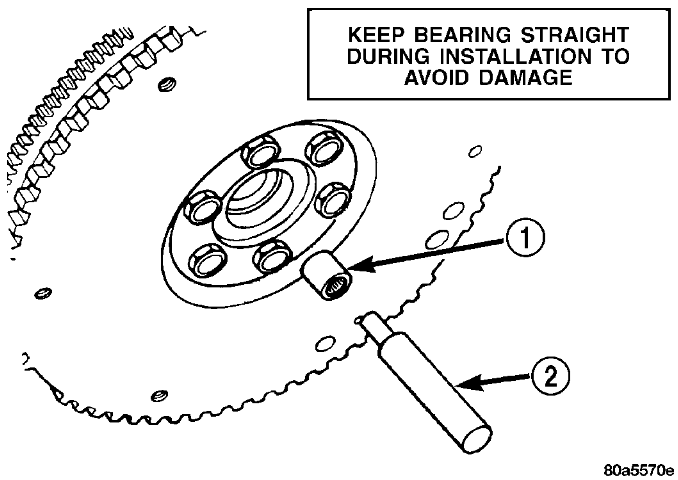


Fig. 6 PILOT BEARING INSTALLER

1 - PILOT BEARING
2 - ALIGNMENT TOOL

(3) Lightly scuff sand flywheel surface with 180 grit emery cloth. Then clean surface with wax and grease remover.
(4) Install clutch disc and pressure plate.
(5) Install transmission.

LINKAGE

REMOVAL

NOTE: Clutch master cylinder, slave cylinder and connecting line are serviced as an assembly only. Components cannot be overhauled or serviced separately. Cylinders and connecting line are sealed units.

Removal/installation procedures for right and left hand drive models are basically the same.

LINKAGE (Continued)

(1) With vehicle in neutral, position vehicle on hoist

(2) Remove fasteners attaching slave cylinder to clutch housing.

(3) Remove slave cylinder from clutch housing (Fig. 7).

(4) Disengage clutch fluid line from body clips.

(5) Lower vehicle.

(6) Verify clutch master cylinder reservoir cap is tight.

(7) Remove clutch master cylinder attaching nuts (Fig. 7) or (Fig. 8).

(8) Disengage captured bushing on clutch master cylinder actuator from pivot pin on pedal arm.

(9) Slide actuator off pivot pin.

(10) Disconnect clutch interlock safety switch wires.

(11) Remove clutch hydraulic linkage through engine compartment.

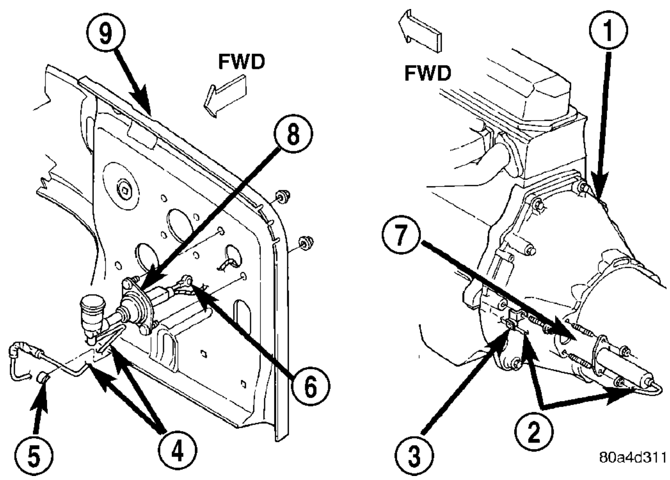


Fig. 7 CLUTCH LINKAGE - LHD

1 - CLUTCH HOUSING
2 - FLUID LINE
3 - BRACKET
4 - FLUID LINE
5 - CLIP
6 - CAPTURED BUSHING
7 - CLUTCH SLAVE CYLINDER
8 - CLUTCH MASTER CYLINDER
9 - DASH PANEL

INSTALLATION

NOTE: Clutch master cylinder, slave cylinder and connecting line are serviced as an assembly only. Components cannot be overhauled or serviced separately. Cylinders and connecting line are sealed units.

Removal/installation procedures for right and left hand drive models are basically the same.

(1) Tighten clutch master cylinder cap.

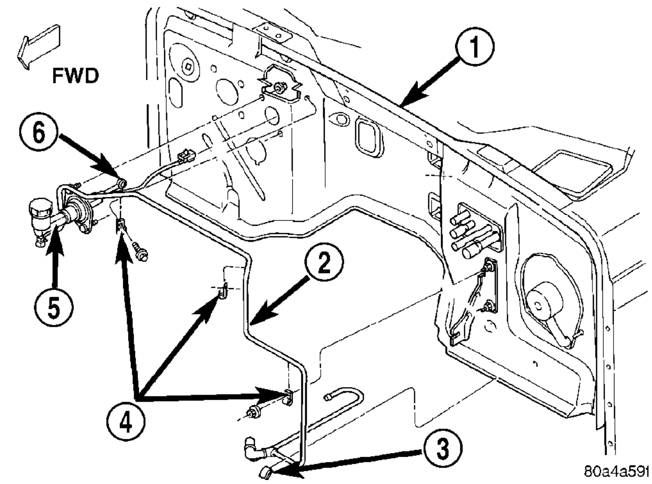


Fig. 8 CLUTCH LINKAGE - RHD

1 - DASH PANEL
2 - FLUID LINE
3 - CLIP
4 - HOLD DOWN STRAP
5 - CLUTCH MASTER CYLINDER
6 - CAPTURED BUSHING

(2) Position connecting line and slave cylinder downward past engine and next to clutch housing.

(3) Position clutch master cylinder on dash panel.

(4) Install clutch master cylinder actuator on clutch pedal pivot pin.

(5) Install clutch master cylinder and tighten nuts to 38 N·m (28 ft. lbs.).

(6) Insert slave cylinder push rod through clutch housing opening and into release lever. Be sure cap on end of rod is securely engaged in lever. Check this before installing cylinder attaching nuts.

(7) Install slave cylinder and tighten nuts to 23 N·m (17 ft. lbs.).

(8) Secure clutch fluid line in body and transmission clips.

(9) Connect clutch interlock safety switch wires.

MASTER CYLINDER

INSPECTION

The clutch fluid reservoir, master cylinder, slave cylinder and fluid lines are pre-filled at the factory. The hydraulic system should not require additional fluid under normal circumstances. The reservoir fluid level increases as clutch wear occurs.

CAUTION: Do not overfill or removing fluid from the reservoir. Failure to heed caution may result in damage.

Wipe reservoir and cover clean. Remove cap and diaphragm, fluid level should not be above indicator ring located on the outside of the reservoir.

CLUTCH PEDAL

REMOVAL

(1) Remove steering column lower cover and knee blocker for access.

(2) Disconnect clutch pedal position switch wires.

(3) Disengage captured bushing lock tabs attaching clutch master cylinder actuator to pedal pivot (Fig. 9) or (Fig. 10).

(4) Remove nuts attaching pedal and bracket to dash panel and upper cowl support (Fig. 9) or (Fig. 10).

(5) Separate pedal assemble from vehicle.

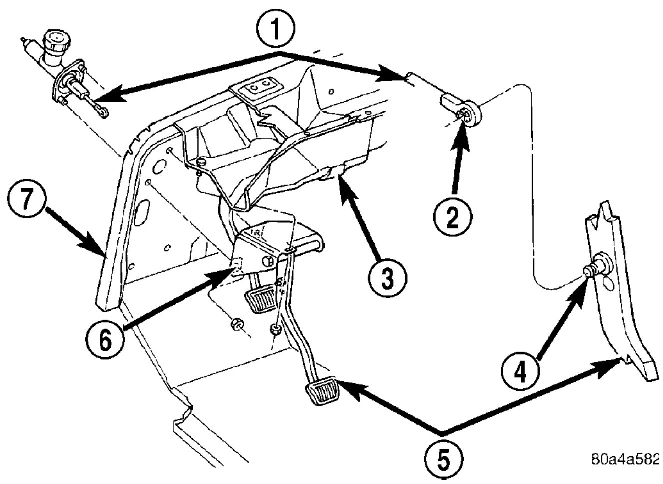


Fig. 9 CLUTCH PEDAL MOUNTING - LHD

1 - CLUTCH CYLINDER ACTUATOR
2 - CAPTURED BUSHING
3 - UPPER COWL SUPPORT
4 - PIVOT
5 - CLUTCH PEDAL
6 - BRACKET
7 - DASH PANEL

INSTALLATION

(1) Place clutch pedal and bracket over studs on dash panel and cowl support. Install nuts and tighten to 39 N·m (29 ft. lbs.).

(2) Engage captured bushing and actuator on brake pedal pivot.

(3) Connect clutch pedal position switch wires.

CLUTCH PEDAL POSITION SWITCH

DESCRIPTION

The Clutch Pedal Position Switch (CPPS) is located under the instrument panel, attached to the clutch master cylinder push rod (Fig. 11). The wiring harness connector is inside of the vehicle under the left side of the instrument panel (Fig. 12).

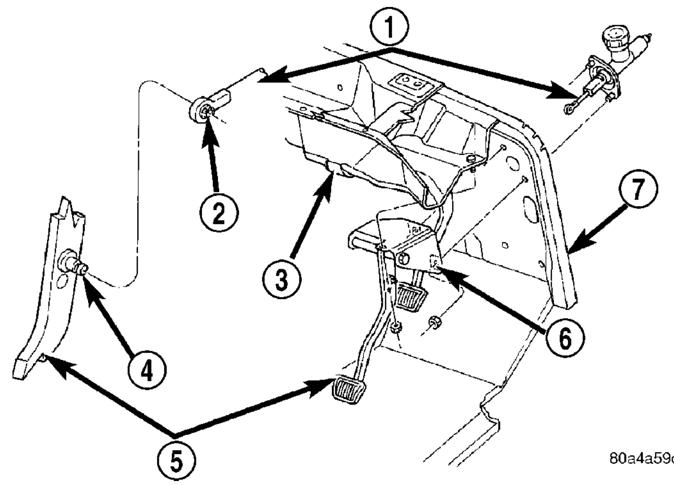


Fig. 10 CLUTCH PEDAL MOUNTING - RHD

1 - CLUTCH CYLINDER ACTUATOR
2 - CAPTURED BUSHING
3 - UPPER COWL SUPPORT
4 - PIVOT
5 - CLUTCH PEDAL
6 - BRACKET
7 - DASH PANEL

NOTE: Switch is serviced with clutch master cylinder only.

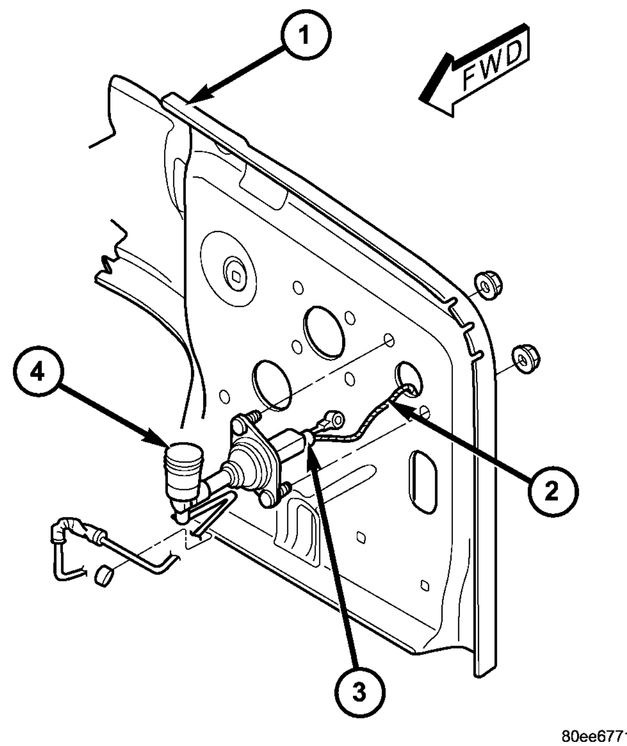


Fig. 11 CLUTCH PEDAL POSITION SWITCH (CPPS)

1 - INSTRUMENT PANEL
2 - SWITCH WIRING HARNESS
3 - CLUTCH PEDAL POSITION SWITCH
4 - CLUTCH MASTER CYLINDER

CLUTCH PEDAL POSITION SWITCH (Continued)

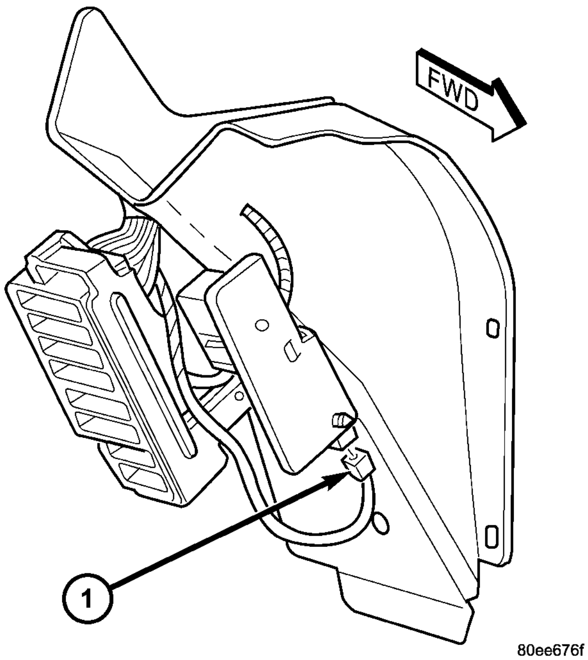


Fig. 12 CPPS ELECTRICAL CONNECTION

1 - CPPS CONNECTION TO MAIN HARNESS

OPERATION

The clutch pedal position switch is used to prevent starter motor engagement unless the clutch pedal is depressed. An input from this switch is also used to either shut down/prevent operation of the speed control system when pedal is depressed.

DIAGNOSIS AND TESTING

(1) Disconnect 2-wire switch connector under instrument panel (Fig. 13).

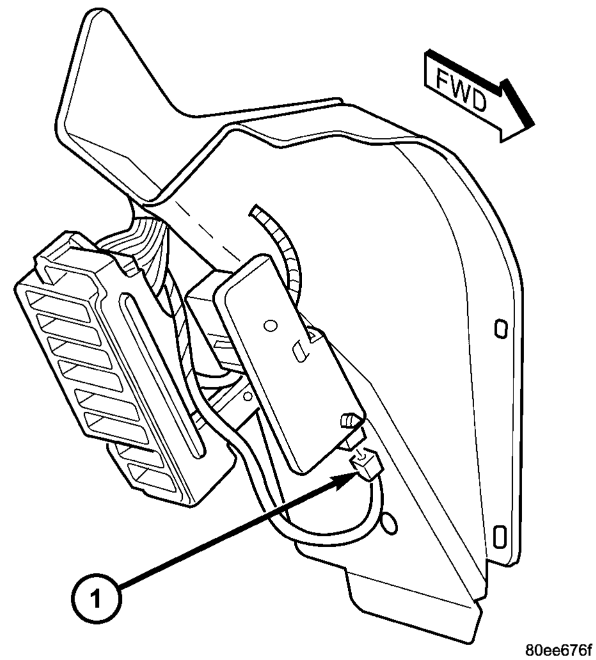


Fig. 13 CPPS ELECTRICAL CONNECTION

1 - CPPS CONNECTION TO MAIN HARNESS

(2) Check switch continuity with an ohmmeter while operating clutch pedal.

- Pedal Depressed - Continuity
- Pedal Released - No Continuity

(3) If continuity is not present or always present, replace clutch master cylinder. Switch is not serviced separately.

COOLING

TABLE OF CONTENTS

COOLING

DESCRIPTION

DESCRIPTION - COOLING SYSTEM 2.4L ENGINE

The cooling system consists of the following items:
- Electric cooling fan - Standard.
- Radiator
- Hot bottle pressure cap
- Thermostat
- Coolant reserve/overflow system
- Radiator in-tank transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps

DESCRIPTION - 4.0L ENGINE

The cooling system (Fig. 1) is designed to maintain engine temperature at an efficient level during all engine operating conditions.

The components of the cooling system are:
- A heavy duty radiator
- Cooling fan (mechanical)
- Thermal viscous fan drive
- Fan shroud
- Radiator pressure cap

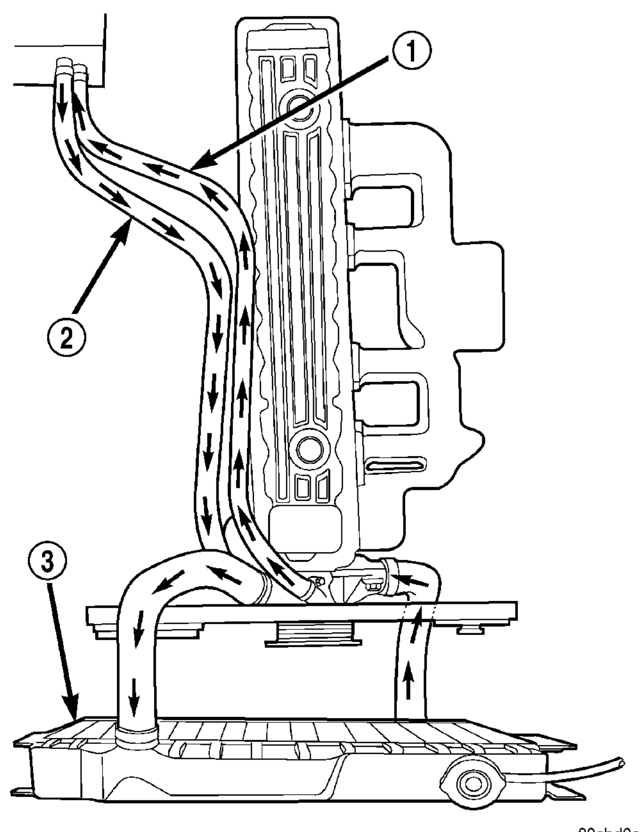


Fig. 1 Coolant Circulation - 4.0L Engine

1 - FROM THERMOSTAT
2 - TO WATER PUMP
3 - RADIATOR

COOLING (Continued)

- Thermostat
- Coolant reserve/overflow system
- Automatic transmission oil cooler (internal to radiator)
- Coolant
- Water pump
- Coolant hoses and clamps

DESCRIPTION - HOSE CLAMPS

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 2).

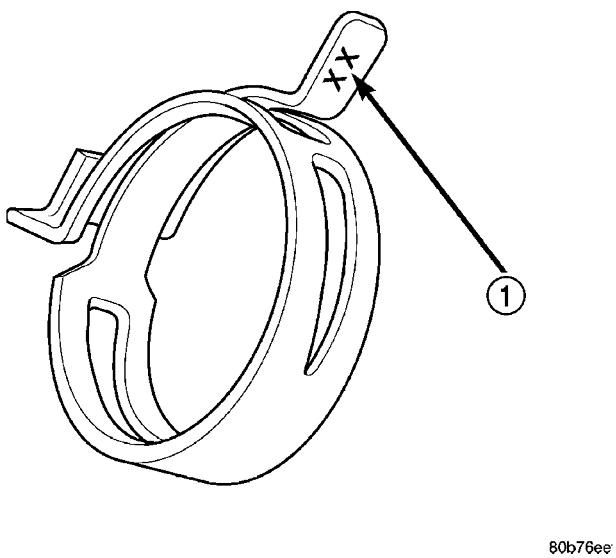


Fig. 2 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

OPERATION - HOSE CLAMPS

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, use Special Tool 6094 or equivalent, constant tension clamp pliers (Fig. 3) to compress the hose clamp.

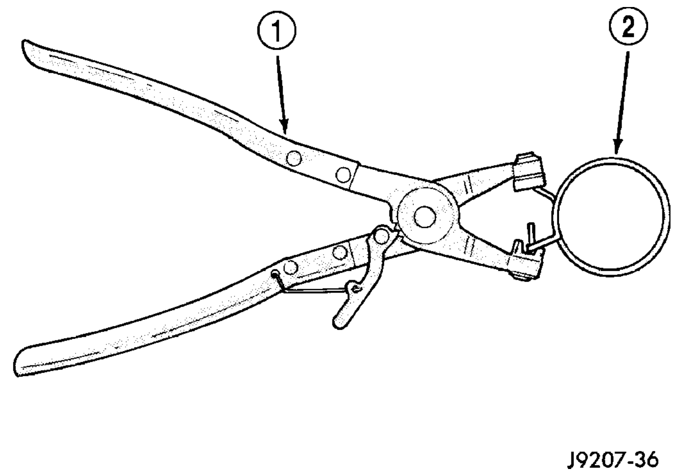


Fig. 3 Hose Clamp Tool

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

DIAGNOSIS AND TESTING

ON-BOARD DIAGNOSTICS - OBD

COOLING SYSTEM RELATED DIAGNOSTICS

The Powertrain Control Module (PCM) has been programmed to monitor the certain following cooling system components:

- If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) can be set.
- If an open or shorted condition has developed in the relay circuit controlling the electric radiator fan, a Diagnostic Trouble Code (DTC) can be set.

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician.

ACCESSING DIAGNOSTIC TROUBLE CODES

To read DTC's and to obtain cooling system data, (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION).

DIAGNOSIS AND TESTING - PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

- Prolonged idle
- Very high ambient temperature
- Slight tail wind at idle
- Slow traffic
- Traffic jams
- High speed or steep grades

Driving techniques that avoid overheating are:

COOLING (Continued)

• Idle with A/C off when temperature gauge is at end of normal range.
• Increasing engine speed for more air flow is recommended.

TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

• Engine adjustments (incorrect timing)
• Slipping engine accessory drive belt(s)
• Brakes (possibly dragging)
• Changed parts. Incorrect water pump or pump rotating in wrong direction due to belt not correctly routed
• Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to COOLING SYSTEM DIAGNOSIS CHART BELOW.

These charts are to be used as a quick-reference only. Refer to COOLING SYSTEM DIAGNOSIS CHART

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat?	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for On-Board Diagnostics and DTC information. Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. (Refer to 8 - ELECTRICAL/ INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL) Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/ENGINE TEMPERATURE GAUGE - DESCRIPTION). Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank or degas bottle and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and CAUTIONS associated with removing the radiator cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING) for procedures.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. Refer to Possible Causes (2-18).
	2. Is the temperature gauge reading correctly?	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL). Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. (Refer to 8 - ELECTRICAL/ INSTRUMENT CLUSTER - SCHEMATIC - ELECTRICAL).
	4. Coolant low in coolant reserve/ overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6.	5. Tighten cap
	6. Poor seals at the radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary. (b) Check condition of radiator filler neck or degas bottle. If neck is bent or damaged, replace radiator or degas bottle.
	7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools	7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary. (b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator. (c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary. (d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.
	8. Incorrect coolant concentration	8. Check coolant. (Refer to LUBRICATION & MAINTENANCE/ FLUID TYPES - DESCRIPTION).

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	9. Coolant not flowing through system	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. (Refer to 7 - COOLING - STANDARD PROCEDURE).
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	12. Fuel or ignition system problems.	12. Refer to 14 - Fuel System or 8 - Electrical for diagnosis and testing procedures.
	13. Dragging brakes.	13. Check and correct as necessary. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING) for correct procedures.
	14. Bug screen or cardboard is being, reducing airflow.	14. Remove bug screen or cardboard.
	15. Thermostat partially or completely shut.	15. Check thermostat operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).
	16. Viscous fan drive not operating properly.	16. Check fan drive operation and replace as necessary. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL) .
	17. Cylinder head gasket leaking.	17. Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	18. Heater core leaking.	18. Check heater core for leaks. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING). Repair as necessary.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTANT (FLUCTUATES, CYCLES, OR IS ERRATIC	1. During cold weather operation, with the heater in the high position, the gauge reading may drop slightly.	1. A normal condition. No correction is necessary.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair if necessary. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)	3. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.
	4. Gauge reading high after re-starting a warmed up (hot) engine.	4. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	5. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	6. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	6. (a) Check for cylinder head gasket leaks. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
		(b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary. (Refer to 7 - COOLING/ ENGINE/WATER PUMP - REMOVAL).
	8. Loose accessory drive belt. (water pump slipping)	8. (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING). Check and correct as necessary.
	9. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. (Refer to 7 - COOLING/ ENGINE/RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace cap as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating.	1. Check reason for overheating and repair as necessary.
	2. Freeze point of coolant not correct. Mixture is too rich or too lean.	2. Check coolant concentration. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/ overflow system.	1. (a) Radiator cap relief valve stuck. (Refer to 7 - COOLING/ENGINE/ RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING). Replace if necessary
		(b) Hose between coolant reserve/ overflow tank and radiator is kinked. Repair as necessary.
		(c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary.
		(d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose.	1. Replace fan blade assembly. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.
	4. Thermal viscous fan drive has defective bearing.	4. Replace fan drive. Bearing is not serviceable. (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
	5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	5. (Refer to 7 - COOLING/ENGINE/ FAN DRIVE VISCOUS CLUTCH - DESCRIPTION) for an explanation of normal fan noise.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a Diagnostic trouble Code (DTC) been set?	1. (Refer to 25 - EMISSIONS CONTROL - DESCRIPTION) for correct procedures and replace thermostat if necessary
	2. Coolant level low	2. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	3. Obstructions in heater hose/fittings	3. Remove heater hoses at both ends and check for obstructions
	4. Heater hose kinked	4. Locate kinked area and repair as necessary
	5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	5. (Refer to 7 - COOLING/ENGINE/ WATER PUMP - REMOVAL). If a slipping belt is detected, (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - DIAGNOSIS AND TESTING). If heater core obstruction is detected, (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/HEATER CORE - REMOVAL).
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION). Adjust coolant mixture as necessary.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM - TESTING FOR LEAKS

ULTRAVIOLET LIGHT METHOD

All Jeep models have a leak detection additive added to the cooling system before they leave the factory. The additive is highly visible under ultraviolet light (black light). If the factory original coolant has been drained, pour one ounce of additive into the cooling system. The additive is available through the parts department. Place the heater control unit in HEAT position. Start and operate the engine until the radiator upper hose is warm to the touch. Aim the commercially available black light tool at the components to be checked. If leaks are present, the black light will cause the additive to glow a bright green color.

The black light can be used along with a pressure tester to determine if any external leaks exist (Fig. 4).

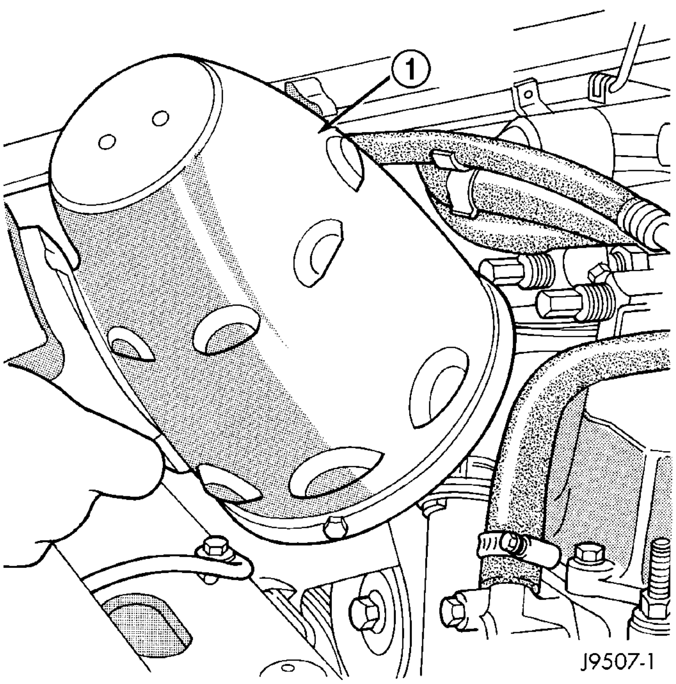


Fig. 4 Leak Detection Using Black Light—Typical

1 - TYPICAL BLACK LIGHT TOOL

PRESSURE TESTER METHOD

The engine should be at the normal operating temperature. Recheck the system cold if the cause of coolant loss is not located during warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove the radiator pressure cap from the filler neck and check the coolant level. Push down on the cap to disengage it from the stop tabs. Wipe the inner part of the filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect the reserve/overflow tank tube for internal obstructions. Insert a wire through the tube to be sure it is not obstructed.

Inspect the cams on the outside part of the filler neck. If the cams are bent, seating of pressure cap valve and tester seal will be affected. Replace cap if cams are bent.

Attach pressure tester 7700 (or an equivalent) to the radiator filler neck (Fig. 5).

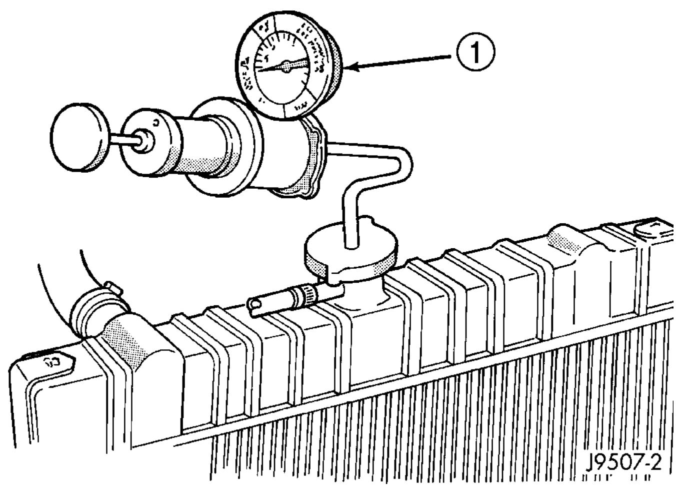


Fig. 5 Pressurizing System - Typical

1 - TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate the tester pump to apply 124 kPa (18 psi) pressure to the system. If the hoses enlarge excessively or bulge while testing, replace as necessary. Observe the gauge pointer and determine the condition of the cooling system according to the following criteria:

- Holds Steady: If the pointer remains steady for two minutes, there are no serious coolant leaks in the system. However, there could be an internal leak that does not appear with normal system test pressure. Inspect for interior leakage or do the Internal Leakage Test. Do this if it is certain that coolant is being lost and no leaks can be detected.
- Drops Slowly: Shows a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect the radiator, hoses, gasket edges and heater. Seal any small leak holes with a Sealer Lubricant or equivalent. Repair leak holes and reinspect the system with pressure applied.
- Drops Quickly: Shows that a serious leakage is occurring. Examine the system for serious external leakage. If no leaks are visible, inspect for internal

COOLING (Continued)

leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove the engine oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier than engine oil, will drain first. Another way of testing is to operate the engine and check for water globules on the engine oil dipstick. Also inspect the automatic transmission oil dipstick for water globules. Inspect the automatic transmission fluid cooler for leakage. Operate the engine without the pressure cap on the radiator until thermostat opens.

Attach a pressure tester to the filler neck. If pressure builds up quickly, a leak exists as a result of a faulty cylinder head gasket or crack in the engine. Repair as necessary.

WARNING: DO NOT ALLOW PRESSURE TO EXCEED 124 KPA (18 PSI). TURN THE ENGINE OFF. TO RELEASE THE PRESSURE, ROCK THE TESTER FROM SIDE TO SIDE. WHEN REMOVING THE TESTER, DO NOT TURN THE TESTER MORE THAN 1/2 TURN IF THE SYSTEM IS UNDER PRESSURE.

If there is no immediate pressure increase, pump the pressure tester until the indicated pressure is within the system range. Vibration of the gauge pointer indicates compression or combustion leakage into the cooling system.

WARNING: DO NOT DISCONNECT THE SPARK PLUG WIRES WHILE THE ENGINE IS OPERATING.

CAUTION: Do not operate the engine with a spark plug shorted for more than a minute. The catalytic converter may be damaged.

Isolate the compression leak by shorting each spark plug to the cylinder block. The gauge pointer should stop or decrease vibration when spark plug for leaking cylinder is shorted. This happens because of the absence of combustion pressure.

COMBUSTION LEAKAGE TEST (WITHOUT PRESSURE TESTER)

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Remove thermostat (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL).

Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

Add coolant to the radiator to bring the level to within 6.3 mm (1/4 in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate boil over of coolant.

Start the engine and accelerate rapidly three times (to approximately 3000 rpm) while observing the coolant. If internal engine combustion gases are leaking into the cooling system, bubbles will appear in the coolant. If bubbles do not appear, there is no internal combustion gas leakage.

DIAGNOSIS AND TESTING - RADIATOR COOLANT FLOW CHECK

The following procedure will determine if coolant is flowing through the cooling system.

If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If hose is hot, the thermostat is open and water is circulating through cooling system.

STANDARD PROCEDURE

STANDARD PROCEDURE - DRAINING COOLING SYSTEM - 2.4L

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS (Fig. 6) OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) DO NOT remove radiator cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

NOTE: Radiator draincock is located on the left/lower side of radiator facing to rear of vehicle.

(2) Attach one end of a hose to the draincock. Put the other end into a clean container. Open draincock and drain coolant from radiator. This will empty the coolant reserve/overflow tank. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture. When tank is

COOLING (Continued)

empty, remove radiator cap and continue draining cooling system.

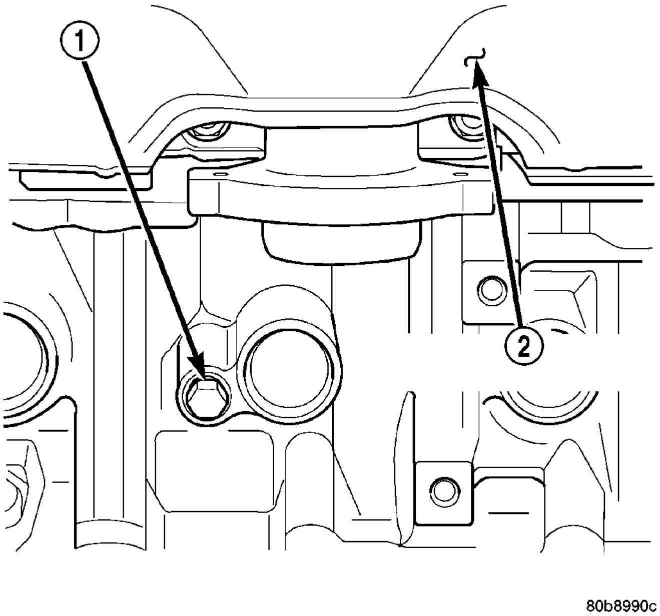


Fig. 6 Drain Plug - 3.7L Engine

1 - CYLINDER BLOCK DRAIN PLUG
2 - EXHAUST MANIFOLD AND HEAT SHIELD

STANDARD PROCEDURE - REFILLING COOLING SYSTEM - 2.4L

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

CAUTION: Failure to purge air from the cooling system can result in an overheating condition and severe engine damage.

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill pressure bottle to service line and install cap.

NOTE: The engine cooling system will push any remaining air into the coolant bottle within about an hour of normal driving. As a result, a drop in coolant level in the pressure bottle may occur. If the engine cooling system overheats and pushes coolant into the overflow side of the coolant bottle, this coolant will be sucked back into the cooling system ONLY IF THE PRESSURE CAP IS LEFT ON THE BOTTLE. Removing the pressure cap breaks the vacuum path between the two bottle sections and the coolant will not return to cooling system.

(3) With heater control unit in the HEAT position, operate engine with pressure bottle cap in place.

(4) Add coolant to pressure bottle as necessary. **Only add coolant to the pressure bottle when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

NOTE: The coolant bottle has two chambers. Coolant will normally only be in the outboard (larger) of the two. The inboard chamber is only to recover coolant in the event of an overheat or after a recent service fill. The inboard chamber should normally be empty. If there is coolant in the overflow side of the coolant bottle (after several warm/cold cycles of the engine) and coolant level is above cold full when cold, disconnect the end of the overflow hose at the fill neck and lower it into a clean container. Allow coolant to drain into the container until emptied. Reconnect overflow hose to fill neck.

STANDARD PROCEDURE - COOLANT LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant reserve/overflow tank.

The coolant reserve/overflow system provides a quick visual method for determining coolant level without removing radiator pressure cap. With engine idling and at normal operating temperature, observe coolant level in reserve/overflow tank. The coolant level should be between ADD and FULL marks.

STANDARD PROCEDURE - COOLING SYSTEM - DRAINING

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

DO NOT remove the radiator cap when draining the coolant from the reserve/overflow tank. Open the radiator draincock and when the tank is empty, remove the radiator cap. The coolant does not have to be removed from the tank unless the system is being refilled with a fresh mixture.

(1) Drain the coolant from the radiator by loosening the draincock.

(2) Drain coolant from engine block by removing drain plug at left rear side of block (Fig. 7).

COOLING (Continued)

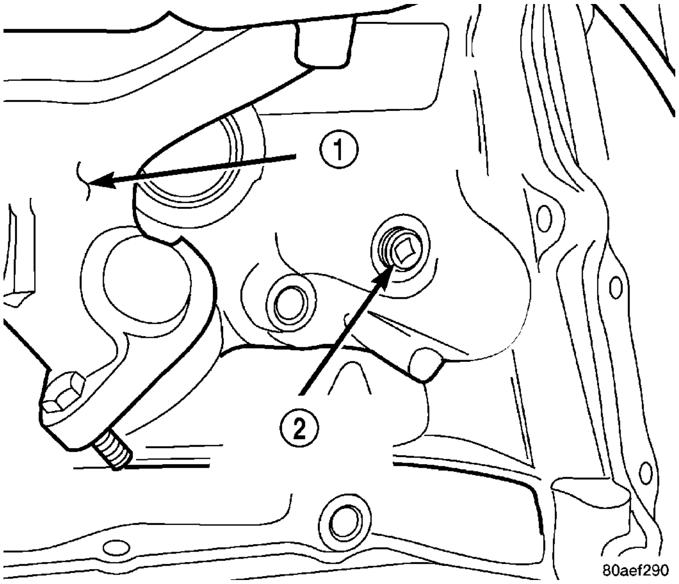


Fig. 7 Draining Coolant From Block - 2.4L/4.0L Engines

1 - EXHAUST MANIFOLD
2 - CYLINDER BLOCK COOLANT DRAIN PLUG

STANDARD PROCEDURE - COOLING SYSTEM - REFILLING

(1) Tighten the radiator draincock and the cylinder block drain plug(s).

(2) Fill system using a 50/50 mixture of water and antifreeze. Fill the radiator to the top and install the radiator cap. Add sufficient coolant to the reserve/overflow tank to raise the level to the FULL mark.

(3) Operate the engine with both the radiator cap and reserve/overflow tank cap in place. After the engine has reached the normal operating temperature, shut the engine off and allow it to cool.

(4) Add coolant to the reserve/overflow tank as necessary. **Only add coolant when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.**

STANDARD PROCEDURE - COOLING SYSTEM - REVERSE FLUSHING

CAUTION: The cooling system normally operates at 97 - 110 C.P.A. 14 - 16 -16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

CHEMICAL CLEANING

If visual inspection indicates the formation of sludge or scaly deposits, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid the flushing operation.

CAUTION: Be sure instructions on the container are followed.

REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: The cooling system normally operates at 97 - 110 C.P.A. (14 - 16 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the radiator to fill with water. When radiator is filled, apply air in short blasts allowing radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. For more information, refer to operating instructions supplied with flushing equipment. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE). Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump. Attach a lead away hose to the water pump inlet fitting.

CAUTION: Be sure that the heater control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose. For more information, refer to operating instructions supplied with flushing equipment.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT - REMOVAL). Install the thermostat and housing with a replacement gasket (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT THERMOSTAT -

COOLING (Continued)

INSTALLATION). Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).

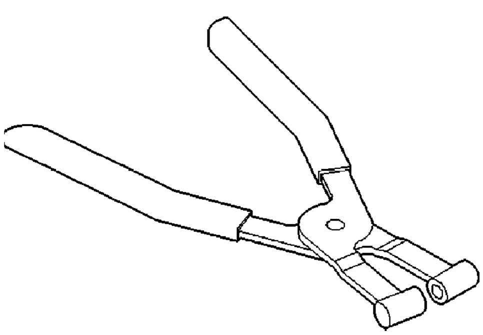
SPECIFICATIONS

TORQUE

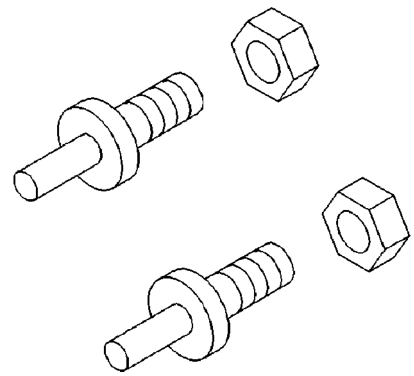
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Automatic Belt Tensioner to Mounting Bracket - 2.4L	41	30	-
Bolt, Automatic Belt Tensioner Pulley - 2.4L	61	45	-
Bolt, Block Heater - 2.4L	2	-	17
Bolts, Condenser to Radiator			
Bolts, Coolant Overflow Bottle to Plenum - 2.4L only	8.5	-	75
Electric Fan to Fan Shroud bolts	5.5		50
Bolts, 3.7LFan Blade Assy. to Viscous Drive	23	-	210
Bolts, Fan Shroud to Radiator Mounting	8	-	70
Bolts, Radiator Upper Isolator to Crossmember	9.5	-	85
Bolts, Thermostat Housing - 2.4L	28	-	250
Bolts, Water Pump			
2.4L	12	-	105
4.0l	23	-	200

SPECIAL TOOLS

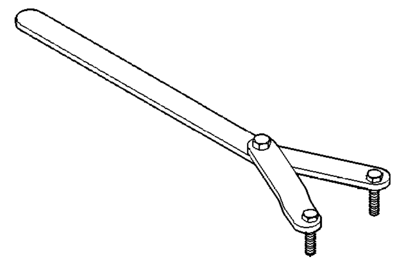
COOLING



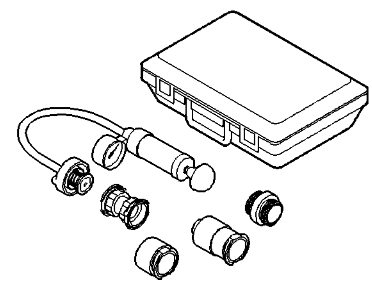
Pliers 6094



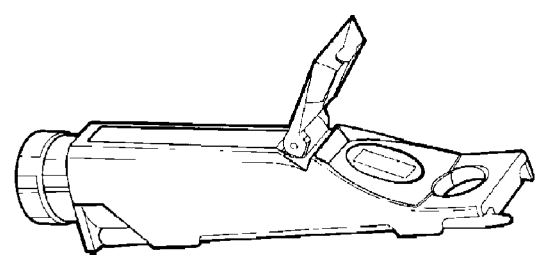
Adapter Pins 8346



Spanner Wrench 6958 with 8346 adapter pins



Pressure Tester 7700–A



Coolant Refractometer 8286

ACCESSORY DRIVE

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ACCESSORY DRIVE

SPECIFICATIONS

BELT TENSION

Belt tension can not be adjusted. Refer to the following Belt Tension chart for specifications.

DESCRIPTION	N·m	Lbs. ft.
New Serpentine Belt*	800-900	180-200
Used Serpentine Belt	623-712	140-160
* Belt is considered new if it has been used 15 minutes or less.		

BELT TENSIONERS

DESCRIPTION

The automatic belt tensioner (Fig. 1) is a spring loaded arm and pulley assembly. The tensioner assembly is designed to apply constant pressure on the accessory drive belt to maintain proper belt tension. There are three marks on the tensioner body, these marks are there to indicate belt wear and belt tension.

NOTE: On 4.0L engines, the tensioner arm has three marks. Upon installation of a new belt, the double line marks close to each other should be very close to the mark on the base. The belt should be replaced if the single line mark lines up with the mark on the base.

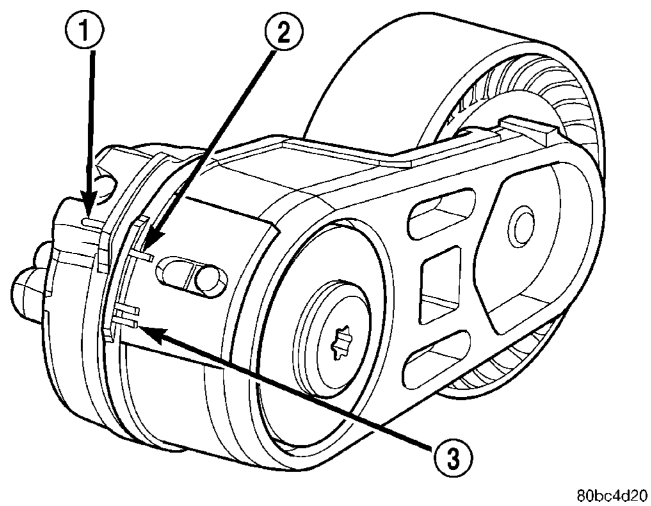

Fig. 1 Accessory Drive Belt Wear Indicator - 4.0L Engine

1 - INDICATOR MARK
2 - MINIMUM TENSION MARK
3 - MAXIMUM TENSION MARK

BELT TENSIONERS (Continued)

REMOVAL

REMOVAL - 2.4L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position.

REMOVAL

On 4.0L engines, the tensioner arm has three marks. Upon installation of a new belt, the double line marks close to each other should be very close to the mark on the base. The belt should be replaced if the single line mark lines up with the mark on the base.

If the above specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minimum travel indicator. Tensioner travel stops at this point.

(1) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove tensioner assembly from mounting bracket (Fig. 2).

WARNING: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY.

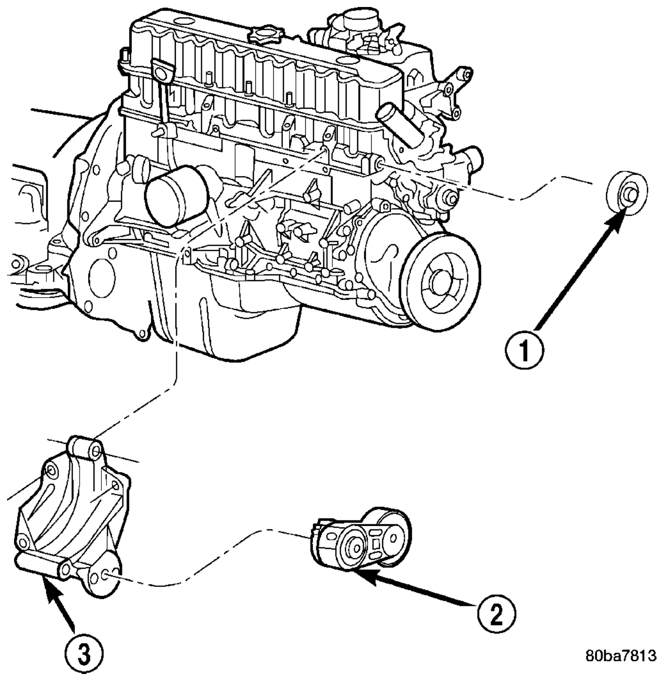

Fig. 2 Automatic Belt Tensioner - 4.0L Engine

1 - IDLER PULLEY TIGHTEN TO 47 N·m (35 FT. LBS.)
2 - AUTOMATIC BELT TENSIONER
3 - GENERATOR MOUNTING BRACKET

INSTALLATION

INSTALLATION - 2.4L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.

(2) Install new belt (Fig. 3) or (Fig. 4). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator. On 2.4L Engines the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches).

BELT TENSIONERS (Continued)

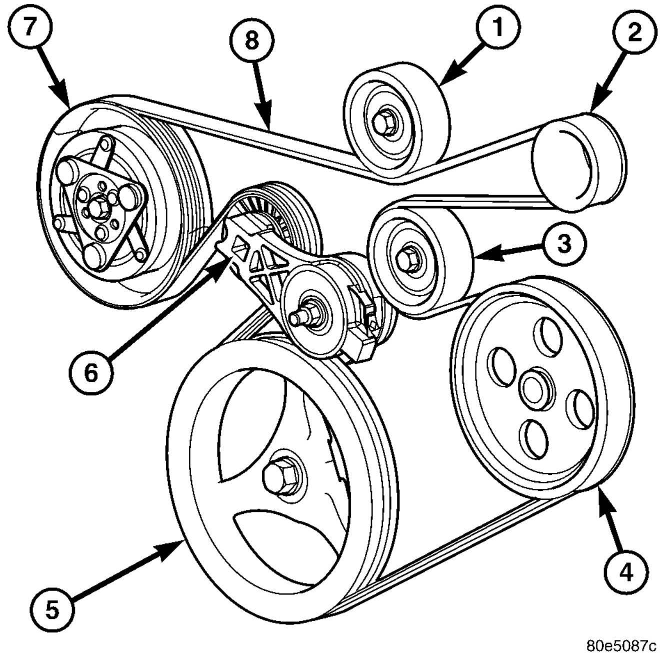

Fig. 3 Belt Routing 2.4L With A/C

1 - IDLER PULLEY
2 - GENERATOR PULLEY
3 - IDLER PULLEY
4 - POWER STEERING PUMP PULLEY
5 -CRANKSHAFT PULLEY
6 - TENSIONER
7 - A/C COMPRESSOR PULLEY
8 - ACCESSORY DRIVE BELT

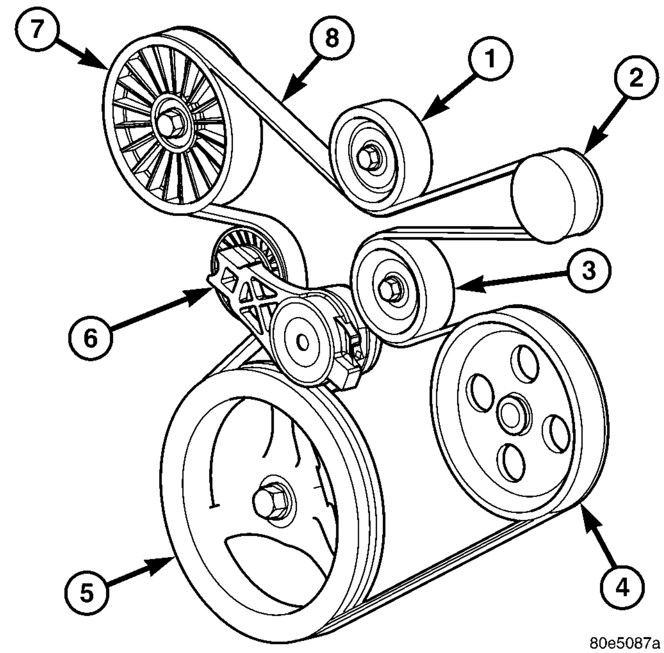

Fig. 4 Belt Routing 2.4L Without A/C

1 - IDLER PULLEY
2 - GENERATOR PULLEY
3 - IDLER PULLEY
4 - POWER STEERING PUMP PULLEY
5 -CRANKSHAFT PULLEY
6 - TENSIONER
7 - NON A/C IDLER PULLEY
8 - ACCESSORY DRIVE BELT

INSTALLATION

(1) Install tensioner assembly to mounting bracket, align the two dowels on the tensioner with the mounting bracket and hand start the bolt. Tighten bolt to 28 N·m (250 in. lbs.).

(2) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Check belt indexing marks.

DRIVE BELTS - 2.4L

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 5), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 5). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the ACCESSORY DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

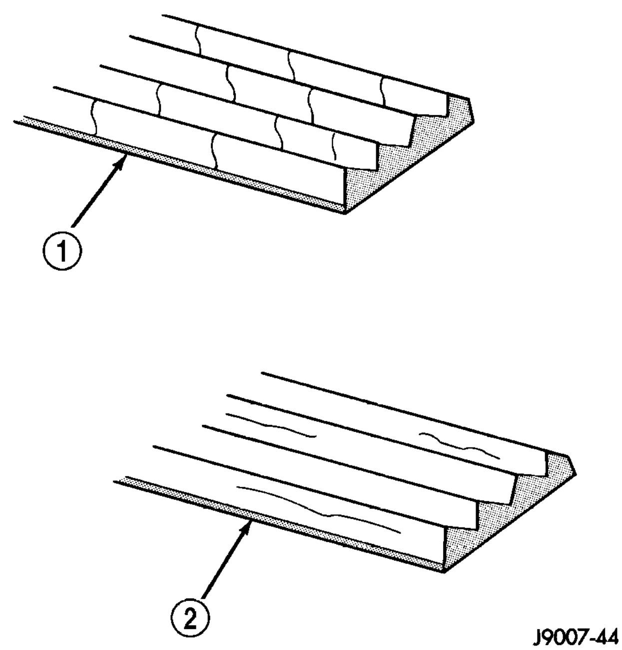

Fig. 5 Belt Wear Patterns

1 - NORMAL CRACKS BELT OK
2 - NOT NORMAL CRACKS REPLACE BELT

DRIVE BELTS - 2.4L (Continued)

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Adjust tension (2.5L)
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
″GROOVE JUMPING″ (Belt does not maintain correct position on pulley)	1. Belt tension either too low or too high	1. Adjust belt tension (2.5L)
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt

DRIVE BELTS - 2.4L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Excessive tension 2. Tensile member damaged during belt installation 3. Severe misalignment 4. Bracket, pulley, or bearing failure	1. Replace belt and adjust tension to specification 2. Replace belt 3. Align pulley(s) 4. Replace defective component and belt
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Belt slippage 2. Bearing noise 3. Belt misalignment 4. Belt to pulley mismatch 5. Driven component induced vibration 6. System resonant frequency induced vibration	1. Adjust belt tension (2.5L) 2. Locate and repair 3. Align belt/pulley(s) 4. Install correct belt 5. Locate defective driven component and repair 6. Vary belt tension within specifications.
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object 2. Excessive heat causing woven fabric to age 3. Tension sheeting splice has fractured	1. Correct rubbing condition 2. Replace belt 3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Excessive tension 2. Belt contacting stationary object 3. Pulley(s) out of tolerance 4. Insufficient adhesion between tensile member and rubber matrix	1. Adjust belt tension (2.5L) 2. Replace belt 3. Replace pulley 4. Replace belt and adjust tension to specifications

DRIVE BELTS - 2.4L (Continued)

REMOVAL

REMOVAL

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position.

REMOVAL

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVERE DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts its stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 6) or (Fig. 7).

INSTALLATION

INSTALLATION

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

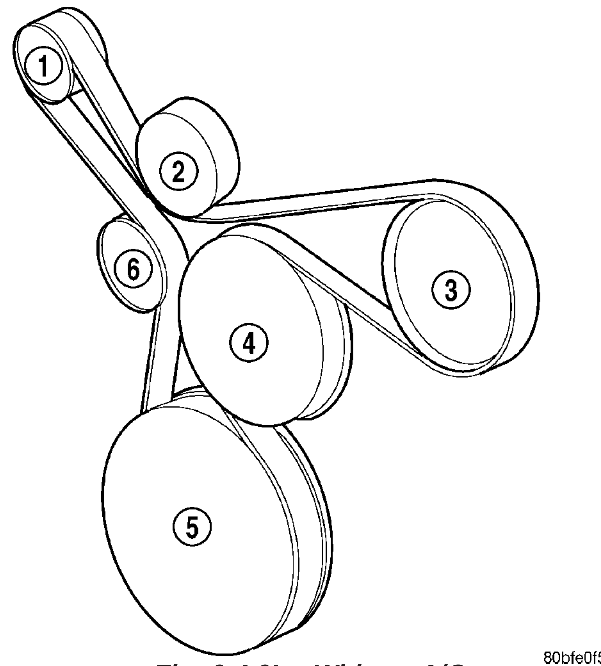

Fig. 6 4.0L - Without A/C

1 - GENERATOR PULLEY
2 - IDLER PULLEY
3 - POWER STEERING PUMP PULLEY
4 - WATER PUMP PULLEY
5 - CRANKSHAFT PULLEY
6 - TENSIONER PULLEY

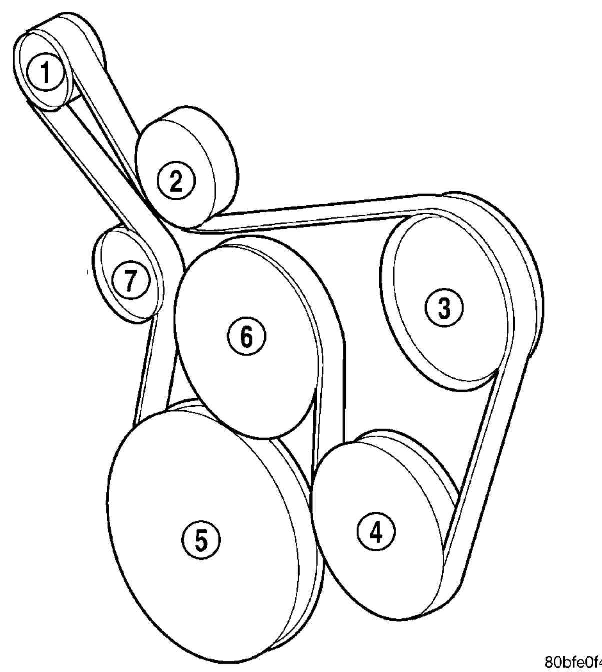

Fig. 7 4.0L Engines - With A/C

1 - GENERATOR PULLEY
2 - IDLER PULLEY
3 - POWER STEERING PUMP PULLEY
4 - AIR CONDITIONING COMPRESSOR PULLEY
5 - CRANKSHAFT PULLEY
6 - WATER PUMP PULLEY
7 - TENSIONER PULLEY

DRIVE BELTS - 2.4L (Continued)

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.

(2) Install new belt (Fig. 8) or (Fig. 9). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

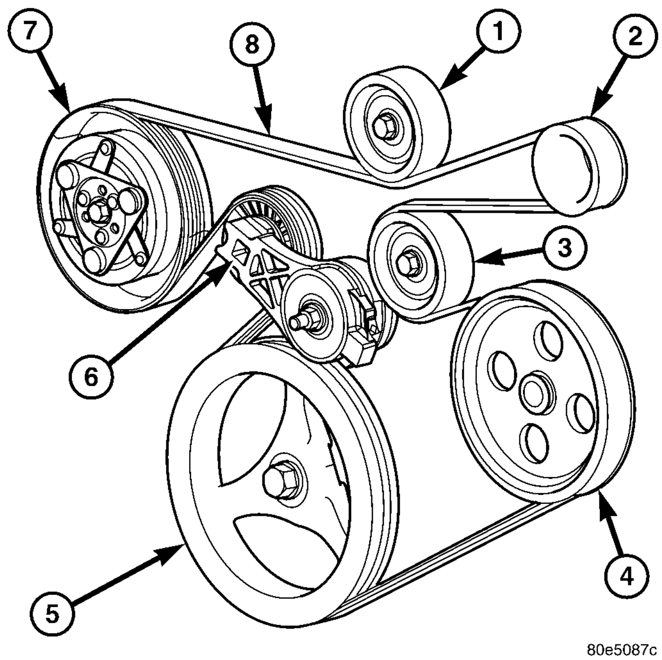

Fig. 8 Belt Routing 2.4L With A/C

1 - IDLER PULLEY
2 - GENERATOR PULLEY
3 - IDLER PULLEY
4 - POWER STEERING PUMP PULLEY
5 -CRANKSHAFT PULLEY
6 - TENSIONER
7 - A/C COMPRESSOR PULLEY
8 - ACCESSORY DRIVE BELT

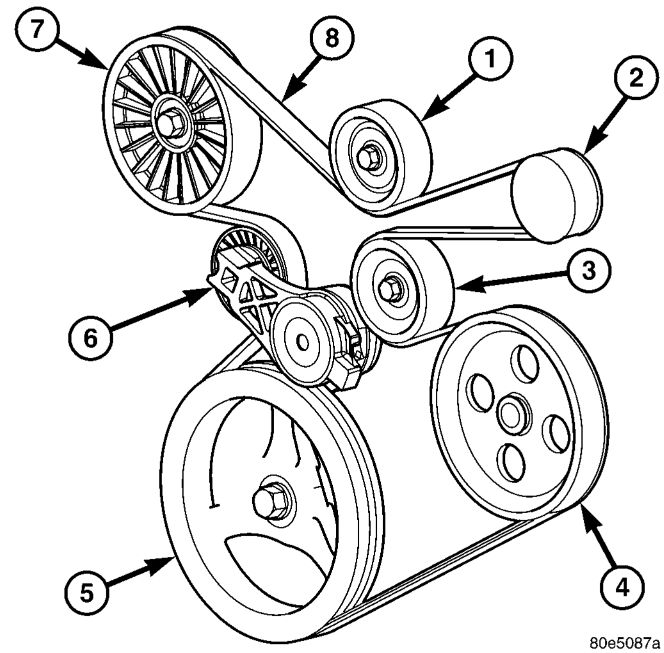

Fig. 9 Belt Routing 2.4L Without A/C

1 - IDLER PULLEY
2 - GENERATOR PULLEY
3 - IDLER PULLEY
4 - POWER STEERING PUMP PULLEY
5 -CRANKSHAFT PULLEY
6 - TENSIONER
7 - NON A/C IDLER PULLEY
8 - ACCESSORY DRIVE BELT

(3) With the drive belt installed, inspect the belt wear indicator. On 2.4L Engines the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches).

DRIVE BELTS - 2.4L (Continued)

INSTALLATION

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 11) (Fig. 12).

(2) Install new belt (Fig. 12) or (Fig. 11). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts its stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 10). On 4.0L Engines, the indicator mark must be between the minimum and maximum marks. If the measurement exceedes this specification replace the serpentine accessory drive belt.

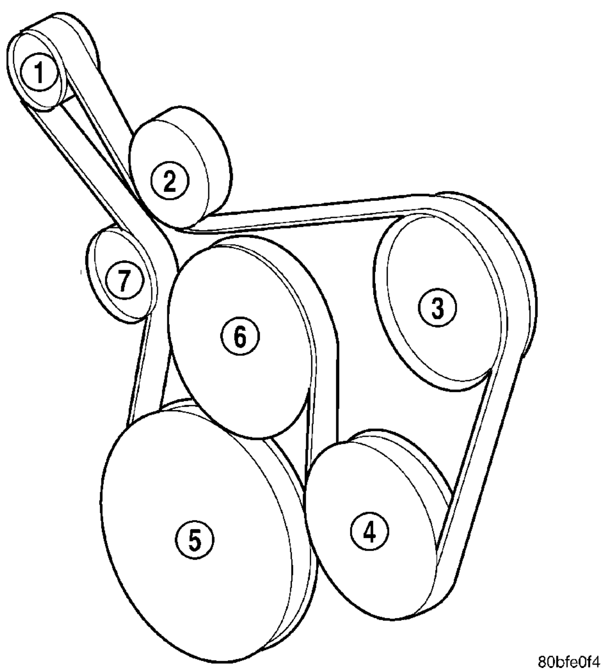

Fig. 10 4.0L Engines - With A/C

1 - GENERATOR PULLEY
2 - IDLER PULLEY
3 - POWER STEERING PUMP PULLEY
4 - AIR CONDITIONING COMPRESSOR PULLEY
5 - CRANKSHAFT PULLEY
6 - WATER PUMP PULLEY
7 - TENSIONER PULLEY

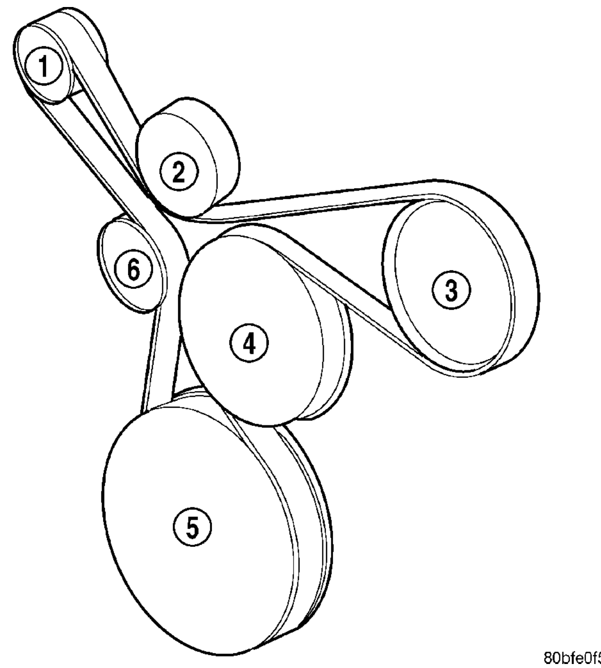

Fig. 11 4.0L - Without/A/C

1 - GENERATOR PULLEY
2 - IDLER PULLEY
3 - POWER STEERING PUMP PULLEY
4 - WATER PUMP PULLEY
5 - CRANKSHAFT PULLEY
6 - TENSIONER PULLEY

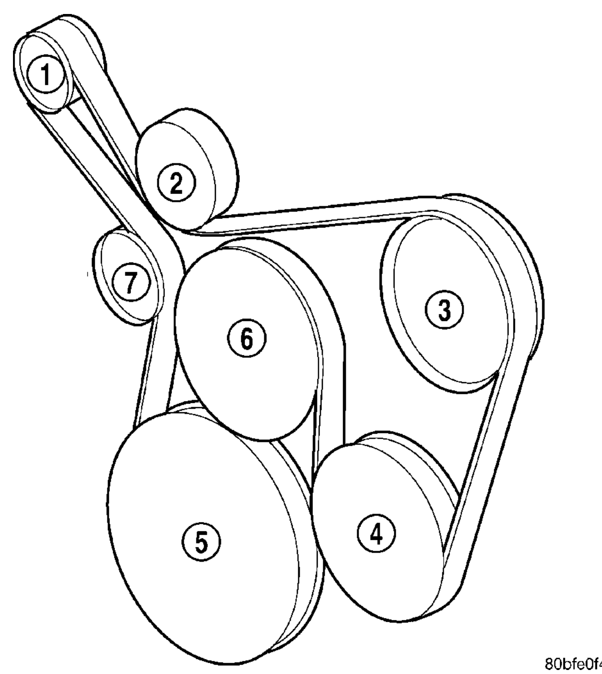

Fig. 12 4.0L Engines - With A/C

1 - GENERATOR PULLEY
2 - IDLER PULLEY
3 - POWER STEERING PUMP PULLEY
4 - AIR CONDITIONING COMPRESSOR PULLEY
5 - CRANKSHAFT PULLEY
6 - WATER PUMP PULLEY
7 - TENSIONER PULLEY

ENGINE

TABLE OF CONTENTS

COOLANT

DESCRIPTION

DESCRIPTION - HOAT COOLANT

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASE COOLANT PROPERLY, CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE, PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED, PERSONAL INJURY CAN RESULT.

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

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

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

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

COOLANT PERFORMANCE

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

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

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

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

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

COOLANT SELECTION AND ADDITIVES

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

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

COOLANT (Continued)

DESCRIPTION - ENGINE COOLANT

ETHYLENE-GLYCOL MIXTURES

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

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

OPERATION

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

COOLANT RECOVERY CONTAINER

DESCRIPTION

The coolant reserve/overflow system consists of a radiator mounted pressurized cap, a plastic coolant recovery bottle (Fig. 1), a tube (hose) connecting the radiator and recovery bottle, and an overflow tube on the side of the bottle.

The reservoir bottle also has an anti-slosh insert located within the bottle, this insert will aid in reducing coolant loss from splash and spillage.

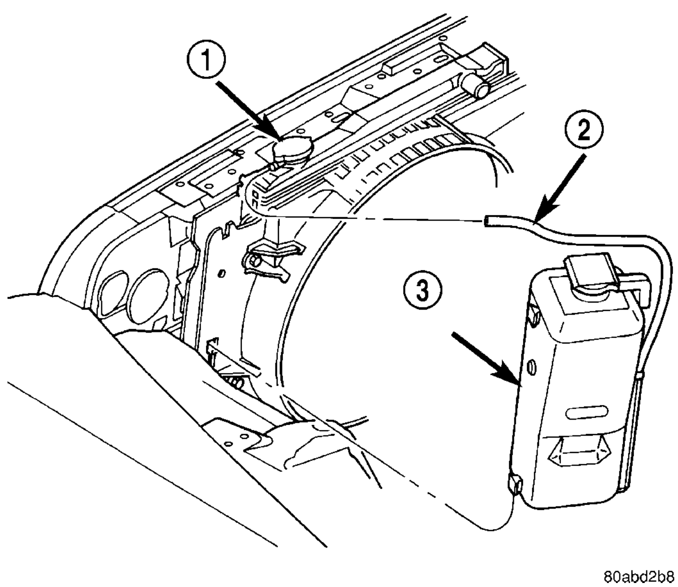

Fig. 1 Coolant Recovery Bottle

1 - RADIATOR PRESSURE CAP
2 - HOSE
3 - COOLANT RECOVERY BOTTLE

COOLANT RECOVERY CONTAINER (Continued)

OPERATION

The system works along with the radiator pressure cap. This is done by using thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides:

- A volume for coolant expansion and contraction.
- A convenient and safe method for checking/adjusting coolant level at atmospheric pressure. This is done without removing the radiator pressure cap.
- Some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

REMOVAL

(1) Disconnect the hose from radiator filler neck.

(2) Remove coolant recovery bottle (Fig. 2).

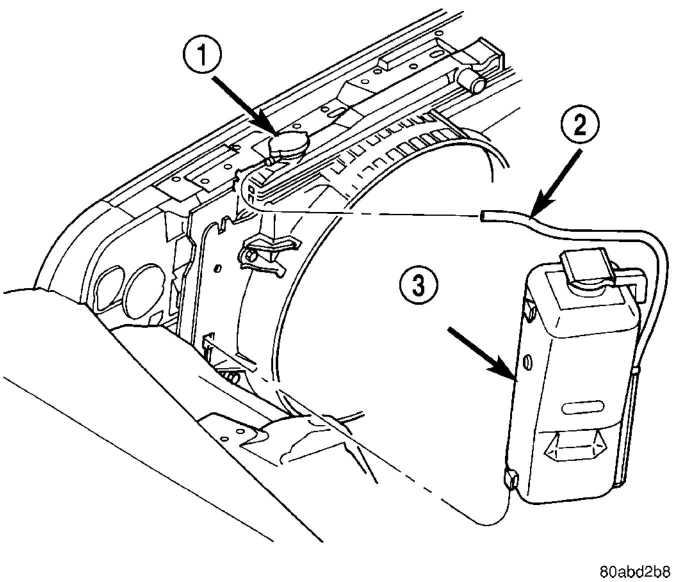

Fig. 2 Coolant Reserve/Overflow Bottle

1 - RADIATOR PRESSURE CAP
2 - HOSE
3 - COOLANT RECOVERY BOTTLE

INSTALLATION

(1) Position the tabs on the overflow bottle into the slots on the fan shroud.

(2) Reconnect the overflow hose onto the radiator filler neck.

(3) Fill resrevoir/overflow bottle.

ENGINE BLOCK HEATER

DESCRIPTION

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE.

An optional engine block heater (Fig. 3) is available for all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The heater is mounted in a core hole of the engine cylinder block (in place of a freeze plug) with the heating element immersed in engine coolant.

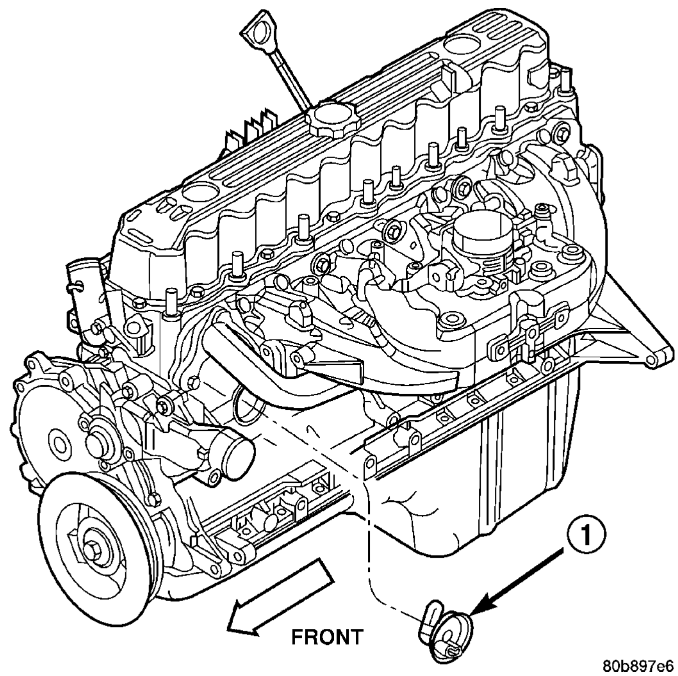

Fig. 3 Block Heater - Typical

1 - ENGINE BLOCK HEATER

OPERATION

Connecting the power cord to a grounded 110-120 volt AC electrical outlet with a grounded, three-wire extension cord, supplies the electricity required to heat the element thus heating the engine coolant.

ENGINE BLOCK HEATER (Continued)

REMOVAL

REMOVAL - 4.0L

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Unplug power cord from block heater.

(3) Loosen screw in center of block heater (Fig. 4).

(4) Remove block heater from cylinder block.

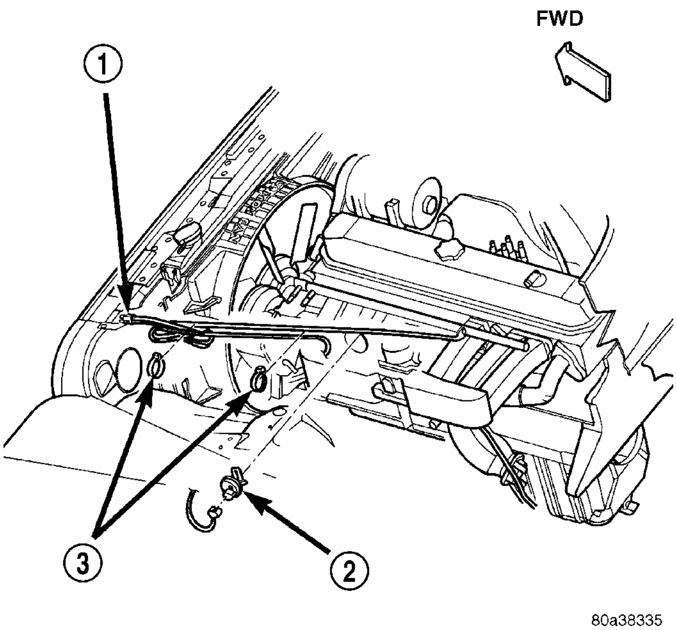

Fig. 4 Block Heater and Cord - 4.0L Engine

1 - POWER CORD
2 - BLOCK HEATER
3 - TIE-STRAPS

REMOVAL - 2.4L

(1) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(2) Raise vehicle on hoist.

(3) Detach power cord plug from heater.

(4) Loosen screw in center of heater. Remove heater assembly.

INSTALLATION

INSTALLATION 4.0L

(1) Thoroughly clean the engine core hole and the block heater seat.

(2) Insert block heater assembly into core hole with element loop pointing **Up** (Fig. 4).

(3) Seat block heater flush against block face. Tighten mounting screw to 4 N·m (31 in. lbs.) torque.

(4) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE), and inspect for leaks (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

(5) Plug power cord into block heater. Route cord away from moving parts, linkages and exhaust system components. Secure cord in place with tie-straps.

INSTALLATION - 2.4L

(1) Thoroughly clean core hole and heater seat.

(2) Insert heater assembly (Fig. 5) with element loop positioned **upward** .

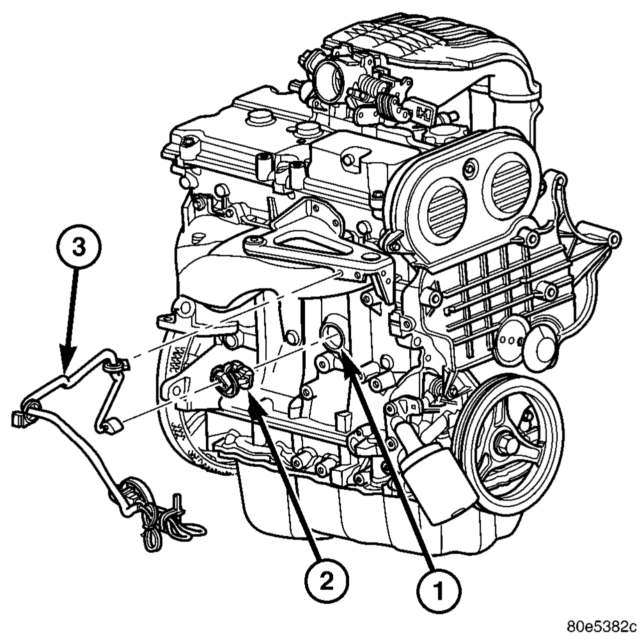

Fig. 5 ENGINE BLOCK HEATER 2.4L

1 - CORE HOLE
2 - BLOCK HEATER
3 - POWER CORD

(3) With heater seated, tighten center screw securely to assure a positive seal.

CAUTION: To prevent damage, the power cord must be secured in it's retaining clips, and not positioned so it could contact linkages or exhaust manifold.

(4) Connect power cord to heater.

(5) Lower vehicle.

(6) Fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

ENGINE COOLANT TEMPERATURE SENSOR

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- For engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING ECT (ENGINE COOLANT TEMPERATURE) SENSOR.

(1) Partially drain cooling system until coolant level is below cylinder head. (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Disconnect ECT (Engine Coolant Temperature) sensor wire connector (Fig. 6) or (Fig. 7).

(3) Remove sensor from engine.

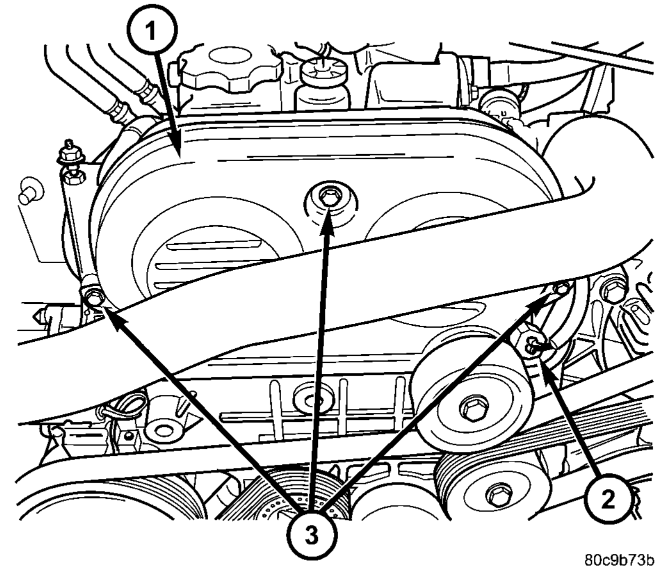

Fig. 6 ECT SENSOR LOCATION- 2.4L

1 - UPPER TIMING BELT COVER
2 - ELECTRICAL CONNECTOR (ECT)
3 - MOUNTING BOLTS (3)

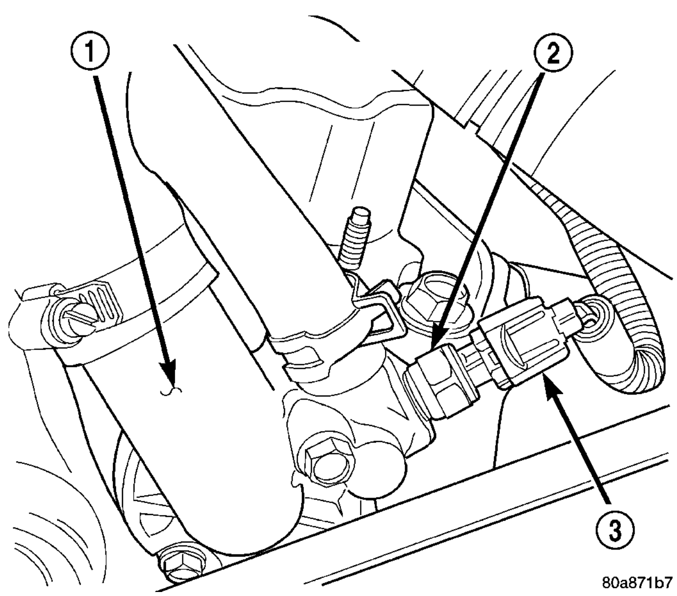

Fig. 7 ECT SENSOR LOCATION - 4.0L

1 - THERMOSTAT HOUSING
2 - ENGINE COOLANT TEMPERATURE SENSOR
3 - ELECTRICAL CONNECTOR

INSTALLATION

(1) Apply sealant to sensor threads (new replacement sensors will have sealant already applied).

(2) Install coolant temperature sensor into thermostat housing. Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Connect wire connector.

(4) Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE).

ENGINE COOLANT THERMOSTAT

DESCRIPTION

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat (Fig. 8) on all gas powered engines is located beneath the thermostat housing at the front of the intake manifold.

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that can result in sludge formation.

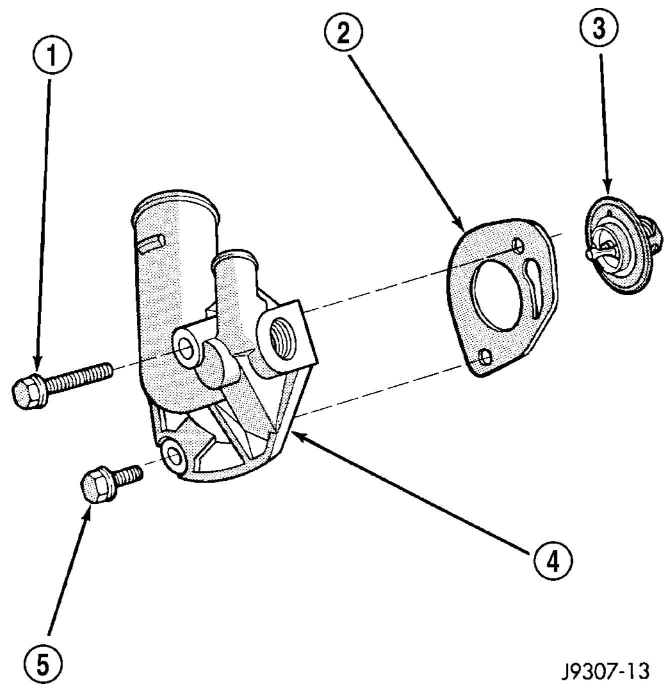

Fig. 8 Thermostat—Typical

1 - LONG BOLT
2 - GASKET
3 - THERMOSTAT
4 - THERMOSTAT HOUSING
5 - SHORT BOLT

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

REMOVAL

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Drain the coolant from the radiator until the level is below the thermostat housing (Refer to 7 - COOLING - STANDARD PROCEDURE).

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 32). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Remove radiator upper hose and heater hose at thermostat housing.

(3) Disconnect wiring connector at engine coolant temperature sensor.

(4) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 9). Discard old gasket.

(5) Clean the gasket mating surfaces.

ENGINE COOLANT THERMOSTAT (Continued)

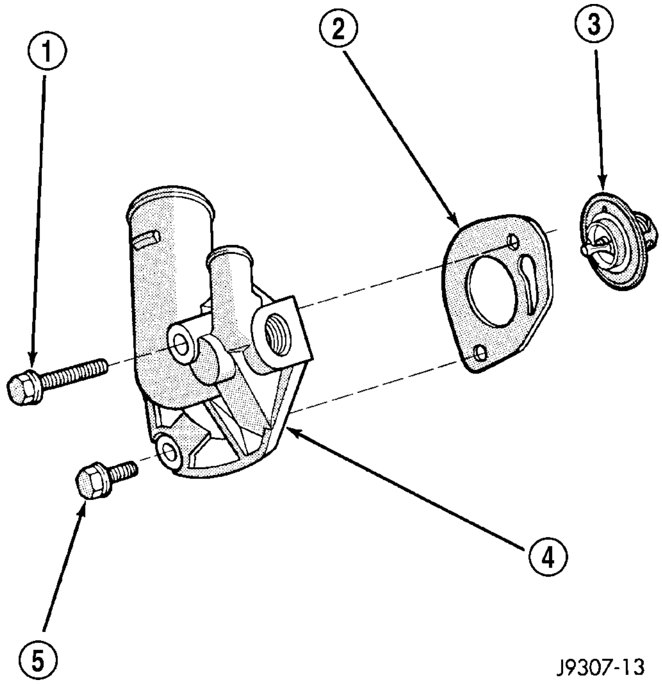

Fig. 9 Thermostat Removal/Installation

1 - LONG BOLT
2 - GASKET
3 - THERMOSTAT
4 - THERMOSTAT HOUSING
5 - SHORT BOLT

REMOVAL

(1) Drain cooling system below thermostat housing level.

(2) Disconnect engine coolant temperature sensor.

(3) Disconnect heater supply hose.

(4) Remove housing attaching bolts (Fig. 10).

(5) Remove housing, gasket and thermostat (Fig. 10).

INSTALLATION

INSTALLATION

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(2) Observe the recess groove in the engine cylinder head (Fig. 11).

(3) Position thermostat into this groove with arrow and air bleed hole on outer flange pointing up.

(4) Install replacement gasket and thermostat housing.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess may result in a cracked housing.

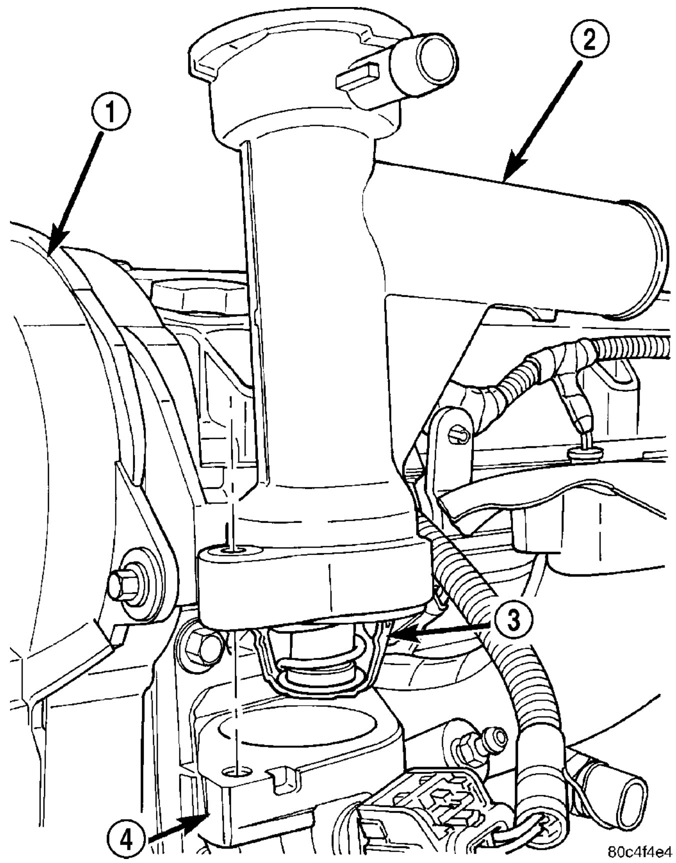

Fig. 10 Thermostat and Coolant Outlet Connector

1 - TIMING BELT COVER
2 - OUTLET CONNECTOR
3 - THERMOSTAT
4 - HOUSING

(5) Tighten the housing bolts to 20 N·m (15 ft. lbs.) torque.

(6) Install hoses to thermostat housing.

(7) Install electrical connector to coolant temperature sensor.

(8) Be sure that the radiator draincock is tightly closed. Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(9) Start and warm the engine. Check for leaks.

INSTALLATION

(1) Clean all gasket sealing surfaces.

(2) Place a new gasket (dipped in clean water) on the coolant outlet connector surface. Position thermostat with air bleed at 12 o'clock position in thermostat housing (Fig. 12).

(3) Position the coolant outlet connector and gasket over the thermostat, making sure thermostat is seated in the thermostat housing.

(4) Position outlet connector to thermostat housing and install bolts. Tighten bolts to 28 N·m (20 ft. lbs.).

(5) Install radiator hose to coolant outlet housing.

(6) Connect engine coolant temperature sensor.

ENGINE COOLANT THERMOSTAT (Continued)

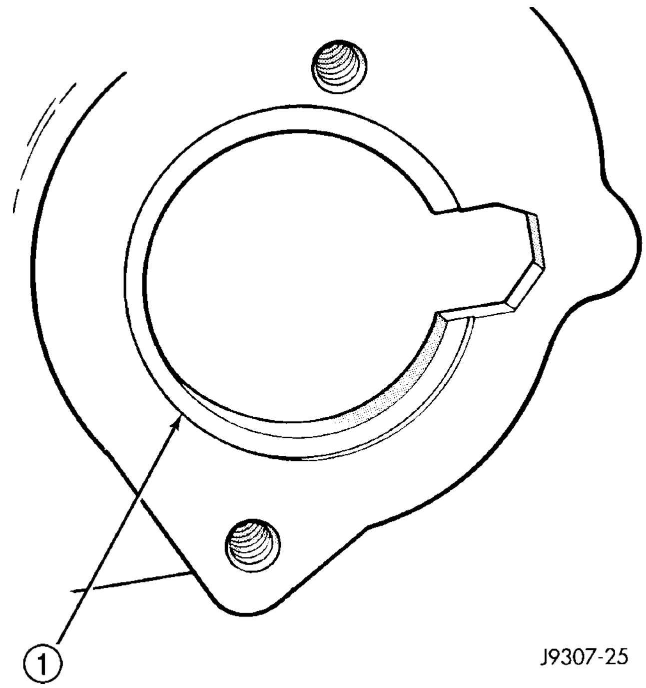

Fig. 11 Thermostat Recess

1 - GROOVE

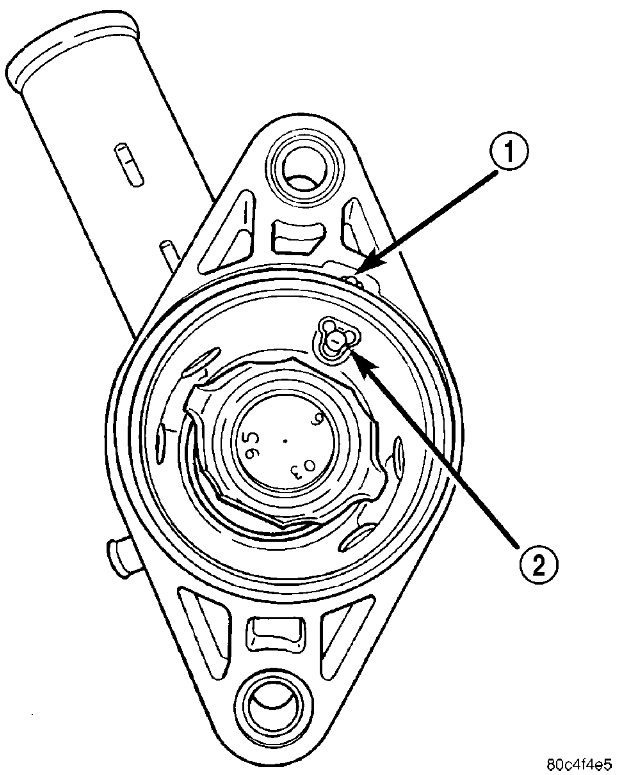

Fig. 12 Thermostat Position

1 - LOCATOR NOTCH
2 - AIR BLEED

(7) Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

FAN DRIVE VISCOUS CLUTCH

DESCRIPTION

CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

The thermal viscous fan drive (Fig. 13) and (Fig. 14) is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

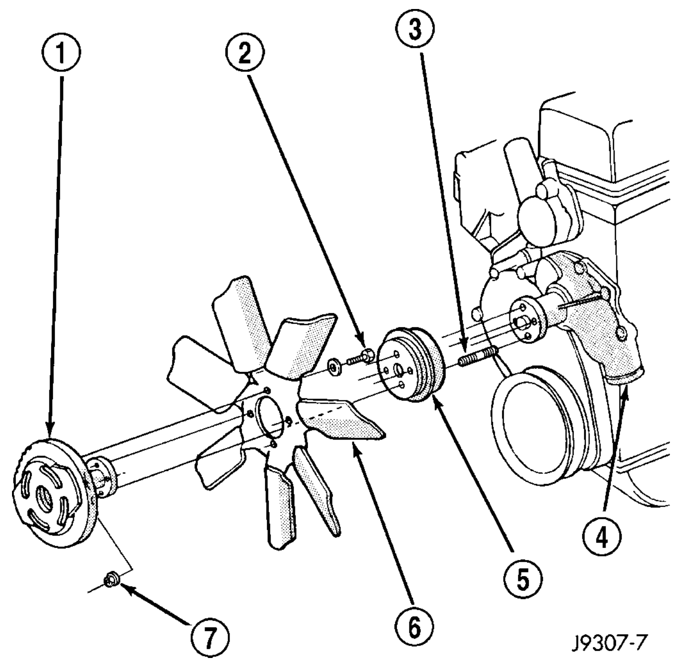

Fig. 13 Water Pump Mounted Fan Drive - 2.5L Engine

1 - THERMAL VISCOUS FAN DRIVE
2 - (4) FAN BLADE-TO-VISCOUS DRIVE BOLTS
3 - (4) FAN HUB-TO-PUMP PULLEY STUDS
4 - WATER PUMP
5 - WATER PUMP PULLEY
6 - FAN BLADE
7 - (4) FAN HUB-TO-PUMP PULLEY NUTS

FAN DRIVE VISCOUS CLUTCH (Continued)

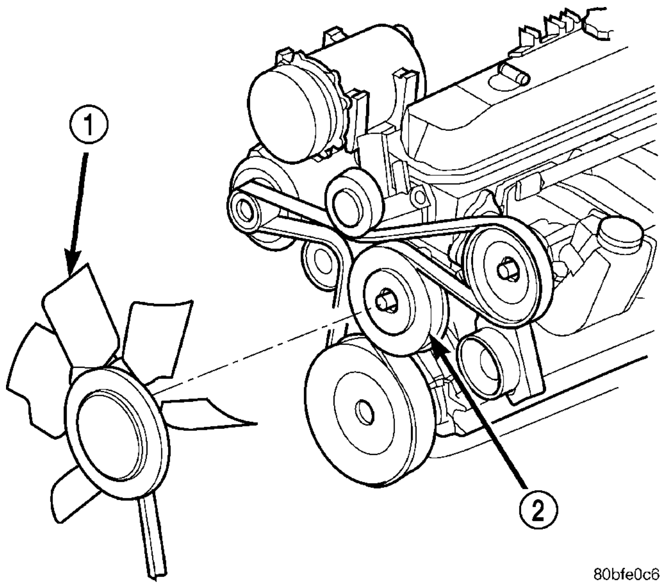

Fig. 14 Water Pump Mounted Fan Drive - 4.0L Engine

1 - FAN AND FAN DRIVE
2 - WATER PUMP PULLEY

OPERATION

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (a typical viscous unit is shown in (Fig. 15) (Fig. 16). This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.

Only when sufficient heat is present, will the viscous fan drive engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

DIAGNOSIS AND TESTING

VISCOUS FAN DRIVE

NOISE

NOTE: It is normal for fan noise to be louder (roaring) when:

- The under hood temperature is above the engagement point for the viscous drive coupling. This may occur when ambient (outside air temperature) is very high.
- Engine loads and temperatures are high such as when towing a trailer.
- Cool silicone fluid within the fan drive unit is being redistributed back to its normal disengaged (warm) position. This can occur during the first 15 seconds to one minute after engine start-up on a cold engine.

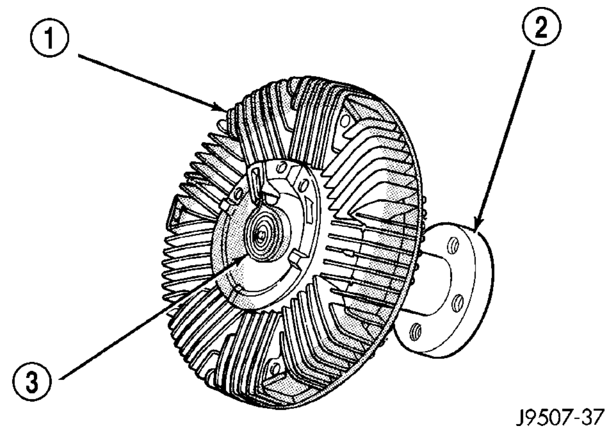

Fig. 15 Viscous Fan Drive - 2.5L Engine

1 - VISCOUS FAN DRIVE
2 - MOUNTING HUB
3 - THERMOSTATIC SPRING

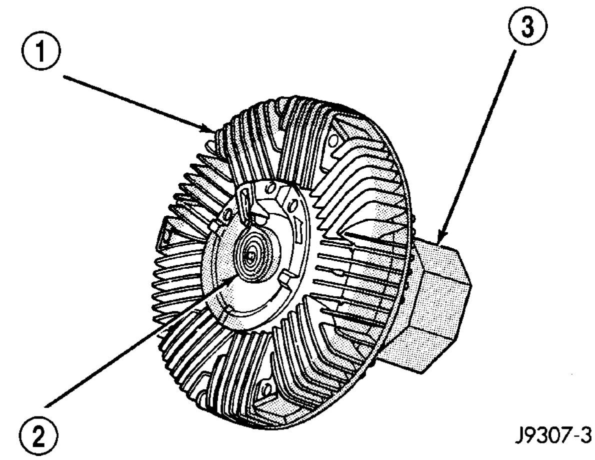

Fig. 16 Viscous Fan Drive - 4.0L Engine

1 - VISCOUS FAN DRIVE
2 - THERMOSTATIC SPRING
3 - MOUNTING NUT TO WATER PUMP HUB

LEAKS

Viscous fan drive operation is not affected by small oil stains near the drive bearing. If leakage appears excessive, replace the fan drive unit.

TESTING

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when

FAN DRIVE VISCOUS CLUTCH (Continued)

spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.18 mm (1/8 in.) diameter hole in the top center of the fan shroud.

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° - 105°C (-4°- 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 88° C (190° F). Fan drive **engagement** should have started to occur at between 74° - 85° C (165° - 185° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 88° C (190° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 57° - 82° C (135° - 180° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

CAUTION: Engines equipped with serpentine drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

CAUTION: If the viscous fan drive is replaced because of mechanical damage, the cooling fan blades should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan blade assembly if any of these conditions are found. Also inspect water pump bearing and shaft assembly for any related damage due to a viscous fan drive malfunction.

REMOVAL

(1) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft. Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using a suitable fan wrench loosen the fan drive (Fig. 17).

(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Some models with certain engines may require the removal of the fan shroud to remove the viscous fan drive. The fan shroud and fan blade/viscous fan drive should be removed from the vehicle as one assembly.

(4) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

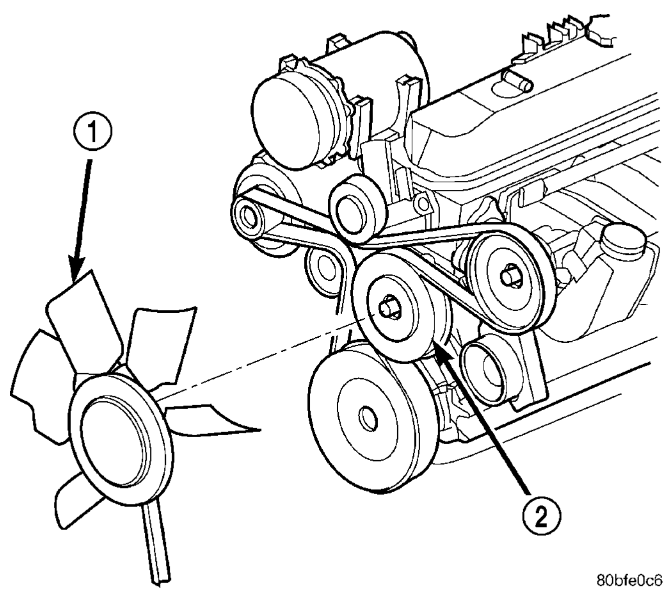

Fig. 17 Fan and Fan Drive - 4.0L Engine

1 - FAN AND FAN DRIVE
2 - WATER PUMP PULLEY

INSTALLATION

(1) Assemble fan blade to viscous fan drive. Tighten mounting bolts to 27 N·m (20 ft. lbs.) torque.

(2) Thread the fan and fan drive onto the water pump pulley.

FAN DRIVE VISCOUS CLUTCH (Continued)

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction.

(3) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

RADIATOR

DESCRIPTION

CAUTION: Plastic tanks, while stronger than brass, are subject to damage by impact, such as wrenches, mishandling, etc.

A heavy duty down-flow aluminum/plastic radiator is used (Fig. 18). The radiator consists of an aluminum core and plastic end tanks, which are fastened to the core with clinch tabs and sealed with a high temperature rubber gasket. On automatic transmission equipped vehicles, the lower tank contains a concentric-tube transmission oil cooler.

If the plastic tank has been damaged, individual parts are not available, and the radiator must be replaced.

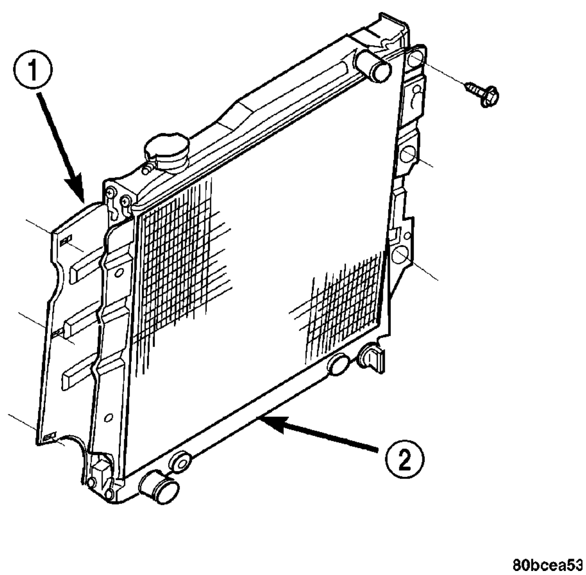

Fig. 18 Downflow Radiator - Typical

1 - DOWNFLOW RADIATOR
2 - INTEGRAL TRANSMISSION OIL COOLER (INTERNAL TO RADIATOR)

OPERATION

As air passes through the radiator core, the heat within the coolant is dissipated into the ambient air.

DIAGNOSIS AND TESTING - RADIATOR COOLANT FLOW

The following procedure will determine if coolant is flowing through the cooling system.

If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If hose is hot, the thermostat is open and water is circulating through cooling system.

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094 (Fig. 19). ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 20). If replacement is necessary, use only an original equipment clamp with matching number or letter.

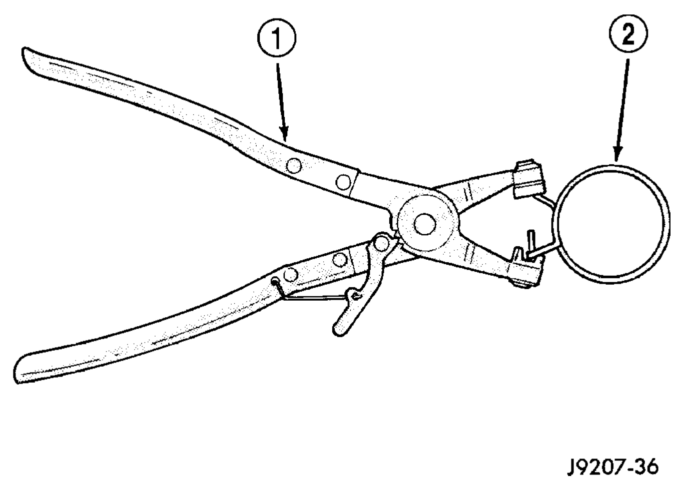

Fig. 19 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

RADIATOR (Continued)

CAUTION: When removing the radiator or A/C condenser for any reason, note the location of all radiator-to-body and radiator-to-A/C condenser rubber air seals (Fig. 21). These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Disconnect negative battery cable at battery.

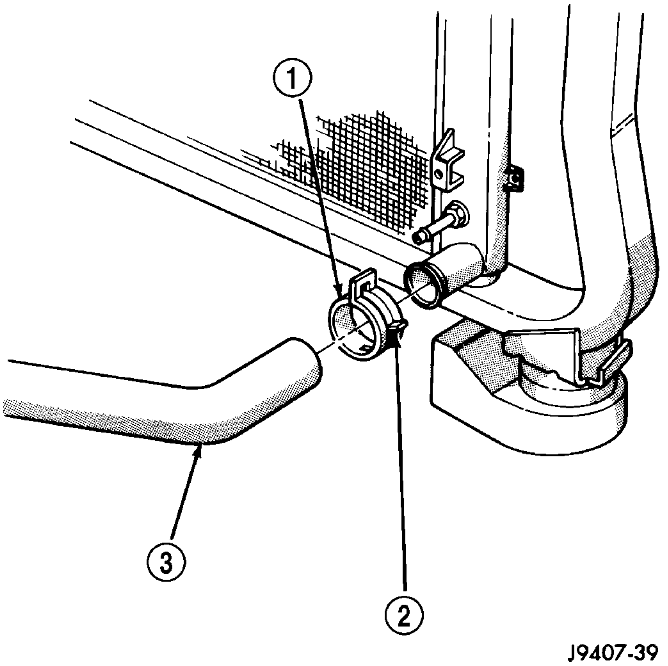

Fig. 20 Clamp Number/Letter Location - Typical

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

(2) Observe the previous **WARNING.** Remove the radiator cap.

(3) Remove the condenser lower seal from the lower core support (Fig. 22).

(4) Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) drain coolant into a clean container for reuse.

(5) Remove radiator upper and lower hose clamps. Remove radiator hoses.

(6) Disconnect coolant reserve/overflow tank hose from radiator.

(7) 2.4L ONLY - Remove the electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(8) 4.0L ONLY - Remove the reservoir tank and power steering reservoir and position out of the way.

(9) 4.0L ONLY - Remove the four fan shroud mounting bolts (Fig. 23). Position the fan shroud back over the fan blades.

(10) If equipped, disconnect and plug automatic transmission fluid cooler lines.

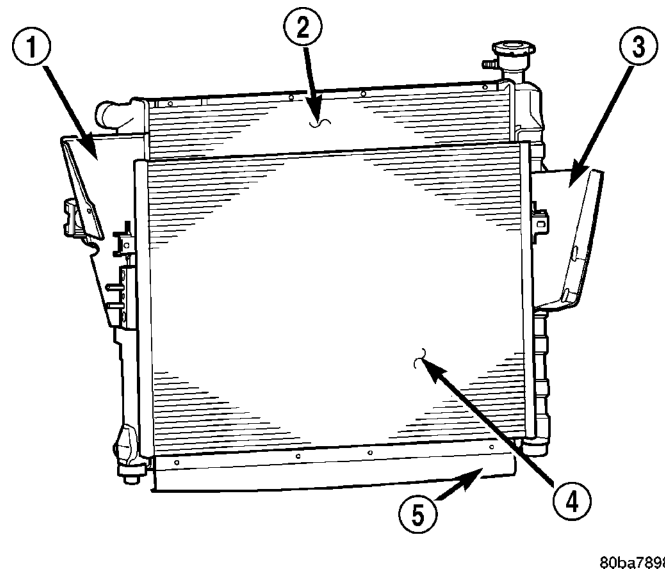

Fig. 21 Air Seals - Typical

1 - AIR DAM
2 - RADIATOR
3 - AIR DAM
4 - A/C CONDENSER
5 - AIR SEAL

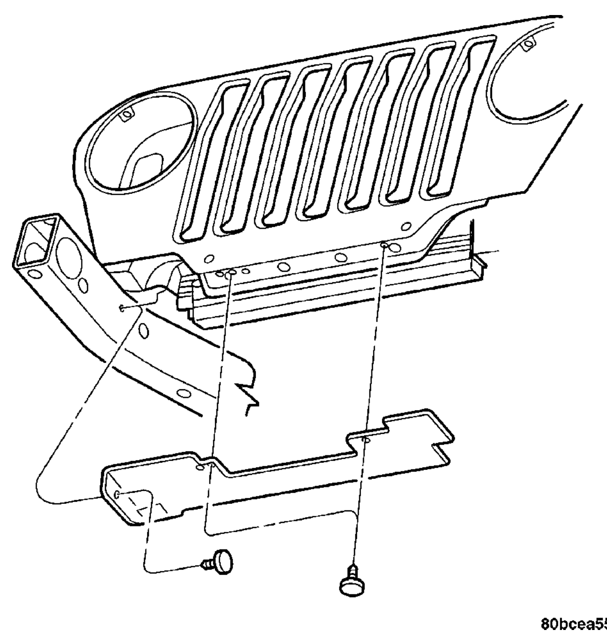

Fig. 22 Condenser Lower Seal

(11) Remove six radiator mounting bolts. Position the front axle vent hose (Fig. 23) to the side.

(12) The lower part of radiator is equipped with two alignment dowel pins (Fig. 24). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

(13) Lift radiator straight up and out of vehicle taking care not to damage radiator fins.

RADIATOR (Continued)

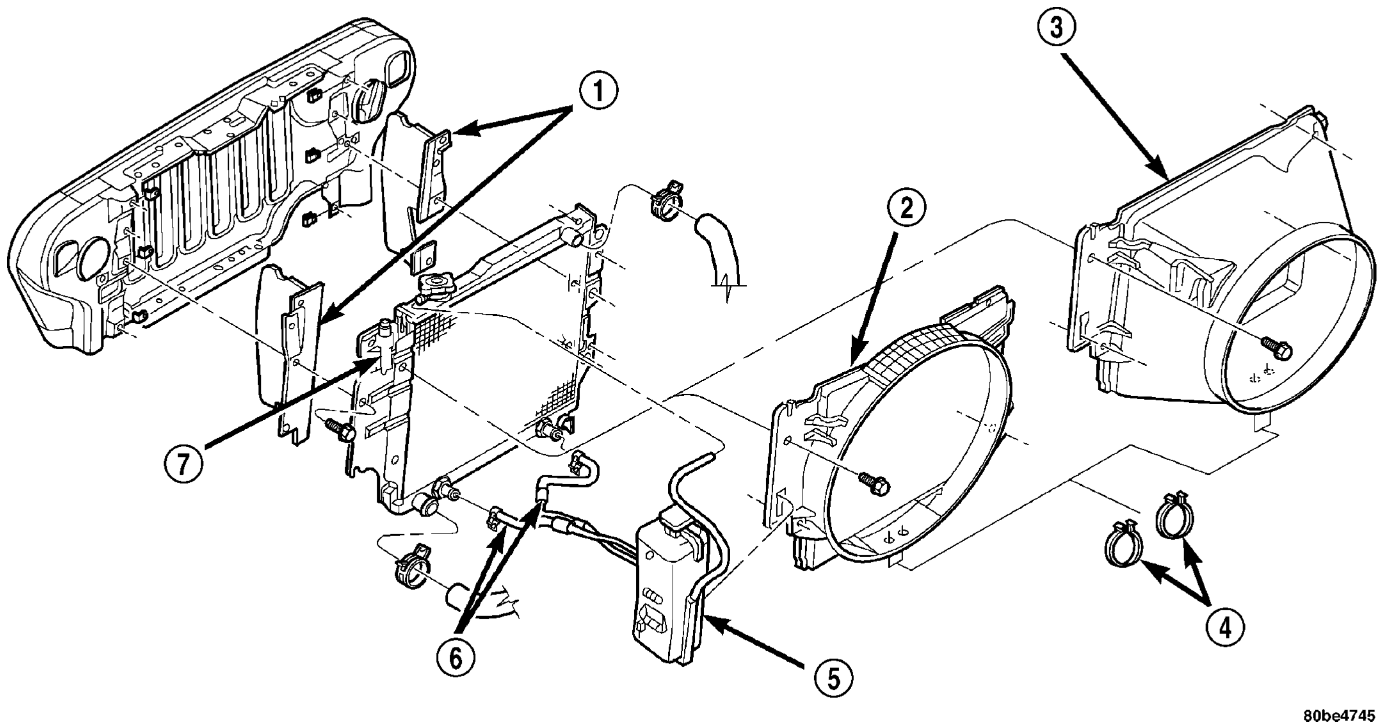

Fig. 23 Radiator - Remove/Install

1 - A/C CONDENSER SEALS
2 - FAN SHROUD (4.0L)
3 - FAN SHROUD (2.5L)
4 - TRANSMISSION OIL COOLER LINES RETAINER CLIPS
5 - COOLANT RECOVERY BOTTLE
6 - TRANSMISSION COOLER LINES (IF EQUIPPED)
7 - FRONT AXLE VENT HOSE

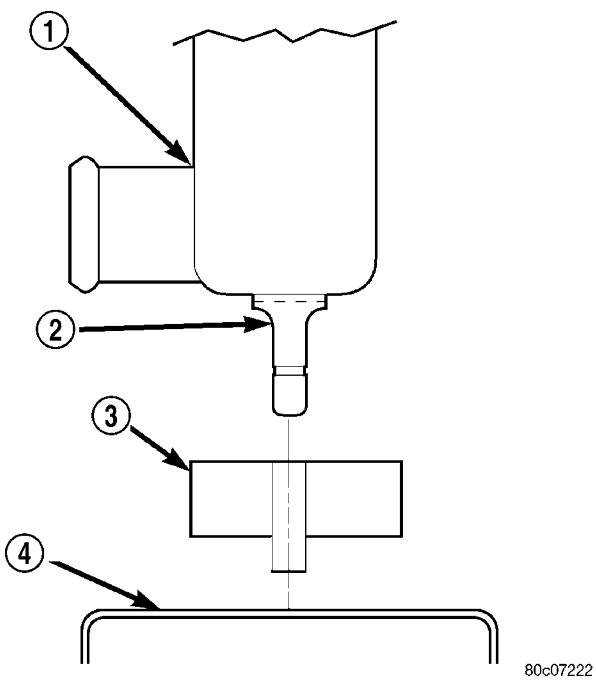

Fig. 24 Radiator Alignment Dowels - Typical

1 - RADIATOR
2 - ALIGNMENT DOWEL
3 - RADIATOR LOWER ISOLATOR
4 - RADIATOR LOWER CROSSMEMBER

(14) When removing radiator, note position of the rubber seals located on the top and bottom of radiator (on certain models only) (Fig. 23). To prevent possible overheating, these seals must be installed to their original positions.

CLEANING

Clean radiator fins. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

RADIATOR (Continued)

INSTALLATION

CAUTION: Before installing the radiator or A/C condenser, be sure the radiator-to-body and radiator-to-A/C condenser rubber air seals are properly fastened to their original positions. These are used at the top, bottom and sides of the radiator and A/C condenser. To prevent overheating, these seals must be installed to their original positions.

(1) Guide the two radiator alignment dowels into the rubber grommets located in lower radiator crossmember. Install and tighten the six mounting bolts (Fig. 23) to 8 N·m (72 in. lbs.) torque.

(2) Close radiator draincock.

(3) 2.4L ONLY - Install the electric cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(4) Position fan shroud and power steering reservoir tank (if equipped). Install and tighten four mounting bolts to 8 N·m (72 in. lbs.) torque.

(5) If equipped, remove plugs and connect automatic transmission fluid cooler lines and constant tension clamps.

CAUTION: The tangs on the hose clamps must be positioned straight down.

(6) Connect radiator hoses and install hose clamps.

(7) Position and install the condenser lower seal (Fig. 22).

(8) Connect battery negative cable.

(9) Fill cooling system with correct coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(10) Connect coolant recovery bottle hose.

(11) Install radiator cap.

(12) Check and adjust automatic transmission fluid level (if equipped).

(13) Start engine and check for leaks.

WATER PUMP - 2.4L

DESCRIPTION

The water pump has a cast aluminum body and housing with a stamped steel impeller. The water pump bolts directly to the block (Fig. 25). The cylinder block to water pump seal is provided by a rubber O-ring. The water pump is driven by the engine timing belt.

OPERATION

The water pump is the heart of the cooling system. The coolant is pumped through the engine block, cylinder head, heater core, and radiator.

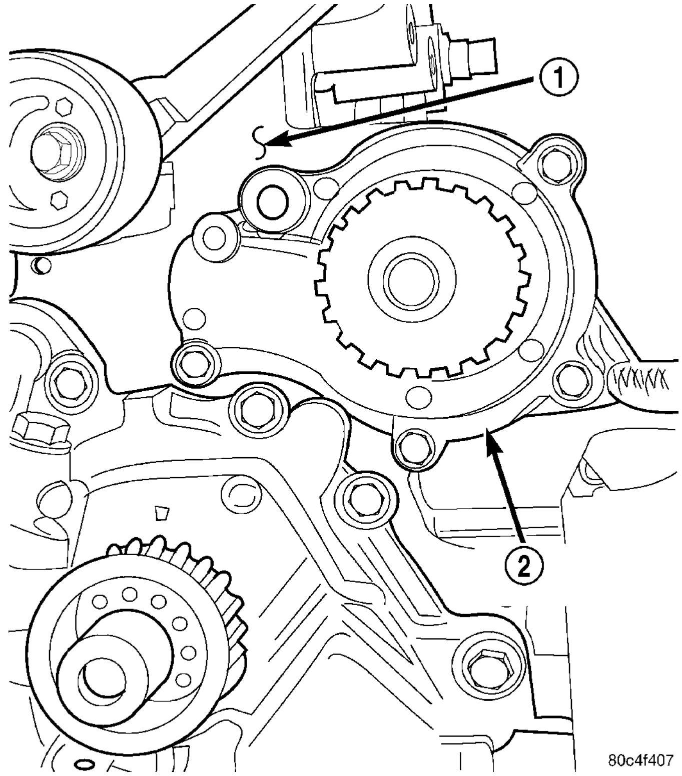

Fig. 25 Water Pump

1 - CYLINDER BLOCK
2 - WATER PUMP

DIAGNOSIS AND TESTING

WATER PUMP

A quick flow test to determine if the water pump is working effectively is to check heater system for proper operation. A defective pump will not provide an adequate flow of heated coolant through the system.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Another flow test to help determine water pump operation is as follows:

(1) Remove cooling system pressure cap.

(2) Remove a small amount of coolant from the system.

(3) Start the engine and warm up until thermostat opens.

(4) With the thermostat open and coolant level low, visually inspect for coolant flow. If flow is present, the water pump is pumping coolant through the system.

WATER PUMP - 2.4L (Continued)

REMOVAL - 2.4L

(1) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(2) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(3) Remove camshaft sprockets and rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(4) Remove screws attaching water pump to engine. Remove pump (Fig. 26).

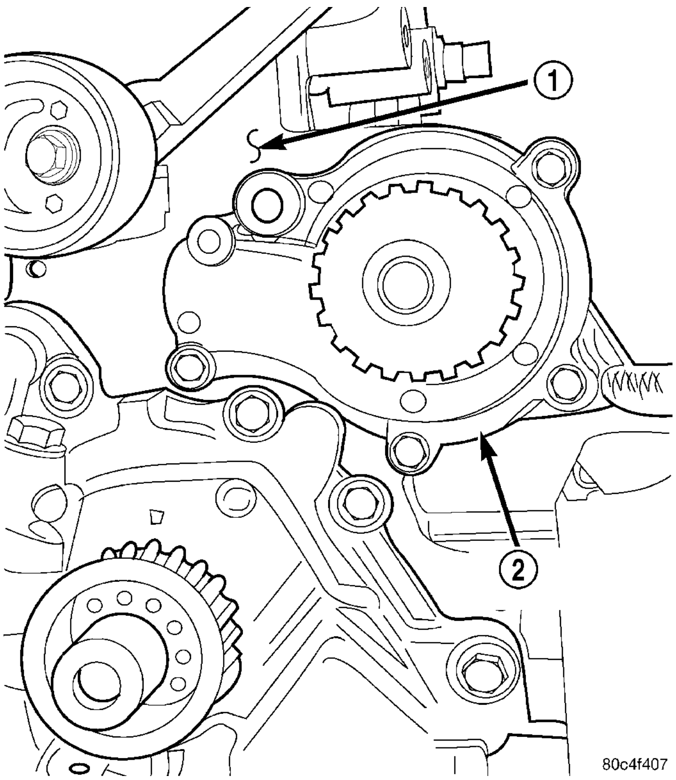

Fig. 26 Water Pump

1 - CYLINDER BLOCK
2 - WATER PUMP

INSTALLATION

INSTALLATION 2.4L

(1) Apply Mopar® Dielectric Grease to new O-ring before installation (Fig. 27).

(2) Install O-ring gasket in water pump body groove (Fig. 27).

CAUTION: Make sure O-ring gasket is properly seated in water pump groove before tightening screws. An improperly located O-ring may cause damage to the O-ring, resulting in a coolant leak.

(3) Assemble pump body to block (Fig. 26) and tighten screws to 12 N·m (105 in. lbs.).

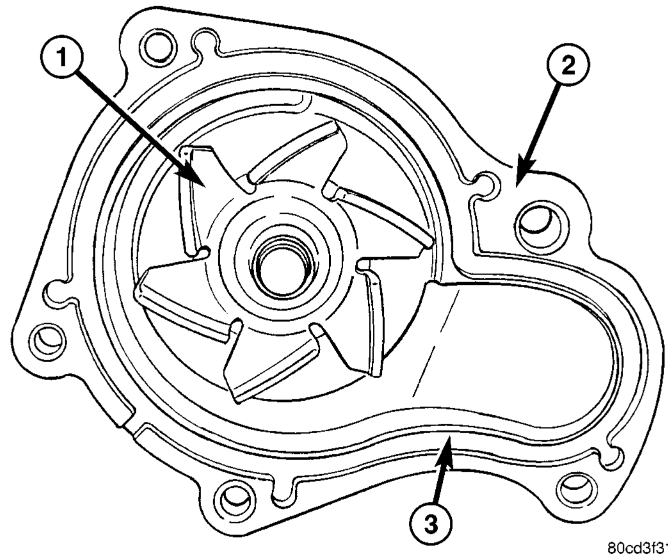

Fig. 27 Water Pump Body

1 - IMPELLER
2 - WATER PUMP BODY
3 - O-RING LOCATING GROOVE

(4) Rotate pump by hand to check for freedom of movement.

(5) Fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE). Pressurize cooling system to 103 Kpa (15 psi) with pressure tester and check water pump shaft seal and O-ring for leaks.

(6) Install rear timing belt cover and camshaft sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

WATER PUMP - 4.0L

DESCRIPTION

CAUTION: The 4.0L 6-cylinder engines is equipped with a reverse (counterclockwise) rotating water pump and thermal viscous fan drive assembly. REVERSE is stamped or imprinted on the cover of the viscous fan drive and inner side of the fan. The letter R is stamped into the back of the water pump impeller. Engines from previous model years, depending upon application, may have been equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump or viscous fan drive will cause engine over heating.

WATER PUMP - 4.0L (Continued)

This aluminum water pump (Fig. 28) is the heart of the cooling system. The water pump is located at the front of the cylinder block, above the timing chain cover

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has two small holes to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

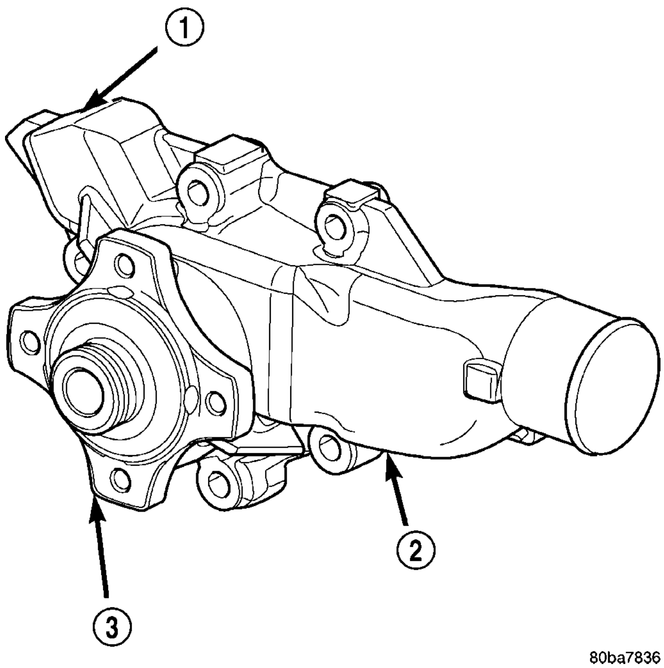

Fig. 28 Water Pump - Typical

1 - HEATER HOSE FITTING BORE
2 - WATER PUMP
3 - WATER PUMP HUB

OPERATION

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a single serpentine drive belt on all engines.

REMOVAL

The water pump can be removed without discharging the air conditioning system (if equipped).

CAUTION: All engines have a reverse (counterclockwise) rotating water pump. The letter R is stamped into the back of the water pump impeller (Fig. 29) to identify. Engines from previous model years, depending upon application, may be equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump will cause engine over heating.

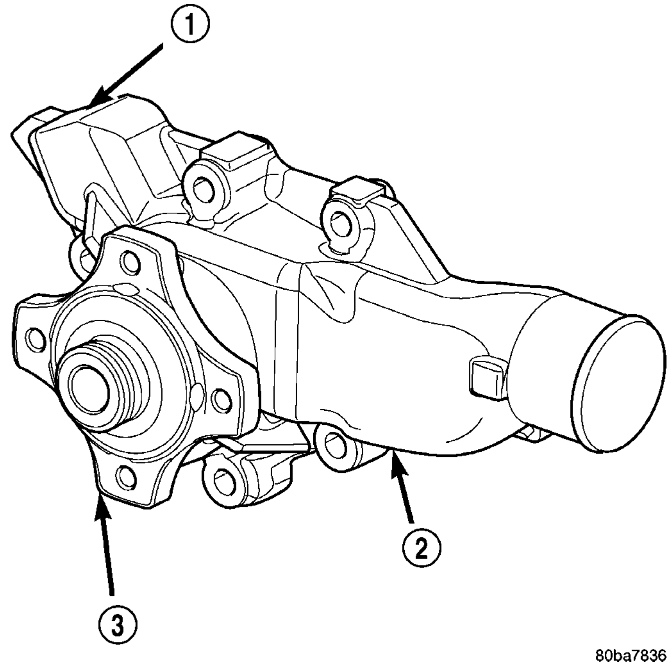

Fig. 29 Water Pump - 4.0L Engine

1 - HEATER HOSE FITTING BORE
2 - WATER PUMP
3 - WATER PUMP HUB

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect negative battery cable at battery.

(2) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

NOTE: The engine accessory drive belt must be removed prior to removing the fan.

(3) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(4) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft. Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using a suitable fan wrench loosen the fan drive (Fig. 30).

(5) Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).

WATER PUMP - 4.0L (Continued)

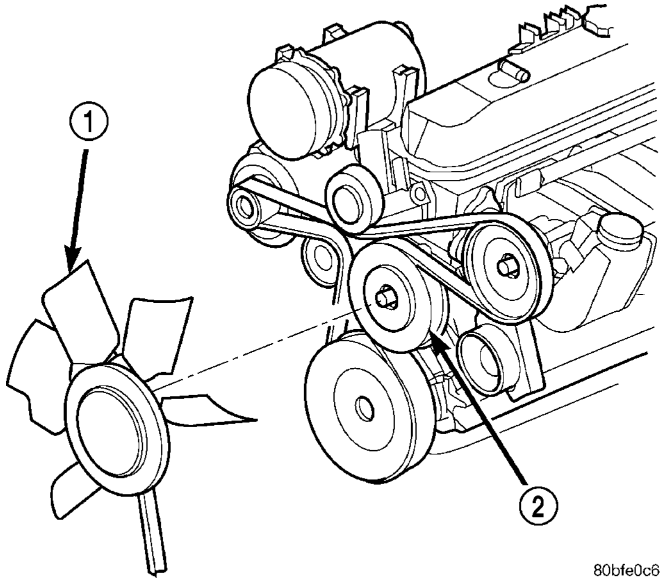

Fig. 30 Fan and Fan Drive Mounting - 4.0L Engine

1 - FAN AND FAN DRIVE
2 - WATER PUMP PULLEY

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL NUMBER 6094 (Fig. 31). ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

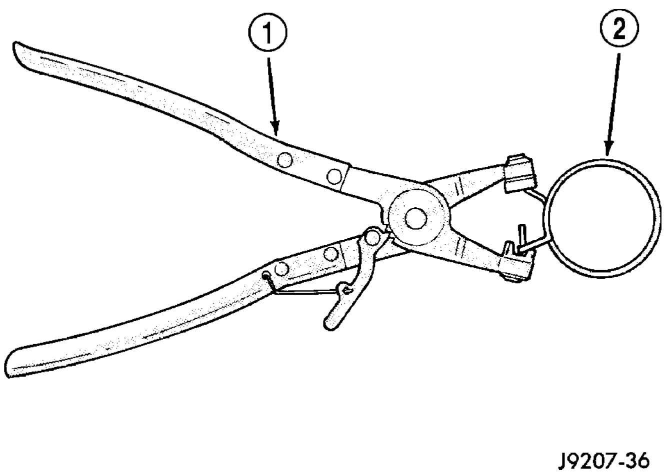

Fig. 31 Hose Clamp Tool - Typical

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 32). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(6) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

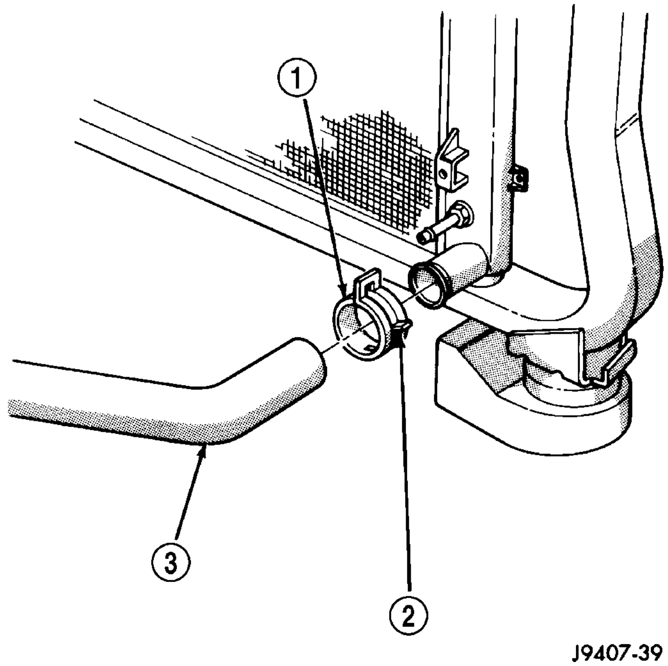

Fig. 32 Clamp Number/Letter Location

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

(8) Remove the four pump mounting bolts (Fig. 33) and remove pump from vehicle. Discard old gasket. Note that one of the four bolts is longer than the other bolts.

(9) If pump is to be replaced, the heater hose fitting must be removed. Note position of fitting before removal.

INSTALLATION

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting such as Mopar® Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, the gasket is installed dry. Tighten mounting bolts to 23 N·m (200 in. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

WATER PUMP - 4.0L (Continued)

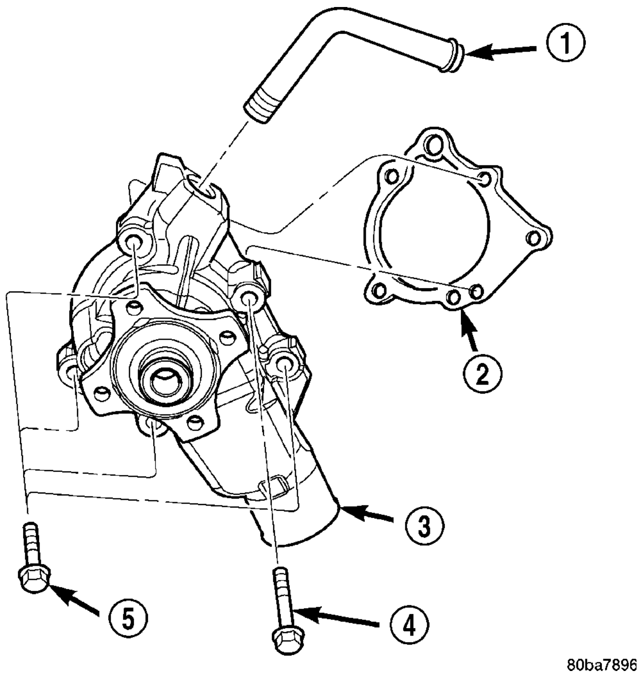

Fig. 33 Water Pump Remove/Install - 4.0L Engine

1 - HEATER HOSE FITTING
2 - PUMP GASKET
3 - WATER PUMP
4 - LONG BOLT
5 - BOLTS (4) SHORT

(5) Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).

(6) Thread the fan and fan hub into the water pump hub shaft.

CAUTION: When installing the serpentine engine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.

(7) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(8) Fill cooling system with coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).

(9) Connect battery cable to battery.

(10) Start and warm the engine. Check for leaks.

RADIATOR PRESSURE CAP

DESCRIPTION

All radiators are equipped with a pressure cap (Fig. 34). This cap releases pressure at some point within a range of 124-145 kPa (18-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-145 kPa (18-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

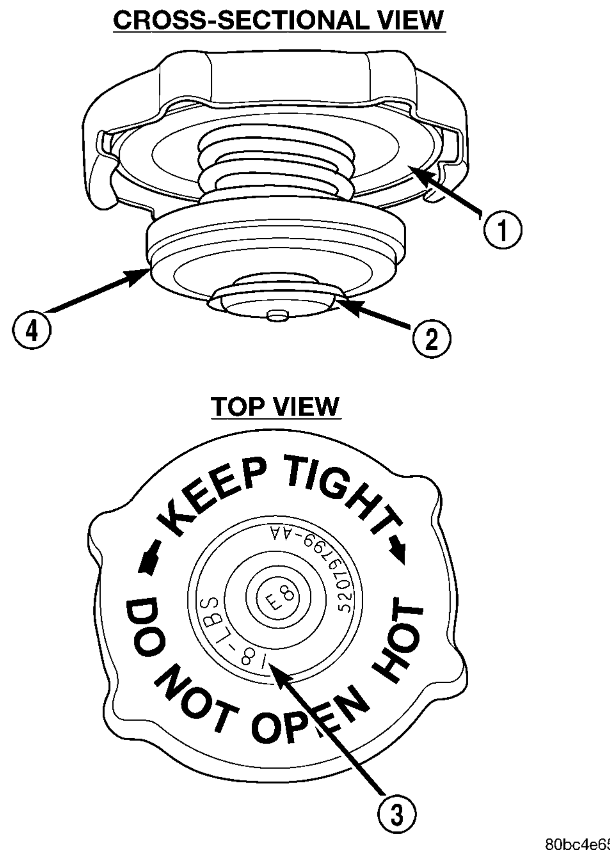

Fig. 34 Radiator Pressure Cap - Typical

1 - FILLER NECK SEAL
2 - VACUUM VENT VALVE
3 - PRESSURE RATING
4 - PRESSURE VALVE

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

RADIATOR PRESSURE CAP (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - RADIATOR CAP-TO-FILLER NECK SEAL

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at a minimum of 55 kPa (8 psi).

WARNING: THE WARNING WORDS - DO NOT OPEN HOT - ON RADIATOR PRESSURE CAP, ARE A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, RADIATOR CAP SHOULD NOT BE REMOVED WHILE SYSTEM IS HOT AND/OR UNDER PRESSURE.

Do not remove radiator cap at any time **except** for the following purposes:

(1) Check and adjust antifreeze freeze point.
(2) Refill system with new antifreeze.
(3) Conducting service procedures.
(4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER CAP AND WITHOUT PUSHING CAP DOWN, ROTATE IT COUNTERCLOCKWISE TO FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH THE COOLANT RESERVE/OVERFLOW HOSE INTO RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.

DIAGNOSIS AND TESTING - RADIATOR CAP

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap on pressure tester 7700 or an equivalent (Fig. 35).

Operate tester pump to bring pressure to 117 kPa (17 psi) on gauge. If pressure cap fails to hold pressure of at least 110 kPa (16 psi) replace cap. Refer to the following **CAUTION**.

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold

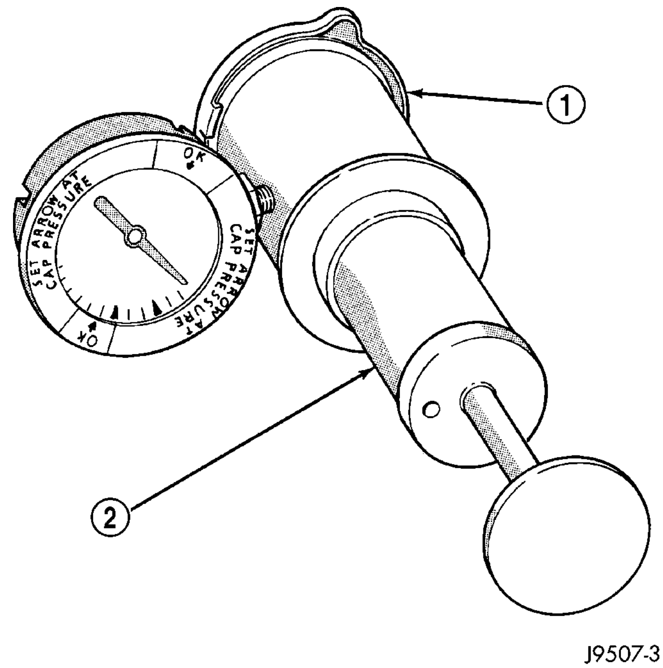

Fig. 35 Pressure Testing Radiator Cap - Typical

1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

CLEANING

Use only a mild soap and water to clean the radiator cap. Using any type solvent may cause damage to the seal in the radiator cap.

INSPECTION

Hold cap at eye level, right side up. The vent valve (Fig. 34) at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm

RADIATOR PRESSURE CAP (Continued)

spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

RADIATOR FAN

DESCRIPTION

The electric cooling fan replaces the engine driven mechanical fan. The electric cooling fan is integral to the fan shroud and is located between the radiator and the engine.

The electric fan is controlled by the electronic control module (ECM).

The electric cooling fan is not serviceable. Any failure of the fan blade, electric motor or fan shroud requires replacement of the fan module.

CAUTION: Do not attempt to service the electric cooling fan or fan blades separately, replace the cooling module as an assembly. Failure to do so may cause severe damage to the electric cooling fan assembly.

REMOVAL

REMOVAL

(1) Remove the coolant recovery bottle and position out of the way (Fig. 36).

(2) Remove and position the power steering reservoir out of the way.

(3) Disconnect the electrical connector.

(4) Remove the mounting screws.

(5) Remove the cooling fan assembly (Fig. 37).

REMOVAL - 4.0L

(1) Remove the thermal viscous fan drive/fan blade assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).

(2) Remove the four fan retaining bolts.

(3) Seperate the fan blade from the thermal viscous fan drive.

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.

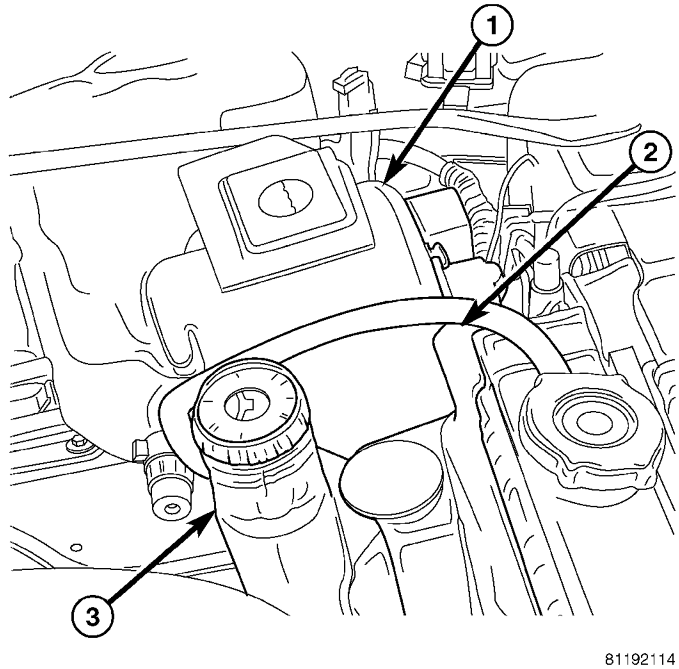

Fig. 36 Coolant Recovery Bottle

1 - COOLANT RECOVERY BOTTLE
2 - COOLING FAN ASSEMBLY
2 - POWER STEERING RESERVOIR

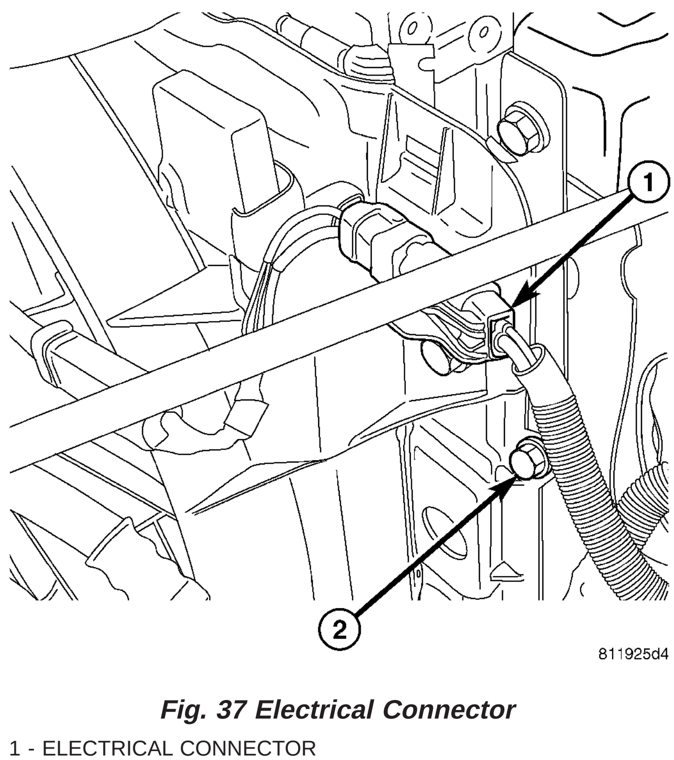

Fig. 37 Electrical Connector

1 - ELECTRICAL CONNECTOR
2 - MOUNTING SCREW

RADIATOR FAN (Continued)

CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

(1) Remove fan blade assembly from viscous fan drive unit (four bolts).

(2) Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

(3) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

INSTALLATION

INSTALLATION

(1) Position the cooling fan assembly.

(2) Install four mounting screws. Tighten to 5.5 N·m (50 in. lbs.)

(3) Connect the electrical connector.

(4) Install the power steering reservoir.

(5) Install the coolant recovery bottle.

INSTALLATION - 4.0L

(1) Position the fan blade on the thermal viscous fan drive.

(2) Install four mounting bolts. Tighten to 23 N·M (210 in. lbs.).

(3) Install the thermal viscous fan drive (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).

RADIATOR FAN RELAY

DESCRIPTION

The electric cooling fan HI and LOW relays are located in the Power Distribution Center (PDC) in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for cooling fan relay identification and location.

The HI and LOW cooling fan relays cannot be adjusted or repaired. If the HI or LOW relay is damaged or faulty, it must be replaced.

TRANSMISSION

TABLE OF CONTENTS

TRANSMISSION COOLER

DESCRIPTION

NOTE: The internal transmission oil cooler located within the radiator is not serviceable. If it requires service, the radiator must be replaced.

All models equipped with an automatic transmission are equipped with a transmission oil cooler (water-to-oil) mounted internally within the radiator tank (Fig. 1). This internal cooler is supplied as standard equipment on all models equipped with an automatic transmission.

OPERATION

Transmission oil is cooled when it passes through this separate cooler. In case of a leak in the internal radiator mounted transmission oil cooler, engine coolant may become mixed with transmission fluid or transmission fluid may enter the cooling system. Both cooling system and transmission should be drained and inspected if the internal radiator mounted transmission cooler is leaking.

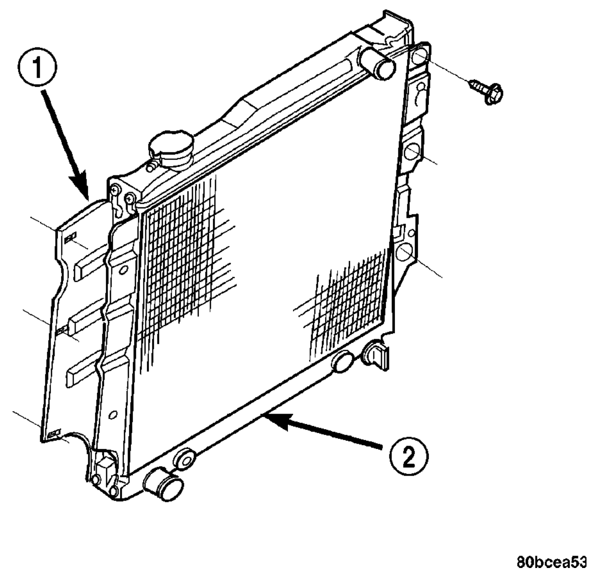

Fig. 1 Radiator with Integral Transmission Oil Cooler

1 - DOWNFLOW RADIATOR
2 - INTEGRAL TRANSMISSION OIL COOLER (INTERNAL TO RADIATOR)

AUDIO/VIDEO

TABLE OF CONTENTS

AUDIO

DESCRIPTION

Several combinations of radio receivers and speaker systems are offered.

The audio system includes the following components:

- Amplified sub woofer (if equipped)
- Antenna
- Radio noise suppression components
- Radio receiver
- Speakers

Certain functions and features of the audio system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communication Interface (PCI) bus network. The data bus network allows the sharing of sensor information. For diagnosis of these electronic modules or of the data bus network, the use of a DRB III® scan tool and the proper Diagnostic Procedures manual are recommended.

OPERATION

The audio system components are designed to provide audio entertainment and information through the reception, tuning and amplification of locally broadcast radio signals in both the Amplitude Modulating (AM) and Frequency Modulating (FM) commercial frequency ranges.

The audio system components operate on battery current received through a fuse in the Junction Block (JB) on a fused ignition switch output (run-acc) circuit so that the system will only operate when the ignition switch is in the Run or Accessory positions.

DIAGNOSIS AND TESTING - AUDIO

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

AUDIO (Continued)

Audio System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
NO AUDIO.	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw fuse in Power Distribution Center. Replace fuses, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Exchange or replace radio, if required.
	6. Speakers inoperative.	6. Refer to speaker diagnosis.
NO DISPLAY.	1. Fuse inoperative.	1. Check radio fuse and Ignition-Off Draw fuse in Power Distribution Center. Replace fuses, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Exchange or replace radio, if required.
CLOCK WILL NOT KEEP SET TIME.	1. Fuse inoperative.	1. Check ignition-off draw fuse. Replace fuse, if required.
	2. Radio connector damaged.	2. Check for loose or corroded radio connector. Repair, if required.
	3. Wiring damaged.	3. Check for battery voltage at radio connector. Repair wiring, if required.
	4. Ground damaged.	4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required.
	5. Radio inoperative.	5. Exchange or replace radio, if required.
POOR RADIO RECEPTION.	1. Antenna inoperative.	1. See antenna diagnosis, in this group. Repair or replace antenna, if required.
	2. Ground damaged.	2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required..
	3. Radio inoperative.	3. Exchange or replace radio, if required.
NO/POOR TAPE OPERATION.	1. Tape damaged.	1. Insert known good tape and test operation.
	2. Foreign objects behind tape door.	2. Remove foreign objects and test operation.
	3. Dirty cassette tape head.	3. Clean head with Mopar Cassette Head Cleaner.
	4. Radio inoperative	4. Exchange or replace radio, if required.

AUDIO (Continued)

Audio System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
NO COMPACT DISC OPERATION	1. CD damaged.	1. Insert known good CD and test operation.
	2. Foreign material on CD.	2. Clean CD and test operation.
	3. Condensation on CD or optics.	3. Allow temperature of vehicle interior to stabilize and test operation.
	4. Radio inoperative	4. Exchange or replace radio, if required.

AMPLIFIED SUBWOOFER

DESCRIPTION

The available amplified subwoofer is mounted within the center console. The amplified subwoofer is rated at 80 watts. The amplified subwoofer should be checked if there is no bass output noted from the center console speaker. The amplified subwoofer can not be repaired or adjusted, and if faulty or damaged, the unit must be replaced.

OPERATION

The amplified subwoofer provides low frequency bass and receives inputs from the front and rear speaker circuits.

DIAGNOSIS AND TESTING - AMPLIFIED SUBWOOFER

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

(1) Turn the ignition switch to the On position. Turn the radio receiver on. Adjust the balance and fader controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly.

(2) Disconnect the wire harness connector from the amplified subwoofer. Turn the ignition switch to the ON position. Turn the radio ON. Check the radio choke relay wire harness connector. If not OK, repair shorted or open wires as necessary. If OK, go to (STEP #3).

(3) Turn the radio off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio and the amplified subwoofer. Check both the speaker feed (+) circuit and return (–) circuit cavities for the inoperative speaker location(s) from the radio wire harness connectors and to the amplified subwoofer for continuity. In each case, there should be continuity. If not OK, repair the shorted speaker feed (+) and/or return (–) circuit(s) to the speaker as required. If OK, replace the amplified subwoofer.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center console (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL).

(3) Disconnect wire harness retainer.

(4) Disconnect wire harness connector.

(5) Remove the mounting screws from the side of the console.

(6) Open console lid and remove the retaining fasteners from the console.

(7) Remove amplified subwoofer from console.

INSTALLATION

(1) Install amplified subwoofer to console.

(2) Install retaining fasteners to the top of the console.

AMPLIFIED SUBWOOFER (Continued)

(3) Install the mounting screws to the side of the console.

(4) Connect wire harness connector and retainer.

(5) Install the center console (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION).

(6) Connect the battery negative cable.

ANTENNA BODY & CABLE

DESCRIPTION

All models use a fixed-length stainless steel rod-type antenna mast, installed on the right front cowl side panel of the vehicle. The antenna mast is connected to the center wire of the coaxial antenna cable, and is not grounded to any part of the vehicle.

To eliminate static, the antenna base must have a good ground. The antenna coaxial cable shield (the outer wire mesh of the cable) is grounded to the antenna base and the radio chassis.

The antenna coaxial cable has an additional disconnect, located behind the right end of the instrument panel between the radio and the right cowl side panel. This additional disconnect allows the instrument panel assembly to be removed and installed without removing the radio.

DIAGNOSIS AND TESTING - ANTENNA BODY AND CABLE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1** - Mast to ground test
- **Test 2** - Tip-of-mast to tip-of-conductor test
- **Test 3** - Body ground to battery ground test
- **Test 4** - Body ground to coaxial shield test.

The ohmmeter test lead connections for each test are shown in Antenna Tests (Fig. 1).

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate an antenna cable problem. First, test the primary antenna cable (integral to the antenna body and cable) from the coaxial cable connector behind the right side of the instrument panel between the radio and the right side cowl panel, to the antenna body. Then, test the secondary antenna cable (instrument panel antenna cable) from the coaxial connector behind the right side of the instrument panel between the radio and the right side cowl panel, to the coaxial cable connector at the radio.

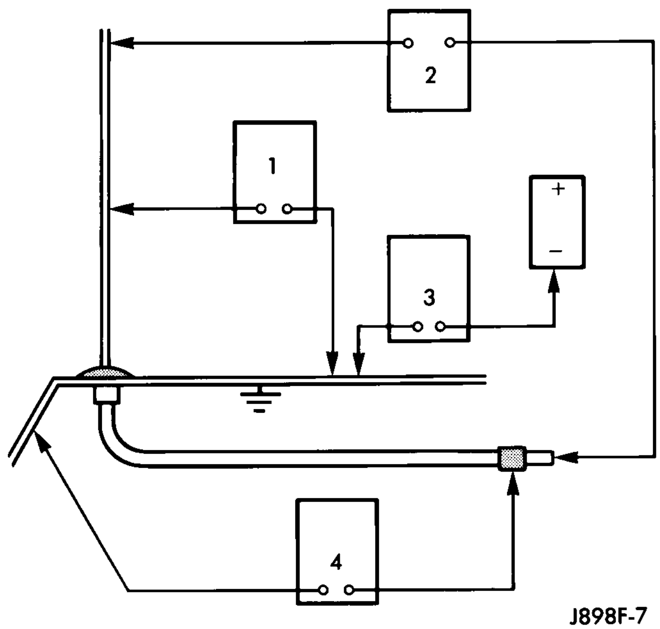

Fig. 1 Antenna Tests

TEST 1

Test 1 determines if the antenna mast is insulated from the base. Proceed as follows:

(1) Unplug the antenna coaxial cable connector from the radio chassis and isolate.

(2) Connect one ohmmeter test lead to the tip of the antenna mast. Connect the other test lead to the antenna base. Check for continuity.

(3) There should be no continuity. If continuity is found, replace the faulty or damaged antenna base and cable assembly.

TEST 2

Test 2 checks the antenna for an open circuit as follows:

(1) Unplug the antenna coaxial cable connector from the radio chassis.

(2) Connect one ohmmeter test lead to the tip of the antenna mast. Connect the other test lead to the center pin of the antenna coaxial cable connector.

(3) Continuity should exist (the ohmmeter should only register a fraction of an ohm). High or infinite resistance indicates damage to the base and cable assembly. Replace the faulty base and cable, if required.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. This test should be performed with the battery positive cable removed from the bat-

ANTENNA BODY & CABLE (Continued)

tery. Disconnect both battery cables, the negative cable first. Reconnect the battery negative cable and perform the test as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the battery negative post.

(2) The resistance should be less than one ohm.

(3) If the resistance is more than one ohm, check the braided ground strap connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair or replace the ground strap connection, if required.

TEST 4

Test 4 checks the condition of the ground between the antenna base and the vehicle body as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the outer crimp on the antenna coaxial cable connector.

(2) The resistance should be less then one ohm.

(3) If the resistance is more then one ohm, clean and/or tighten the antenna base to fender mounting hardware.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Reach through the instrument panel glove box opening to unplug the two antenna coaxial cables in line connector. Unplug the connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.

(4) Unscrew the antenna mast from the antenna body base on the right outer cowl side panel (Fig. 2).

(5) Using a trim stick, gently pry the edge of the antenna base trim cover to unsnap it from the antenna body base.

(6) Remove the three screws that secure the antenna body base to the right outer cowl side panel.

(7) From inside the passenger compartment, push the coaxial cable grommet on the antenna body half of the coaxial cable out through the hole in the right inner cowl side panel.

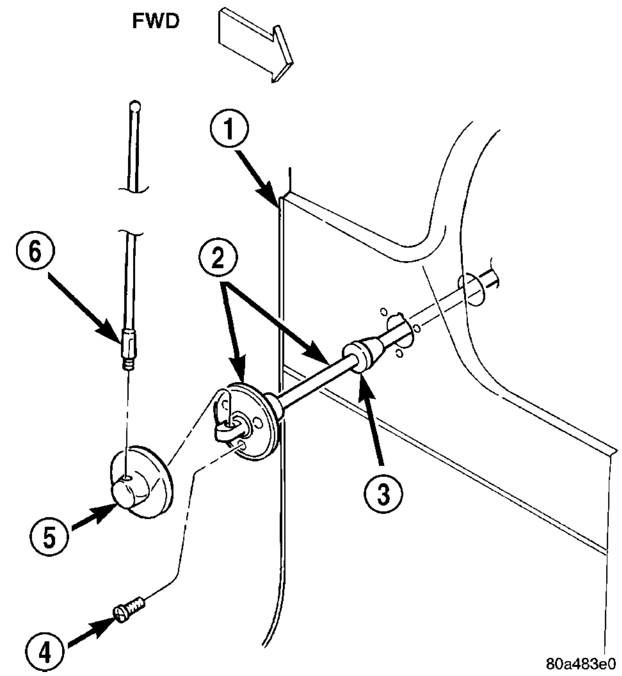

Fig. 2 Antenna Remove/Install

1 - RIGHT COWL SIDE PANEL
2 - BASE & CABLE
3 - GROMMET
4 - SCREW
5 - COVER
6 - MAST

(8) From the outside of the vehicle, pull the antenna body base and cable assembly out through the hole in the right outer cowl side panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) From outside the vehicle, feed the antenna cable and base assembly through the outer cowl side panel and into the inner cowl side panel hole.

(2) From inside the passenger compartment, pull the cable and grommet into the hole in the inside cowl side panel until the grommet is fully seated.

(3) Install the three screws retaining the antenna body base to right outer cowl side panel. Tighten the screws to 3.3 N·m (30 in. lbs.).

(4) Snap on the antenna base trim cover to the antenna body base.

(5) Install antenna mast. Tighten to 5 N·m (46 in. lbs.). **Ensure that the antenna mast is fully**

ANTENNA BODY & CABLE (Continued)

seated on antenna base and that there is no gap between the mast and base.

(6) Reach through the glove box opening and connect the two antenna coaxial cables in line connector.

(7) Install the glove box to the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(8) Connect the battery negative cable.

RADIO

DESCRIPTION

Available factory-installed radio receivers for this model include:

• AM/FM/cassette with CD changer control feature (RBB sales code)

• AM/FM/CD with CD changer control feature (RBK sales code)

• AM/FM/cassette/CD/ with CD changer control feature (RAD, RBT or RBY sales code) - export only

All factory-installed radio receivers can communicate on the Programmable Communications Interface (PCI) data bus network. All factory-installed receivers are stereo Electronically Tuned Radios (ETR) and include an electronic digital clock function.

These radio receivers can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

OPERATION

The radio receiver operates on ignition switched battery current that is available only when the ignition switch is in the On or Accessory positions. The electronic digital clock function of the radio operates on fused battery current supplied through the IOD fuse, regardless of the ignition switch position.

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).

(3) Remove the center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).

(4) Remove the screws that secure the radio to the instrument panel.

(5) If the vehicle is equipped with the CD radio, go to Step 6. If the vehicle is not equipped with the CD radio receiver, go to Step 8.

(6) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(7) Reach through the instrument panel glove box opening to access and remove the nut that secures the CD radio bracket and the ground strap to the back of the radio.

(8) Pull the radio out from the instrument panel far enough to access the wire harness connectors and the antenna coaxial cable connector.

(9) Unplug the wire harness connectors from the rear of the radio.

CAUTION: Pulling the antenna cable straight out of the radio without pulling on the locking antenna connector could damage the cable or radio.

(10) Disconnect the antenna cable by pulling the locking antenna connector away from the radio (Fig. 3).

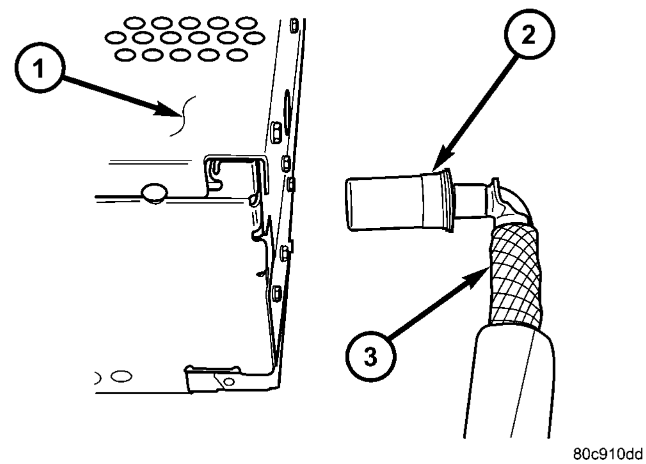

Fig. 3 ANTENNA TO RADIO

1 - RADIO
2 - LOCKING ANTENNA CONNECTOR
3 - INSTRUMENT PANEL ANTENNA CABLE

(11) Remove the radio from the instrument panel.

RADIO (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Connect the coaxial antenna cable at the rear of the radio chassis.
(2) Connect the radio wire harness connectors to the rear of the radio.
(3) Install the radio to the instrument panel.
(4) If equipped with a CD radio, reach through the glove box opening and install the nut through the CD radio bracket stud plate. Ensure that antenna in-line connector is properly mated and has not become disconnected or pinched.
(5) Install glove box.
(6) Install the retaining screws. Tighten the screws to 5 N·m (20 in. lbs).
(7) Install the center bezel to the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).
(8) Connect the battery negative cable.

RADIO NOISE SUPPRESSION COMPONENTS

DESCRIPTION

Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) noise suppression is accomplished primarily through circuitry internal to the radio receivers. These internal suppression devices are only serviced as part of the radio receiver.

External suppression devices that are used on this vehicle to control RFI or EMI noise include the following:
- Radio antenna base ground
- Radio receiver chassis ground wire
- Engine-to-body ground strap
- Resistor-type spark plugs
- Radio suppression-type secondary ignition wiring.

DIAGNOSIS AND TESTING - RADIO NOISE SUPPRESSION COMPONENTS

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For complete circuit diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds. Inspect the ground paths and connections at the following locations:
- Blower motor
- Electric fuel pump
- Engine-to-body ground strap
- Generator
- Ignition module
- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Wiper motor.

If the source of RFI or EMI noise is identified as a component on the vehicle (i.e., generator, blower motor, etc.), the ground path for that component should be checked. If excessive resistance is found in any ground circuit, clean, tighten, or repair the ground circuits or connections to ground as required before considering any component replacement.
- Ignition coil
- Spark plugs
- Spark plug wire routing and condition.

Reroute the spark plug wires or replace the faulty components as required.

If the source of the RFI or EMI noise is identified as two-way mobile radio or telephone equipment, check the equipment installation for the following:
- Power connections should be made directly to the battery, and fused as closely to the battery as possible.
- The antenna should be mounted on the roof or toward the rear of the vehicle. Remember that magnetic antenna mounts on the roof panel can adversely affect the operation of an overhead console compass, if the vehicle is so equipped.
- The antenna cable should be fully shielded coaxial cable, should be as short as is practical, and should be routed away from the factory-installed vehicle wire harnesses whenever possible.
- The antenna and cable must be carefully matched to ensure a low Standing Wave Ratio (SWR).

REMOVAL

ENGINE-TO-BODY GROUND STRAP

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the screw that secures the engine-to-body ground strap eyelet to the hood panel center reinforcement.

(2) Remove the screw that secures the engine-to-body ground strap eyelet to the dash panel.

(3) Remove the nut that secures the engine-to-body ground strap eyelet to the stud on the left upper rear corner of the engine cylinder head.

(4) Remove the engine-to-body ground strap eyelet from the stud on the left upper rear corner of the engine cylinder head.

(5) Remove the engine-to-body ground strap from the engine compartment.

INSTALLATION

ENGINE-TO-BODY GROUND STRAP

(1) Position the engine-to-body ground strap in the engine compartment.

(2) Position the engine-to-body ground strap eyelet over the stud on the left upper rear corner of the engine cylinder head.

(3) Install and tighten the nut that secures the engine-to-body ground strap eyelet to the stud on the left upper rear corner of the engine cylinder head. Tighten the nut to 5.6 N·m (50 in. lbs.).

(4) Install and tighten the screw that secures the engine-to-body ground strap eyelet to the dash panel. Tighten the screw to 48.5 N·m (430 in. lbs.).

(5) Install and tighten the screw that secures the engine-to-body ground strap eyelet to the hood panel center reinforcement. Tighten the screw to 1.9 N·m (17 in. lbs.).

SPEAKER

DESCRIPTION

The standard equipment speaker system includes four full-range speakers. The two front speakers are mounted behind a removable bezel located on each outboard end of the lower instrument panel. With the premium speaker system, the standard front speakers are replace with an enclosure assembly that includes a 4 inch speaker and a 1 inch tweeter. The two rear speakers are mounted behind a grille located on each outboard end of the sport bar, above the rear seating area of the vehicle.

OPERATION

Two wires connected to each speaker, one feed circuit (+) and one return circuit (–), allow the audio output signal electrical current to flow through the speaker voice coil.

DIAGNOSIS AND TESTING - SPEAKER

Any diagnosis of the Audio system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, SIDE AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio is a "floating ground" system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

SPEAKER (Continued)

NOTE: If poor sound quality is noted in the audio system, check the Cabin Equalization curve programmed in the instrument cluster. Make sure a base speaker system has the Base Cabin Equalization Curve programmed to the vehicle. If the vehicle has a premium speaker system, make sure the Premium Cabin Equalization Curve is programmed to the vehicle

(1) If all speakers are inoperative, check the fuses in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the ON position. Turn the radio receiver ON. Adjust the balance and fader control controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 3.

(3) Turn the radio receiver OFF. Turn the ignition OFF. Disconnect and isolate the battery negative cable. Remove the radio receiver. Go to Step 4.

(4) Check both the speaker feed (+) circuit and return (-) circuit cavities for the inoperative speaker at the radio receiver wire harness connector for continuity to ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted speaker feed (+) and/or return (-) circuits(s) to the speaker as required.

(5) Disconnect wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (-) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (-) circuits(s) as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FRONT

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two screws that secure the outboard end of the speaker bezel to the instrument panel (Fig. 4).

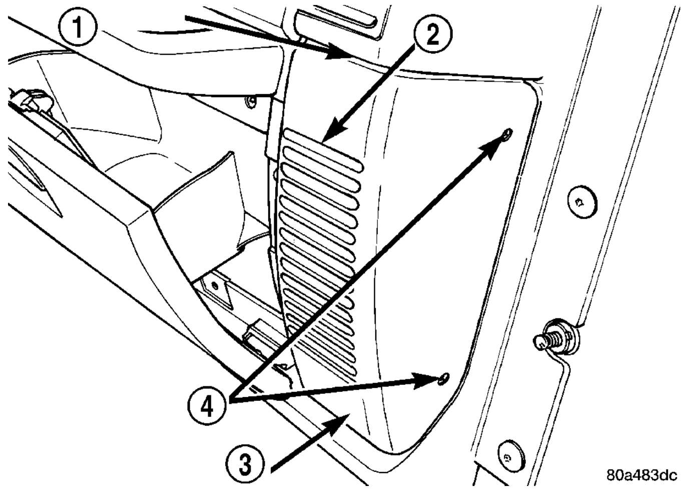

Fig. 4 Instrument Panel Speaker Bezel Remove/Install

1 - PRY HERE
2 - SPEAKER BEZEL
3 - PRY HERE
4 - MOUNTING SCREWS

(3) Using a trim stick, gently pry at the top and bottom edges of the speaker bezel to release the two snap clip retainers that secure the bezel to the instrument panel.

(4) Remove the speaker bezel from the instrument panel.

(5) Remove the four screws that secure the speaker to the instrument panel (Fig. 5).

(6) Pull the speaker away from the instrument panel far enough to access the speaker wire harness connector.

(7) Unplug the wire harness connector from the speaker.

REAR

(1) Disconnect and isolate the battery negative cable.

(2) Remove mounting screws and speaker grill.

(3) Remove speaker from housing and disconnect wire harness connector.

SPEAKER (Continued)

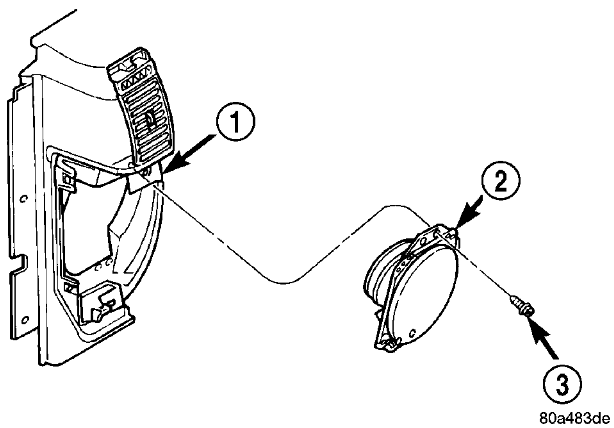

Fig. 5 Instrument Panel Speaker Remove/Install

1 - INSTRUMENT PANEL
2 - SPEAKER
3 - SCREW

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, (REFER TO ELECTRICAL/RESTRAINTS) BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FRONT

(1) Connect the speaker wire connector to the speaker.

(2) Position the speaker to the instrument panel.

(3) Install the four speaker retaining screws. Tighten the screws to 1.1 N·m (10.in.lbs).

(4) Install the speaker bezel to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Connect the battery negative cable.

REAR

(1) Connect wire harness and position speaker into housing.

(2) Install speaker grill and mounting screws.

(3) Connect battery negative cable.

CHIME/BUZZER

TABLE OF CONTENTS

CHIME WARNING SYSTEM

DESCRIPTION

A chime warning system is standard factory-installed equipment on this model. The chime warning system uses a single chime tone generator that is integral to the instrument cluster to provide an audible indication of various vehicle conditions that may require the attention of the vehicle operator. The chime warning system includes the following major components, which are described in further detail elsewhere in this service information:

- **Door Ajar Switch** - A door ajar switch is mounted to each front door hinge pillar. This switch provides an input to the chime warning system indicating whether the front doors are open or closed.
- **Ignition Switch** - A key-in ignition switch is integral to the ignition switch. The key-in ignition switch provides an input to the chime warning system indicating whether a key is present in the ignition lock cylinder.
- **Instrument Cluster** - The instrument cluster contains an integral chime tone generator, integrated circuitry, a central processing unit and the programming to provide all of the proper chime warning system features based upon the monitored inputs. The instrument cluster circuitry monitors hard-wired switch inputs, as well as message inputs received from other vehicle electronic modules on the Programmable Communications Interface (PCI) data bus network.
- **Left Multi-Function Switch** - The exterior lighting switch is integral to the left multi-function switch. The exterior lighting switch provides an input to the chime warning system indicating when the exterior lamps are turned On or Off.
- **Seat Belt Switch** - A seat belt switch is integral to the driver side front seat belt buckle-half unit. The seat belt switch provides an input to the chime warning system indicating whether the driver side front seat belt is fastened.

Hard wired circuitry connects many of the chime warning system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. Refer to the appropriate wiring information.

The instrument cluster chime warning system circuitry and the integral chime tone generator cannot be adjusted or repaired. If the instrument cluster or the chime tone generator are damaged or faulty, the instrument cluster must be replaced.

OPERATION

The chime warning system is designed to provide an audible output as an indication of various conditions that may require the attention or awareness of the vehicle operator. The chime warning system components operate on battery voltage received through the Ignition-Off Draw (IOD) fuse in the Power Distribution Center (PDC) so that the system may operate regardless of the ignition switch position.

The chime warning system provides an audible warning to the vehicle operator under the following conditions:

- **Air Bag Warning** - The instrument cluster chime tone generator will generate a single chime tone when the airbag indicator is illuminated for an airbag system fault condition. The instrument cluster uses airbag indicator lamp-on and lamp-off message inputs received from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus indicating that the airbag indicator should be illuminated for an airbag system fault condition.
- **Charging System Warning** - The instrument cluster chime tone generator will generate a single chime when the check gauges indicator is illuminated for a charging system fault or a system voltage high warning condition. The instrument cluster uses system voltage status message inputs received from the Powertrain Control Module (PCM) over the PCI data bus to illuminate the check gauges indicator for a charging system fault. This chime feature will only occur once in an ignition cycle.
- **Driver Door Ajar Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate to announce that the hard

CHIME WARNING SYSTEM (Continued)

wired inputs from the driver door ajar switch and the ignition switch as well as an engine speed message input received from the PCM over the PCI data bus indicate that the driver door is opened with the ignition switch in the On position and the engine is not running. The chimes will continue to sound for a duration of about twenty minutes, until the driver door is closed, until the ignition switch is turned to the Off position, or until the engine speed message indicates the engine is running, whichever occurs first.

- **Engine Coolant Temperature High Warning** - The instrument cluster chime tone generator will generate a single chime tone when the check gauges indicator is illuminated for a high or critical engine coolant temperature condition. The instrument cluster uses engine coolant temperature message inputs received from the PCM over the PCI data bus to illuminate the check gauges indicator for a coolant temperature high condition. This chime feature will only occur once in an ignition cycle.
- **Fasten Seat Belt Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate each time the ignition switch is turned to the On or Start positions to announce that the hard wired inputs from the seat belt switch and the ignition switch indicate that the driver side front seat belt is not fastened. The chimes will continue to sound for a duration of about six seconds, until the driver side front seat belt is fastened, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Head/Park Lights-On Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate to announce that the hard wired inputs from the driver door ajar switch, the ignition switch, and the exterior lighting circuitry of the left multi-function switch indicate that the exterior lamps are turned On with the driver door opened and the ignition switch in the Off position. The chimes will continue to sound for about three minutes or until the exterior lamps are turned Off, the driver door is closed, or the ignition switch is turned to the On position, whichever occurs first.
- **Key-In-Ignition Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate to announce that the hard wired inputs from the driver door ajar switch, the ignition switch, and the key-in ignition circuitry of the ignition switch indicate that the key is in the ignition lock cylinder with the driver door opened and the ignition switch in the Off position. The chimes will continue to sound until the key is removed from the ignition lock cylinder, the driver door is closed, or the ignition switch is turned to the On position, whichever occurs first.
- **Low Fuel Warning** - The instrument cluster chime tone generator will generate one chime tone when the low fuel indicator is illuminated by the instrument cluster. The instrument cluster uses a percent tank full message input received from the PCM over the PCI data bus indicating that there is less than about one-eighth tank of fuel remaining to illuminate the low fuel indicator. This chime feature will only occur once in an ignition cycle.
- **Low Oil Pressure Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a fast rate when the check gauges indicator is illuminated for a low oil pressure condition. The instrument cluster uses engine speed and oil pressure message inputs received from the PCM over the PCI data bus indicating that the engine is running at greater than 300 rpm and that the oil pressure is low to illuminate the check gauges indicator. The chimes will continue to sound for five seconds, until the engine oil pressure message indicates that the oil pressure is not low, or until the engine speed message indicates that the engine is running at less than 300 rpm, whichever occurs first. This chime tone will only occur once in an ignition cycle.
- **Overspeed Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate to announce that a vehicle speed message input received from the PCM over the PCI data bus indicates that the vehicle speed is above 120 kilometers-per-hour (75 miles-per-hour). The chimes will continue to sound until the vehicle speed message indicates that the vehicle speed is below 120 kilometers-per-hour (75 miles-per-hour). This feature is only enabled on an instrument cluster that has been programmed with a Middle East Gulf Coast Country (GCC) country code.
- **Park Brake Reminder** - The instrument cluster chime tone generator will generate ten repetitive chimes at a slow rate to announce that the hard wired input from the park brake switch and a vehicle speed message input received from the PCM over the PCI data bus indicates that the park brake is applied and the vehicle is moving. This chime feature will repeat each time the input conditions are met.
- **Passenger Door Ajar Warning** - The instrument cluster chime tone generator will generate three sets of two chimes at a slow rate to announce that the hard wired inputs from the passenger door ajar switch and the ignition switch as well as an engine speed message input received from the PCM over the PCI data bus indicate that the passenger door is opened with the ignition switch in the On position and the engine is not running. This chime feature will repeat each time the input conditions are met.

CHIME WARNING SYSTEM (Continued)

• **Sentry Key Immobilizer System "Customer Learn" Mode Announcement** - This chime feature is only active on vehicles equipped with the optional Sentry Key Immobilizer System (SKIS) and sold in markets where the optional "Customer Learn" programming feature is available. The instrument cluster chime tone generator will generate one chime to announce that a status message input received from the Sentry Key Immobilizer Module (SKIM) over the PCI data bus indicates that the SKIS is in the "Customer Learn" mode, which is used for programming additional sentry key transponders.

• **Turn Signal On Warning** - The instrument cluster chime tone generator will generate repetitive chimes at a slow rate to announce that the hard wired input for the right or left turn signal indicator as well as vehicle distance and speed message inputs received from the PCM over the PCI data bus indicate that a turn signal has been active continuously for 1.6 kilometers (1 mile) with the vehicle speed greater than 22 kilometers-per-hour (15 miles-per hour). Vehicles built for markets other than the United States and Canada have a revised distance threshold of 4 kilometers for this feature. The chime will continue until the turn signal input becomes inactive, the status changes, or until the vehicle speed message indicates that the speed is less than 22 kilometers-per-hour (15 miles-per-hour), whichever occurs first. The hazard warning flashers will not activate this chime feature.

The instrument cluster provides chime service for all available features in the chime warning system. The instrument cluster relies upon its internal programming, hard wired inputs from numerous switches, and electronic message inputs received from other electronic modules over the PCI data bus network. Upon receiving the proper inputs, the instrument cluster activates the integral chime tone generator to provide the audible chime to the vehicle operator. The chime tone generator in the instrument cluster is capable of producing single chime tones, or repeated chime tones at two different rates: about fifty chime tones per minute, or about 180 chime tones per minute. The internal programming of the instrument cluster determines the priority of each chime request input that is received, as well as the rate and duration of each chime that is to be generated.

The hard wired chime warning system inputs to the instrument cluster, as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster or the PCI data bus network. The most reliable, efficient and accurate means to diagnose the instrument cluster and the PCI data bus network inputs for the chime warning system requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - CHIME WARNING SYSTEM

The chime warning system features driven by hard wired inputs to the instrument cluster may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the chime warning system features driven by message inputs to the instrument cluster over the Programmable Communications Interface (PCI) data bus network. The most reliable, efficient and accurate means to diagnose the instrument cluster and the PCI data bus network inputs for the chime warning system requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic and wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CHIME WARNING SYSTEM (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO SEAT BELT WARNING CHIME WITH SEAT BELT UNBUCKLED, BUT OTHER CHIME FEATURES OK	1. Seat belt switch ground circuit open.	1. Check for continuity between the ground circuit of the floor wire harness connector for the seat belt switch and a good ground. Repair open ground circuit, if required.
	2. Seat belt switch sense circuit open.	2. Check for continuity between the seat belt switch sense circuit of the floor wire harness connector for the seat belt switch and the instrument panel wire harness instrument cluster connector. Repair the open seat belt switch sense circuit, if required.
	3. Faulty seat belt switch.	3. Check for continuity between the ground circuit and the seat belt switch sense circuit of the seat belt switch pigtail connector. There should be continuity with the seat belt unbuckled. Replace the faulty seat belt, if required.
SEAT BELT WARNING CHIME WITH SEAT BELT BUCKLED	1. Seat belt switch sense circuit shorted.	1. With the floor wire harness connector for the seat belt switch and the instrument panel wire harness instrument cluster connector disconnected, there should be no continuity between the seat belt switch sense circuit and a good ground. Repair the shorted seat belt switch sense circuit, if required.
	2. Faulty seat belt switch.	2. Check for continuity between the ground circuit cavity and the seat belt switch sense circuit of the seat belt switch pigtail connector. There should be no continuity with the seat belt buckled. Replace the faulty seat belt, if required.
NO KEY-IN IGNITION WARNING CHIME, BUT OTHER CHIME FEATURES OK	1. Driver door ajar switch sense circuit open.	1. Check for continuity between the driver door ajar switch sense circuit of the connector for the driver door ajar switch and the cross body wire harness ignition switch connector. Repair the open driver door ajar switch sense circuit, if required.
	2. Key-in ignition switch sense circuit open.	2. Check for continuity between the key-in ignition switch sense circuit of the cross body wire harness ignition switch connector and the instrument panel wire harness instrument cluster connector. Repair the open key-in ignition switch sense circuit, if required.
	3. Ignition switch ground circuit open.	3. Check for continuity between the ground circuit cavity of the cross body wire harness ignition switch connector and a good ground. Repair the open ground circuit, if required
	4. Faulty ignition switch.	4. Check for continuity between the ground circuit terminal and the key-in ignition switch sense circuit terminal in the ignition switch connector. There should be continuity with a key in the ignition lock cylinder. Replace the faulty ignition switch, if required.

CHIME WARNING SYSTEM (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO HEADLAMPS-ON WARNING CHIME, BUT OTHER CHIME FEATURES OK	1. Driver door ajar switch sense circuit open.	1. Check for continuity between the driver door ajar switch sense circuit of the connector for the driver door ajar switch and the instrument panel wire harness instrument cluster connector. Repair the open driver door ajar switch sense circuit, if required.
	2. Headlamp switch output circuit open.	2. Check for continuity between the headlamp switch output circuit of the instrument panel wire harness instrument cluster connector and the park lamp feed circuit of the cross body wire harness left multi-function switch connector. Repair the open headlamp switch output circuit, if required.
	3. Faulty multi-function switch.	3. Check for continuity between the B(+) circuit terminal and the park lamp feed circuit terminal in the left multi-function switch connector. There should be continuity with the headlamp switch in the On position. Replace the faulty left multi-function switch, if required.
NO CHIMES AND OTHER INSTRUMENT CLUSTER FEATURES ERRATIC OR DISABLED	1. Instrument cluster ground circuit open.	1. Check for continuity between the ground circuit of the instrument panel wire harness instrument cluster connector and a good ground. Repair the open ground circuit, if required.
	2. Instrument cluster fused B(+) circuit open.	2. Check for battery voltage at the B(+) circuit of the instrument panel wire harness instrument cluster connector. Repair the open fused B(+) circuit, if required.
	3. Instrument cluster fused ignition switch output (run-start) circuit open.	3. With the ignition switch in the On position, check for battery voltage at the fused ignition switch output (run-start) circuit of the instrument panel wire harness instrument cluster connector. Repair the open fused ignition switch output (run-start) circuit, if required.
	4. Faulty instrument cluster.	4. Replace the faulty instrument cluster, if required.
NO CHIMES, BUT ALL OTHER INSTRUMENT CLUSTER FEATURES OK	1. Faulty instrument cluster.	1. Replace the faulty instrument cluster, if required.

ELECTRONIC CONTROL MODULES

TABLE OF CONTENTS

COMMUNICATION

DESCRIPTION

The DaimlerChrysler Programmable Communication Interface (PCI) data bus system is a single wire multiplex system used for vehicle communications on many DaimlerChrysler Corporation vehicles. Multiplexing is a system that enables the transmission of several messages over a single channel or circuit. All DaimlerChrysler vehicles use this principle for communication between various microprocessor-based electronic control modules. The PCI data bus exceeds the Society of Automotive Engineers (SAE) J1850 Standard for Class B Multiplexing.

Many of the electronic control modules in a vehicle require information from the same sensing device. In the past, if information from one sensing device was required by several controllers, a wire from each controller needed to be connected in parallel to that sensor. In addition, each controller utilizing analog sensors required an Analog/Digital (A/D) converter in order to ″read″ these sensor inputs. Multiplexing reduces wire harness complexity, sensor current loads and controller hardware because each sensing device is connected to only one controller, which reads and distributes the sensor information to the other controllers over the data bus. Also, because each controller on the data bus can access the controller sensor inputs to every other controller on the data bus, more function and feature capabilities are possible.

In addition to reducing wire harness complexity, component sensor current loads and controller hardware, multiplexing offers a diagnostic advantage. A multiplex system allows the information flowing between controllers to be monitored using a diagnostic scan tool. The DaimlerChrysler system allows an electronic control module to broadcast message data out onto the bus where all other electronic control modules can ″hear″ the messages that are being sent. When a module hears a message on the data bus that it requires, it relays that message to its microprocessor. Each module ignores the messages on the data bus that are being sent to other electronic control modules.

OPERATION

Data exchange between modules is achieved by serial transmission of encoded data over a single wire broadcast network. The wire colors used for the PCI data bus circuits are yellow with a violet tracer, or violet with a yellow tracer, depending upon the application. The PCI data bus messages are carried over the bus in the form of Variable Pulse Width Modulated (VPWM) signals. The PCI data bus speed is an average 10.4 Kilo-bits per second (Kbps). By comparison, the prior two-wire Chrysler Collision Detection (CCD) data bus system is designed to run at 7.8125 Kbps.

COMMUNICATION (Continued)

The voltage network used to transmit messages requires biasing and termination. Each module on the PCI data bus system provides its own biasing and termination. Each module (also referred to as a node) terminates the bus through a terminating resistor and a terminating capacitor. There are two types of nodes on the bus. The dominant node terminates the bus through a 1 KW resistor and a 3300 pF capacitor. The Powertrain Control Module (PCM) is the only dominant node for the PCI data bus system. A standard node terminates the bus through an 11 KW resistor and a 330 pF capacitor.

The modules bias the bus when transmitting a message. The PCI bus uses low and high voltage levels to generate signals. Low voltage is around zero volts and the high voltage is about seven and one-half volts. The low and high voltage levels are generated by means of variable-pulse width modulation to form signals of varying length. The Variable Pulse Width Modulation (VPWM) used in PCI bus messaging is a method in which both the state of the bus and the width of the pulse are used to encode bit information. A ″zero″ bit is defined as a short low pulse or a long high pulse. A ″one″ bit is defined as a long low pulse or a short high pulse. A low (passive) state on the bus does not necessarily mean a zero bit. It also depends upon pulse width. If the width is short, it stands for a zero bit. If the width is long, it stands for a one bit. Similarly, a high (active) state does not necessarily mean a one bit. This too depends upon pulse width. If the width is short, it stands for a one bit. If the width is long, it stands for a zero bit.

In the case where there are successive zero or one data bits, both the state of the bus and the width of the pulse are changed alternately. This encoding scheme is used for two reasons. First, this ensures that only one symbol per transition and one transition per symbol exists. On each transition, every transmitting module must decode the symbol on the bus and begin timing of the next symbol. Since timing of the next symbol begins with the last transition detected on the bus, all of the modules are re-synchronized with each symbol. This ensures that there are no accumulated timing errors during PCI data bus communication.

The second reason for this encoding scheme is to guarantee that the zero bit is the dominant bit on the bus. When two modules are transmitting simultaneously on the bus, there must be some form of arbitration to determine which module will gain control. A data collision occurs when two modules are transmitting different messages at the same time. When a module is transmitting on the bus, it is reading the bus at the same time to ensure message integrity. When a collision is detected, the module that transmitted the one bit stops sending messages over the bus until the bus becomes idle.

Each module is capable of transmitting and receiving data simultaneously. The typical PCI bus message has the following four components:

- **Message Header -** One to three bytes in length. The header contains information identifying the message type and length, message priority, target module(s) and sending module.
- **Data Byte(s) -** This is the actual message that is being sent.
- **Cyclic Redundancy Check (CRC) Byte -** This byte is used to detect errors during a message transmission.
- **In-Frame Response (IFR) byte(s) -** If a response is required from the target module(s), it can be sent during this frame. This function is described in greater detail in the following paragraph.

The IFR consists of one or more bytes, which are transmitted during a message. If the sending module requires information to be received immediately, the target module(s) can send data over the bus during the original message. This allows the sending module to receive time-critical information without having to wait for the target module to access the bus. After the IFR is received, the sending module broadcasts an End of Frame (EOF) message and releases control of the bus.

The PCI data bus can be monitored using the DRBIII® scan tool. It is possible, however, for the bus to pass all DRBIII® tests and still be faulty if the voltage parameters are all within the specified range and false messages are being sent.

CONTROLLER ANTILOCK BRAKE

DESCRIPTION

The CAB operates the ABS system, and is separate from other vehicle electrical circuits. The CAB is located under the instrument panel to the right side of the steering column. It is mounted to bracket with one bolt. The bracket is mounted to the front upper cowl panel.

OPERATION

The CAB voltage source is through the ignition switch in the RUN position. The CAB contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously. The CAB contains a self check program that illuminates the ABS warning light when a system fault is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB scan tool. ABS faults remain in memory until cleared, or until after

CONTROLLER ANTILOCK BRAKE (Continued)

the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

REMOVAL

(1) Remove the negative battery cable from the battery.

(2) Pull up on the CAB harness connector release (Fig. 1)and remove connector.

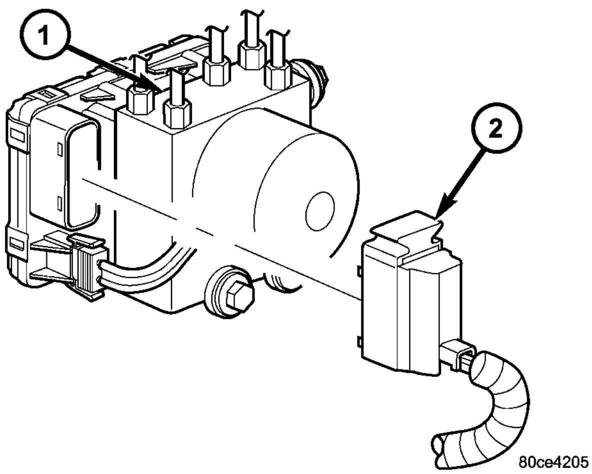

Fig. 1 CAB HARNESS CONNECTOR RELEASE

1 - ABS MODULE
2 - ELECTRICAL CONNECTOR

(3) Remove the pump connector from the CAB.

(4) Remove the CAB mounting bolts.

(5) Remove the CAB from the HCU (Fig. 2).

INSTALLATION

(1) Install CAB to the HCU (Fig. 2).

(2) Install mounting bolts. Tighten to 2 N·m (16 in. lbs.).

(3) Install the pump electircal connector to the CAB (Fig. 2).

(4) Install the wiring harness connector to the CAB and push down on the release to secure the connector.

(5) Install negative battery cable to the battery.

DATA LINK CONNECTOR

DESCRIPTION - DATA LINK CONNECTOR

The data link connector (DLC) is located at the lower edge of the instrument panel near the steering column.

OPERATION - DATA LINK CONNECTOR

The 16–way data link connector (diagnostic scan tool connector) links the Diagnostic Readout Box (DRB) scan tool or the Mopar Diagnostic System (MDS) with the Powertrain Control Module (PCM).

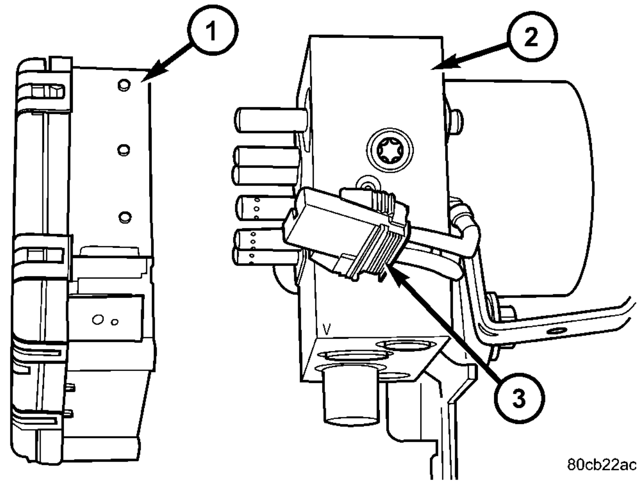

Fig. 2 CONTROLLER AND HCU

1 - CONTROLLER ANTILOCK BRAKE MODULE
2 - HYDRAULIC CONTROL UNIT (H.C.U)
3 - ELECTRICAL CONNECTOR

POWERTRAIN CONTROL MODULE

DESCRIPTION

DESCRIPTION

The PCM is located in the engine compartment (Fig. 3). The PCM is referred to as JTEC.

DESCRIPTION - MODES OF OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT).

The PCM will operate in two different modes: **Open Loop and Closed Loop**.

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)

POWERTRAIN CONTROL MODULE (Continued)

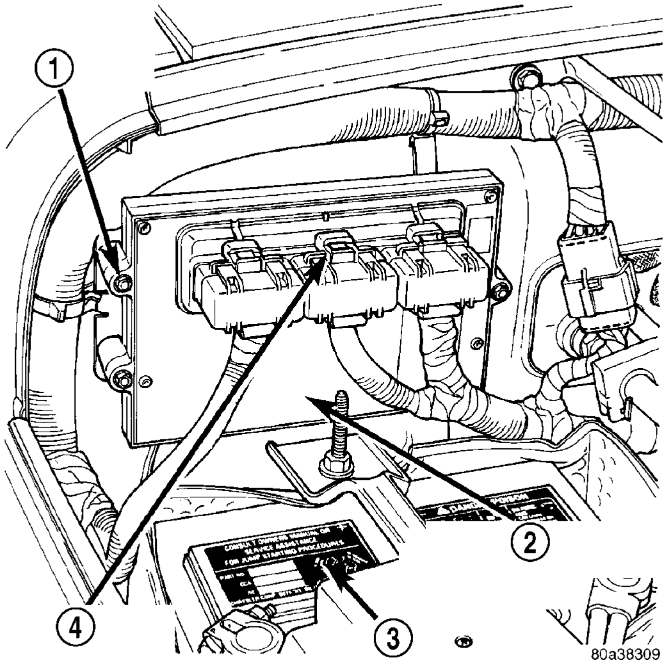

Fig. 3 PCM Location

1 - PCM MOUNTING BOLTS (3)
2 - POWERTRAIN CONTROL MODULE (PCM)
3 - BATTERY
4 - (3) 32–WAY CONNECTOR

- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The PCM pre-positions the Idle Air Control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle position sensor (TPS) is monitored.
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the ASD relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.
- The Up-shift Indicator Lamp is illuminated (manual transmission only).

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by

POWERTRAIN CONTROL MODULE (Continued)

turning the ground circuit to each individual injector on and off.

• The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.

• The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low–pressure A/C switches. Refer to Group 24, Heating and Air Conditioning for additional information.

• When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM) receives inputs from:

• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)
• Battery voltage
• Crankshaft position sensor
• Engine coolant temperature sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)
• Battery voltage
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Oxygen sensors
• Power steering pressure switch (2.5L engine only)

Based on these inputs, the following occurs:

• Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.

• The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.

• The PCM adjusts ignition timing by increasing and decreasing spark advance.

• The PCM operates the A/C compressor clutch through the A/C compressor clutch relay. This is done if A/C has been selected by the vehicle operator and specified pressures are met at the high and low–pressure A/C switches. Refer to Group 24, Heating and Air Conditioning for additional information.

On 2.5L 4–cylinder engines, a power steering pressure switch is used to supply an input to the PCM when steering pump pressure is high. This will raise engine speed. Refer to Power Steering Pressure Switch in this group for additional information. **The 4.0L 6–cylinder engine does not use this switch.**

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)
• Battery voltage
• Engine coolant temperature sensor
• Crankshaft position sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Oxygen (O2S) sensors

Based on these inputs, the following occurs:

• Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.

• The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.

• The PCM adjusts ignition timing by turning the ground path to the coil on and off.

• The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

• The Up-shift Indicator Lamp is operated (manual transmission only).

ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

• Air conditioning select signal (if equipped)
• Air conditioning request signal (if equipped)
• Battery voltage
• Engine coolant temperature sensor
• Crankshaft position sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor

POWERTRAIN CONTROL MODULE (Continued)

• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)
• Park/neutral switch (gear indicator signal—auto. trans. only)
• Vehicle speed sensor

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

• Battery voltage
• Crankshaft position sensor
• Engine coolant temperature sensor
• Intake manifold air temperature sensor
• Manifold absolute pressure (MAP) sensor
• Throttle position sensor (TPS)
• Camshaft position sensor signal (in the distributor)

During wide open throttle conditions, the following occurs:

• Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
• The PCM adjusts ignition timing by turning the ground path to the coil on and off.
• The Up-shift Indicator Lamp is operated (manual transmission only).

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

DESCRIPTION - 5 VOLT SUPPLIES

Two different Powertrain Control Module (PCM) five volt supply circuits are used; primary and secondary.

DESCRIPTION - IGNITION CIRCUIT SENSE

This circuit ties the ignition switch to the Powertrain Control Module (PCM).

DESCRIPTION - POWER GROUNDS

The Powertrain Control Module (PCM) has 2 main grounds. Both of these grounds are referred to as power grounds. All of the high-current, noisy, electrical devices are connected to these grounds as well as all of the sensor returns. The sensor return comes into the sensor return circuit, passes through noise suppression, and is then connected to the power ground.

The power ground is used to control ground circuits for the following PCM loads:

• Generator field winding
• Fuel injectors
• Ignition coil(s)
• Certain relays/solenoids
• Certain sensors

DESCRIPTION - SENSOR RETURN

The Sensor Return circuits are internal to the Powertrain Control Module (PCM).

Sensor Return provides a low–noise ground reference for all engine control system sensors. Refer to Power Grounds for more information.

OPERATION

OPERATION

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, speed control (if equipped), air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as PCM Outputs. The sensors and switches that provide inputs to the PCM are considered PCM Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed, power steering pump pressure (2.5L only), and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine

POWERTRAIN CONTROL MODULE (Continued)

coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: Powertrain Control Module (PCM) Inputs:

- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- CCD bus (+) circuits
- CCD bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connector for DRB scan tool
- Engine coolant temperature sensor
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in run position)
- Intake manifold air temperature sensor
- Leak detection pump (if equipped)
- Manifold Absolute Pressure (MAP) sensor
- Oil pressure sensor
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Power steering pressure switch (2.5L only)
- SCI receive (DRB scan tool 16–way connection)
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Vehicle speed sensor

NOTE: Powertrain Control Module (PCM) Outputs:

- A/C clutch relay
- Auto Shutdown (ASD) relay
- CCD bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Duty cycle EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field source (+)
- Idle Air Control (IAC) motor
- Ignition coil
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through CCD circuits.
- SCI transmit (DRB scan tool 16–way connection)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through CCD circuits.
- Transmission convertor clutch solenoid

OPERATION - 5 VOLT SUPPLIES

Primary 5–volt supply:

- supplies the required 5 volt power source to the Crankshaft Position (CKP) sensor.
- supplies the required 5 volt power source to the Camshaft Position (CMP) sensor.
- supplies a reference voltage for the Manifold Absolute Pressure (MAP) sensor.
- supplies a reference voltage for the Throttle Position Sensor (TPS) sensor.

Secondary 5–volt supply:

- supplies the required 5 volt power source to the oil pressure sensor.
- supplies the required 5 volt power source for the Vehicle Speed Sensor (VSS) (if equipped).
- supplies the 5 volt power source to the transmission pressure sensor (if equipped with an RE automatic transmission).

OPERATION - IGNITION CIRCUIT SENSE

The ignition circuit sense input tells the PCM the ignition switch has energized the ignition circuit.

Battery voltage is also supplied to the PCM through the ignition switch when the ignition is in the RUN or START position. This is referred to as the ″ignition sense″ circuit and is used to ″wake up″ the PCM. Voltage on the ignition input can be as low as 6 volts and the PCM will still function. Voltage is supplied to this circuit to power the PCM's 8-volt regulator and to allow the PCM to perform fuel, ignition and emissions control functions.

REMOVAL

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

The PCM is located in the engine compartment (Fig. 4).

To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

(1) Disconnect negative battery cable at battery.

POWERTRAIN CONTROL MODULE (Continued)

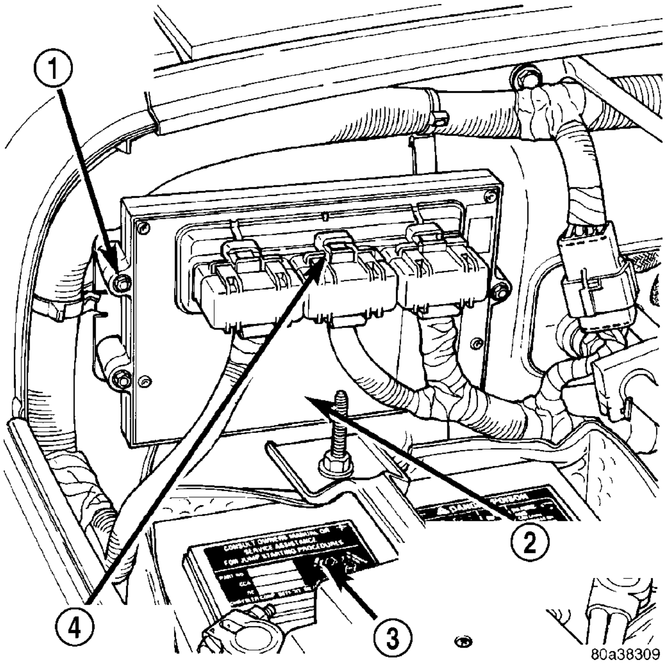

Fig. 4 PCM Location

1 - PCM MOUNTING BOLTS (3)
2 - POWERTRAIN CONTROL MODULE (PCM)
3 - BATTERY
4 - (3) 32–WAY CONNECTOR

(2) Remove plastic shield from over 32–way connectors. Shield snaps to connectors.

(3) Carefully unplug three 32–way connectors (Fig. 4) from PCM.

(4) Remove three PCM mounting bolts and remove PCM from vehicle.

INSTALLATION

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

(1) Install PCM and mounting bolts to vehicle.

(2) Tighten bolts to 4 N·m (35 in. lbs.).

(3) Check pin connectors in PCM and three 32–way connectors for corrosion or damage. Also check pin heights in connectors. Pin heights should all be the same. Repair as necessary before installing 32–way connectors.

(4) Install three 32–way connectors.

(5) Install plastic shield to 32–way connectors. Shield snaps to connectors.

(6) Install battery cable.

(7) Use the DRB scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage.

SENTRY KEY IMMOBILIZER MODULE

DESCRIPTION

The Sentry Key Immobilizer Module (SKIM) is the primary component of the Sentry Key Immobilizer System (SKIS) (Fig. 5). The SKIM is located in the steering column, below the ignition lock cylinder housing. The SKIM has an integral halo-like antenna ring that extends from one end. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing.

The SKIM cannot be adjusted or repaired. If faulty or damaged, the entire SKIM unit must be replaced.

OPERATION

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a microprocessor. The SKIM transmits RF signals to, and receives RF signals from the Sentry Key transponder through a tuned antenna enclosed within the molded plastic antenna ring integral to the SKIM housing. If this antenna ring is not mounted properly around the ignition lock cylinder housing, communication problems between the SKIM and the transponder may arise. These communication problems will result in Sentry Key transponder-related faults. The SKIM also communicates over the Programmable Communications Interface (PCI) data bus with the Powertrain Control Module (PCM), the ElectroMechanical Instrument Cluster (EMIC) and/or the DRBIII® scan tool.

The SKIM retains in memory the ID numbers of any Sentry Key transponder that is programmed into it. A maximum of eight Sentry Key transponders can be programmed into the SKIM. For added system security, each SKIM is programmed with a unique Secret Key code. This code is stored in memory, sent over the PCI data bus to the PCM, and is encoded to the transponder of every Sentry Key that is programmed into the SKIM. Therefore, the Secret Key code is a common element that is found in every component of the Sentry Key Immobilizer System (SKIS). Another security code, called a PIN, is used to gain access to the SKIM Secured Access Mode. The Secured Access Mode is required during service to perform the SKIS initialization and Sentry Key transponder programming procedures. The SKIM also stores the Vehicle Identification Number (VIN) in its memory, which it learns through a PCI data bus message from the PCM during SKIS initialization.

In the event that a SKIM replacement is required, the Secret Key code can be transferred to the new SKIM from the PCM using the DRBIII® scan tool

SENTRY KEY IMMOBILIZER MODULE (Continued)

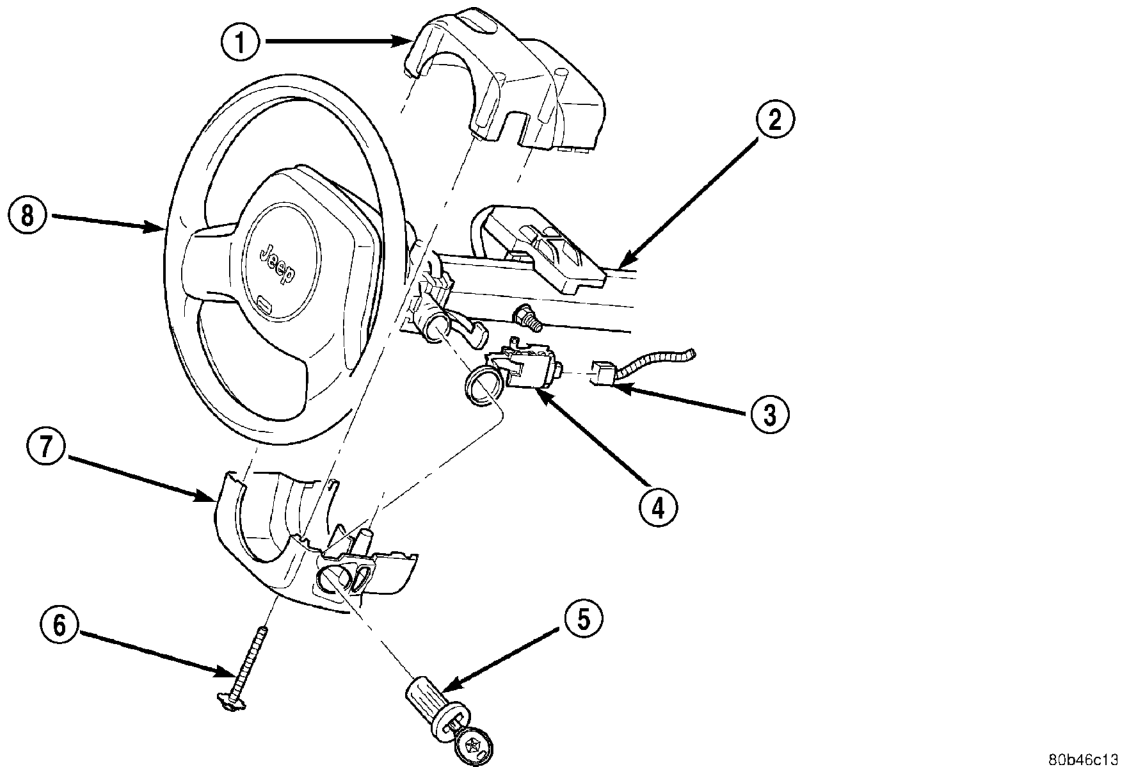

Fig. 5 Sentry Key Immobilizer Module - Typical

1 - UPPER SHROUD
2 - STEERING COLUMN
3 - WIRE HARNESS CONNECTOR
4 - SENTRY KEY IMMOBILIZER MODULE
5 - IGNITION LOCK CYLINDER
6 - SCREW
7 - LOWER SHROUD
8 - STEERING WHEEL

and the SKIS initialization procedure. Proper completion of the SKIS initialization will allow the existing Sentry Keys to be programmed into the new SKIM so that new keys will not be required. In the event that the original Secret Key code cannot be recovered, SKIM replacement will also require new Sentry Keys. The DRBIII® scan tool will alert the technician during the SKIS initialization procedure if new Sentry Keys are required.

When the ignition switch is On, the SKIM transmits an RF signal to the transponder in the ignition key. The SKIM then waits for an RF signal response from the transponder. If the response received identifies the key as valid, the SKIM sends a valid key message to the PCM over the PCI data bus. If the response received identifies the key as invalid, or if no response is received from the key transponder, the SKIM sends an invalid key message to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages. It is important to note that the default condition in the PCM is an invalid key; therefore, if no message is received from the SKIM by the PCM, the engine will be disabled and the vehicle immobilized after two seconds of running.

The SKIM also sends SKIS indicator status messages to the EMIC. This indicator status message tells the EMIC to turn the indicator on for about three seconds each time the ignition switch is turned On, as a bulb test. The SKIM sends indicator status messages to the EMIC to turn the indicator off, turn the indicator on, or to flash the indicator on and off. If the SKIS indicator flashes upon ignition On or stays on solid after the bulb test, it signifies a SKIS fault. If the SKIM detects a system malfunction and/or the SKIS has become inoperative, the SKIS indicator will stay on solid. If the SKIM detects an invalid key or if a key transponder-related fault exists, the SKIS indicator will flash. If the vehicle is equipped with the Customer Learn transponder programming feature, the SKIM will also send messages to the EMIC to flash the SKIS indicator and to generate a single audible chime whenever the Customer Learn programming mode is being utilized. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of Diagnostic

SENTRY KEY IMMOBILIZER MODULE (Continued)

Trouble Codes (DTC's) in SKIM memory if a system malfunction is detected. The SKIM can be diagnosed, and any stored DTC's can be retrieved using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

STANDARD PROCEDURE - PCM/SKIM PROGRAMMING

CAUTION: ASSURE THE DRBIII® IS PROGRAMMED WITH THE LATEST VERSION OF CURRENT SOFTWARE.

NOTE: Before replacing the PCM for a failed driver, control circuit, or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM driver/control circuit failures are caused by internal component failures (i.e. relays and solenoids) and shorted circuits (i.e. pull-ups, drivers, and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has been set.

When a PCM (JTEC) and the SKIM are replaced at the same time, perform the following steps in order:

(1) Program the new PCM (JTEC).
(2) Program the new SKIM.
(3) Replace all ignition keys and program them to the new SKIM.

PROGRAMMING THE PCM (JTEC)

The SKIS Secret Key is an ID code that is unique to each SKIM. This code is programmed and stored in the SKIM, the PCM, and the ignition key transponder chip(s). When replacing the PCM, it is necessary to program the secret key into the new PCM using the DRBIII® scan tool. Perform the following steps to program the secret key into the PCM.

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).
(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.
(3) Select PCM REPLACED (GAS ENGINE).
(4) Enter secured access mode by entering the vehicle four-digit PIN.
(5) Select ENTER to update PCM VIN.

NOTE: If three attempts are made to enter secured access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit this lockout mode, turn the ignition switch to the ON position for one hour, then enter the correct PIN. (Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary).

(6) Press ENTER to transfer the secret key (the SKIM will send the secret key to the PCM).
(7) Press PAGE BACK to get to the Select System menu and select ENGINE, MISCELLANEOUS, and SRI MEMORY CHECK.
(8) The DRBIII® will ask, "Is odometer reading between XX and XX?" Select the YES or NO button on the DRBIII®. If NO is selected, the DRBIII® will read, "Enter Odometer Reading (From I.P. odometer)". Enter the odometer reading from the instrument cluster and press ENTER.

PROGRAMMING THE SKIM

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).
(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.
(3) Select PCM REPLACED (GAS ENGINE).
(4) Program the vehicle four-digit PIN into SKIM.
(5) Select COUNTRY CODE and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, it cannot be changed and the SKIM must be replaced.

(6) Select YES to update VIN (the SKIM will learn the VIN from the PCM).
(7) Press ENTER to transfer the secret key (the PCM will send the secret key to the SKIM).
(8) Program ignition keys to the SKIM.

NOTE: If the PCM and the SKIM are replaced at the same time, all vehicle ignition keys will need to be replaced and programmed to the new SKIM.

PROGRAMMING IGNITION KEYS TO THE SKIM

(1) Turn the ignition switch to the On position (transmission in Park/Neutral).
(2) Use the DRBIII® and select THEFT ALARM, SKIM, then MISCELLANEOUS.
(3) Select PROGRAM IGNITION KEY'S.
(4) Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM it (the key) cannot be transferred to another vehicle.

(5) Obtain ignition keys to be programmed from the customer (8 keys maximum).

SENTRY KEY IMMOBILIZER MODULE (Continued)

(6) Using the DRBIII®, erase all ignition keys by selecting MISCELLANEOUS, and ERASE ALL CURRENT IGN. KEYS.

(7) Program all of the ignition keys.

If ignition key programming is unsuccessful, the DRBIII® will display one of the following messages:

• **Programming Not Attempted** - The DRBIII® attempts to read the programmed key status and there are no keys programmed into SKIM memory.

• **Programming Key Failed (Possible Used Key From Wrong Vehicle)** - SKIM is unable to program an ignition key transponder due to one of the following:

− The ignition key transponder is faulty.

− The ignition key transponder is or has been already programmed to another vehicle.

• **8 Keys Already Learned, Programming Not Done** - The SKIM transponder ID memory is full.

• **Learned Key In Ignition** - The ID for the ignition key transponder currently in the ignition lock cylinder is already programmed in SKIM memory.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the screws that secure the lower steering column shroud to the upper shroud (Fig. 6).

(4) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.

(5) Remove the upper and lower shrouds from the steering column.

(6) On models equipped with a manual transmission, remove the screws that secure the multi-function switch assembly to the upper steering column housing.

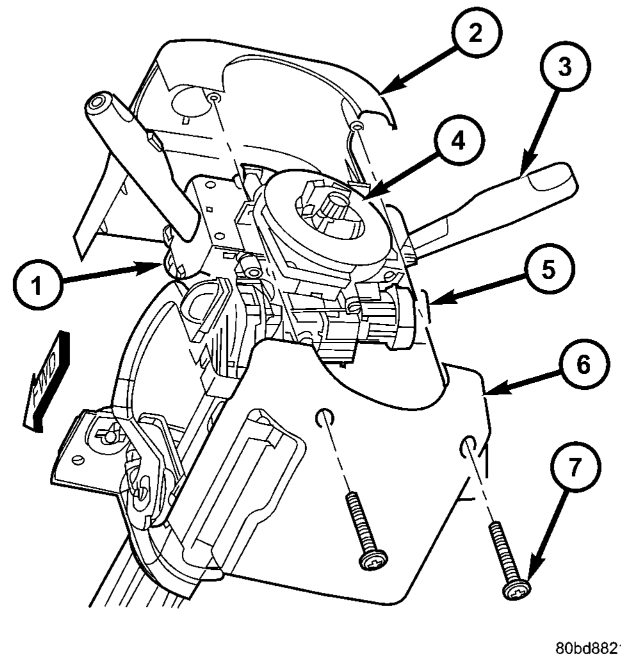

Fig. 6 Steering Column Shrouds Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - UPPER SHROUD
3 - RIGHT MULTI-FUNCTION SWITCH
4 - CLOCKSPRING
5 - IGNITION LOCK CYLINDER HOUSING
6 - LOWER SHROUD
7 - SCREW (2)

(7) Disconnect the cross body wire harness connector for the SKIM from the SKIM connector (Fig. 7).

(8) The SKIM mounting bracket features a clip that secures the SKIM to the inboard lower flange of the steering column jacket. Pull downward on the connector end of the SKIM mounting bracket to release this clip from the steering column jacket.

(9) Rotate the SKIM and its mounting bracket downwards and then to the side away from the steering column to slide the SKIM antenna ring from around the ignition switch lock cylinder housing. On models with a manual transmission, lift the multi-function switch upward off of the upper steering column housing far enough to extract the SKIM antenna from between the ignition key release button and the right multi-function switch housing.

(10) Remove the SKIM from the steering column.

SENTRY KEY IMMOBILIZER MODULE (Continued)

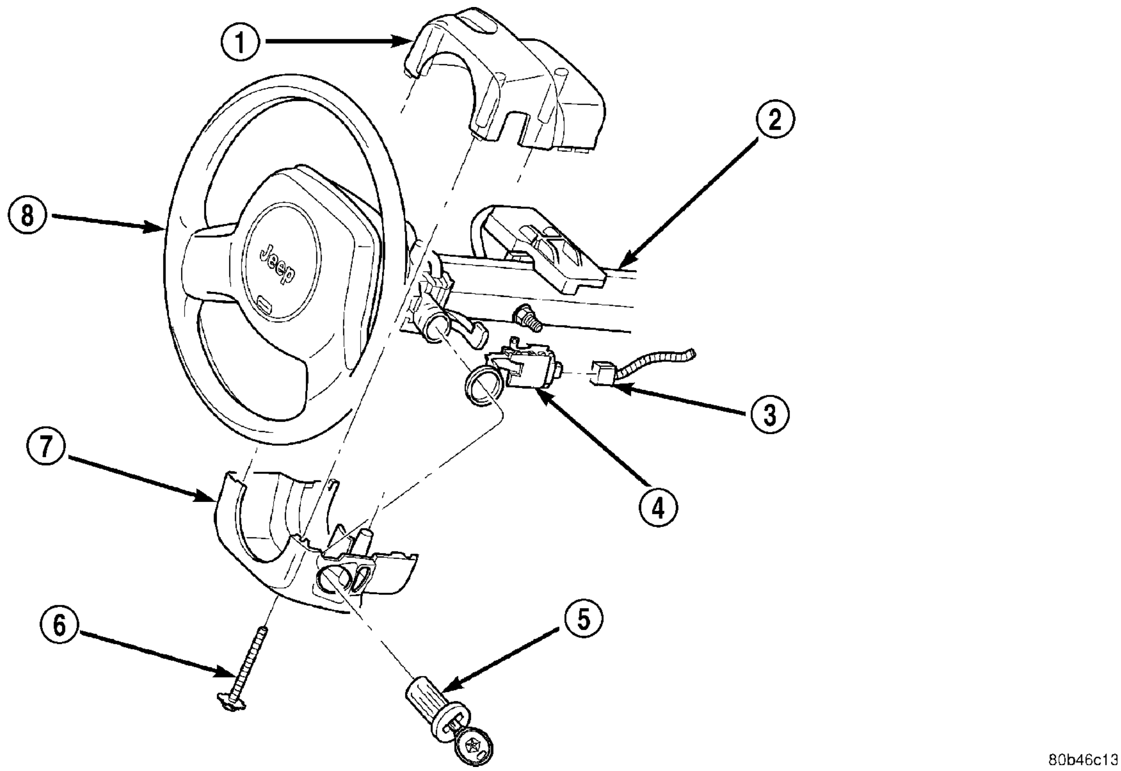

Fig. 7 Sentry Key Immobilizer Module - Typical

1 - UPPER SHROUD
2 - STEERING COLUMN
3 - WIRE HARNESS CONNECTOR
4 - SENTRY KEY IMMOBILIZER MODULE
5 - IGNITION LOCK CYLINDER
6 - SCREW
7 - LOWER SHROUD
8 - STEERING WHEEL

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the Sentry Key Immobilizer Module (SKIM) (Fig. 7). On models with a manual transmission, lift the multi-function switch upward off of the upper steering column housing far enough to insert the SKIM antenna formation between the ignition key release button and the multi-function switch housing.

(2) Slide the SKIM antenna ring around the ignition switch lock cylinder housing, then rotate the SKIM and its mounting bracket upwards and toward the steering column.

(3) Align the SKIM mounting bracket clip with the inboard lower flange of the steering column and, push upward firmly on the connector end of the SKIM mounting bracket to engage the clip with the steering column.

(4) Reconnect the cross body wire harness connector for the SKIM to the SKIM connector.

(5) On models equipped with a manual transmission, install and tighten the screws that secure the multi-function switch assembly to the upper steering column housing. Tighten the screws to 2 N·m (20 in. lbs.).

(6) Position both the upper and lower shrouds onto the steering column (Fig. 6).

(7) Install and tighten the screws that secure the lower steering column shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).

(8) Move the tilt steering column to the fully raised position and secure it in place by moving the tilt release lever back to the locked (up) position.

(9) Reinstall the steering column opening cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

SENTRY KEY IMMOBILIZER MODULE (Continued)

(10) Reconnect the battery negative cable.

NOTE: If the SKIM has been replaced with a new unit, the Sentry Key Immobilizer System (SKIS) MUST be initialized before the vehicle can be operated. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SKIS INITIALIZATION).

TRANSMISSION CONTROL MODULE

DESCRIPTION

The Transmission Control Module (TCM) is located in the engine compartment on the left (driver's) side and is mounted to the inner fender (Fig. 8).

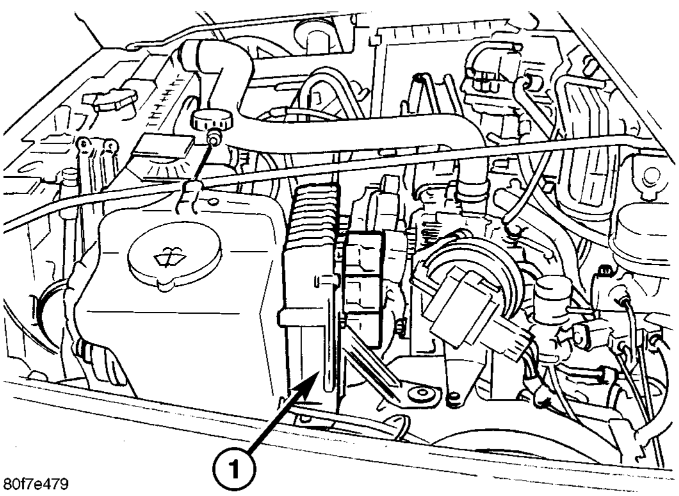

Fig. 8 Transmission Control Module Location

1 - TRANSMISSION CONTROL MODULE

OPERATION

The TCM is the controlling unit for all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hard-wired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the PCI bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition "ON" voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor (CKP)
- Transmission Range Sensor (TRS)
- Pressure Switches (L/R, 2/4, OD)
- Transmission Temperature Sensor (Integral to TRS)
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Speed Control ON/OFF Switch
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Brake Switch Status
- DRB® III Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids (L/R, 2/4, OD and UD)
- Vehicle Speed (to PCM)
- Torque Reduction Request (to PCM)

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indices (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB® III scan tool)

NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

CLUTCH VOLUME INDEX (CVI)

An important function of the TCM is to monitor Clutch Volume Index (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

TRANSMISSION CONTROL MODULE (Continued)

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 9).

Gear ratios can be determined by using the DRB® III Scan Tool and reading the Input/Output Speed Sensor values in the “Monitors” display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

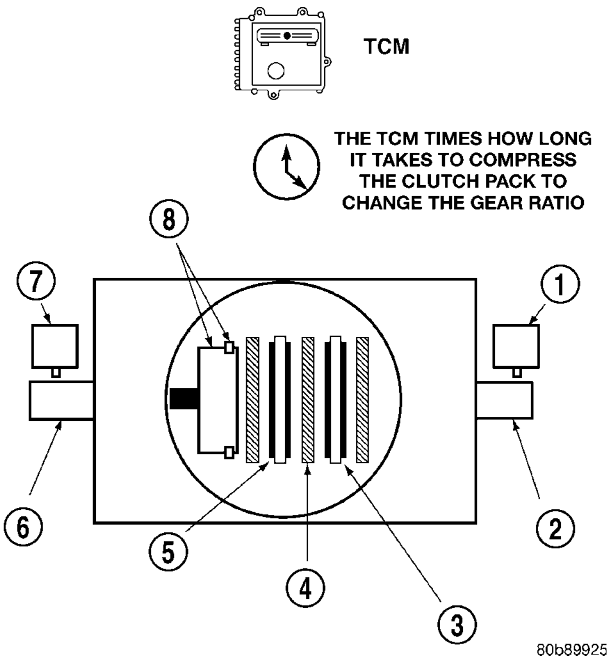

Fig. 9 Example of CVI Calculation

1 - OUTPUT SPEED SENSOR
2 - OUTPUT SHAFT
3 - CLUTCH PACK
4 - SEPARATOR PLATE
5 - FRICTION DISCS
6 - INPUT SHAFT
7 - INPUT SPEED SENSOR
8 - PISTON AND SEAL

CLUTCH VOLUMES

Clutch	When Updated			Proper Clutch Volume
	Shift Sequence	Oil Temperature	Throttle Angle	
L/R	2-1 or 3-1 coast downshift	> 70°	< 5°	35 to 83
2/4	1-2 shift	> 110°	5 - 54°	20 to 77
OD	2-3 shift			48 to 150
UD	4-3 or 4-2 shift		> 5°	24 to 70

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following table 42RLE Shift Schedule to determine the appropriate operation expected, depending on driving conditions.

TRANSMISSION CONTROL MODULE (Continued)

42RLE SHIFT SCHEDULE

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature at start-up below -16° F	Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts)
Cold	Oil temperature at start-up above -12° F and below 36° F	– Delayed 2-3 upshift (approximately 22-31 mph) – Delayed 3-4 upshift (45-53 mph) – Early 4-3 costdown shift (approximately 30 mph) – Early 3-2 coastdown shift (approximately 17 mph) – High speed 4-2, 3-2, 2-1 kickdown shifts are prevented – No EMCC
Warm	Oil temperature at start-up above 36° F and below 80 degree F	– Normal operation (upshift, kickdowns, and coastdowns) – No EMCC
Hot	Oil temperature at start-up above 80° F	– Normal operation (upshift, kickdowns, and coastdowns) – Full EMCC, no PEMCC except to engage FEMCC (except at closed throttle at speeds above 70-83 mph)
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	– Delayed 2-3 upshift (25-32 mph) – Delayed 3-4 upshift (41-48 mph) – 3rd gear FEMCC from 30-48 mph – 3rd gear PEMCC from 27-31 mph
Super Overheat	Oil temperature above 260° F	– All ″Overheat″ shift schedule features apply – 2nd gear PEMCC above 22 mph – Above 22 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

TRANSMISSION CONTROL MODULE (Continued)

STANDARD PROCEDURE - TCM QUICK LEARN

The quick learn procedure requires the use of the DRB® scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the proper transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay in PARK until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB® indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

ENGINE SYSTEMS

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BATTERY SYSTEM

TABLE OF CONTENTS

BATTERY SYSTEM

DESCRIPTION

A single 12-volt battery is standard factory-installed equipment on this model. All of the components of the battery system are located within the engine compartment of the vehicle. The battery system for this vehicle covers the following related components, which are covered in further detail later in this section of the service manual:

- **Battery** - The storage battery provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cable** - The battery cables connect the battery terminal posts to the vehicle electrical system.
- **Battery Holddown** - The battery holddown hardware secures the battery in the battery tray in the engine compartment.

BATTERY SYSTEM (Continued)

- **Battery Tray** - The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware.

For battery system maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box. Optionally, refer to the Lubrication and Maintenance section of this manual for the recommended battery maintenance schedules and for the proper battery jump starting procedure. While battery charging can be considered a maintenance procedure, the battery charging procedure and related information are located later in this section of this service manual. This was done because the battery must be fully-charged before any battery system diagnosis or testing procedures can be performed.

OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING - BATTERY SYSTEM

The battery, starting, and charging systems in the vehicle operate with one another and must be tested as a complete system. In order for the engine to start and the battery to maintain its charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting, and charging systems be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to Charging System for the proper charging system on-board diagnostic test procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is faulty.	2. Determine if the charging system is performing to specifications. Refer to Charging System for charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Charge the faulty battery, as required.
	4. The battery terminal connections are loose or corroded.	4. Refer to Battery Cables for the proper battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. Refer to Battery System Specifications for the proper size and rating. Replace an incorrect battery, as required.
	6. The battery is faulty.	6. Determine the battery cranking capacity using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Replace the faulty battery, as required.
	7. The starting system is faulty.	7. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. Refer to Battery System Specifications for the proper specifications. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. Refer to Battery Cable for the proper cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the faulty electrical system, as required.
	4. The battery is faulty.	4. Test the battery using the Micro 420 battery tester. Refer to Standard Procedures for additional test procedures. Replace the faulty battery, as required.
	5. The starting system is faulty.	5. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	6. The charging system is faulty.	6. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw systems in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is faulty.	1. Test the battery using the Micro 420 battery tester. Charge or replace the faulty battery, as required.

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

1. A faulty or incorrect charging system component. Refer to Charging System for charging system diagnosis and testing procedures.
2. A faulty or incorrect battery. Use Micro 420 battery tester and refer to Battery System for additional battery diagnosis and testing procedures.
3. A faulty circuit or component causing excessive ignition-off draw.
4. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
5. A faulty or incorrect starting system component. Refer to Starting System for the proper starting system diagnosis and testing procedures.
6. Corroded or loose battery posts and/or terminal clamps.
7. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.

CLEANING

The following information details the recommended cleaning procedures for the battery and related com-

BATTERY SYSTEM (Continued)

ponents. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Clean the battery cable terminal clamps of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 1).

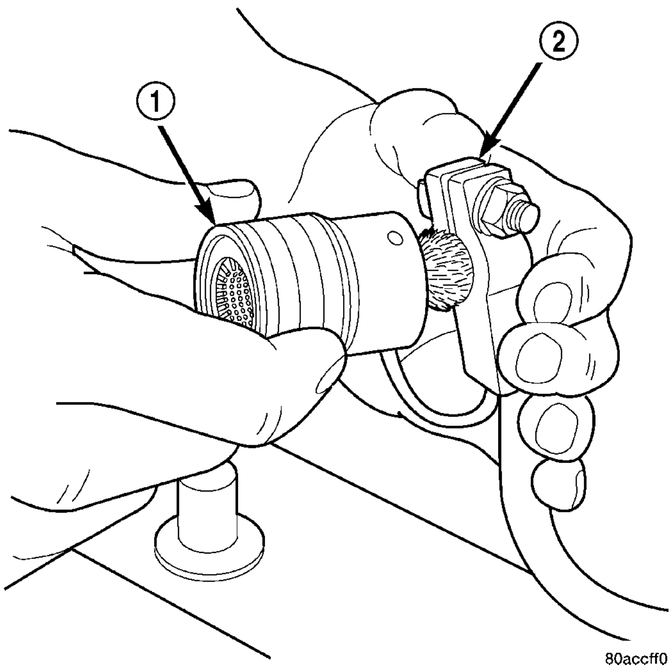


Fig. 1 Clean Battery Cable Terminal Clamp - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE

(2) Clean the battery tray and battery hold down hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.

(3) If the removed battery is to be reinstalled, clean the outside of the battery case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film (Fig. 2). Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, refer to Battery System Specifications for the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.

(4) If the vehicle is so equipped, clean the battery thermal guard with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film.

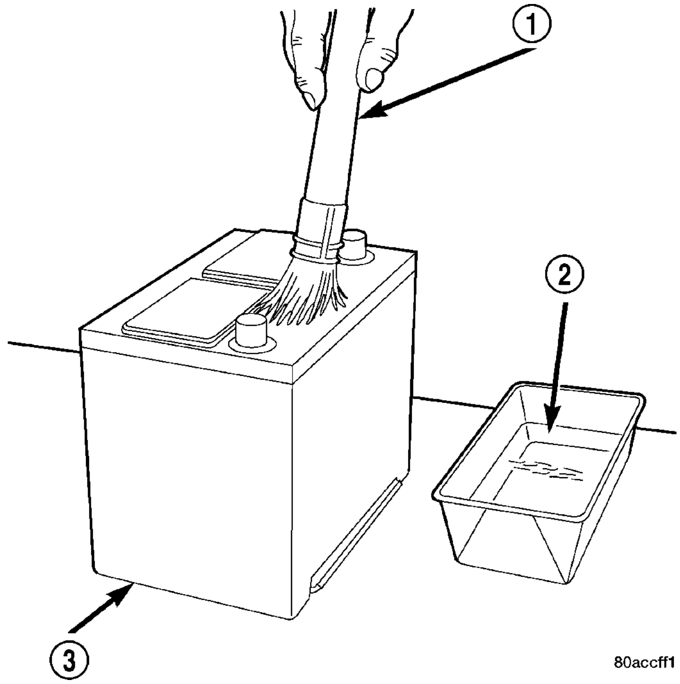


Fig. 2 Battery Cleaning - Typical

1 - CLEANING BRUSH
2 - WARM WATER AND BAKING SODA SOLUTION
3 - BATTERY

(5) Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 3).

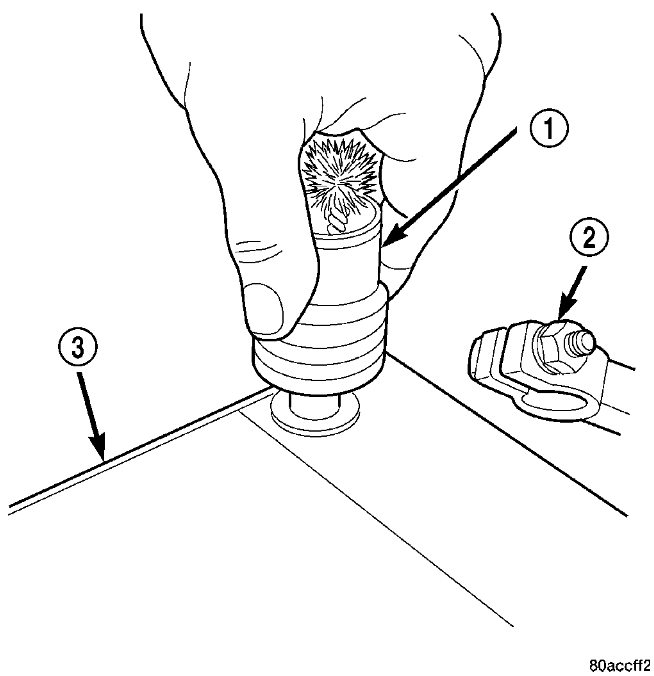


Fig. 3 Clean Battery Terminal Post - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE
3 - BATTERY

BATTERY SYSTEM (Continued)

INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.

(2) Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.

(3) Slide the thermal guard off of the battery case. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.

(4) Inspect the battery thermal guard for tears, cracks, deformation or other damage. Replace any battery thermal guard that has been damaged.

(5) Inspect the battery built-in test indicator sight glass for an indication of the battery condition. If the battery is discharged, charge as required. Refer to Standard Procedures for the proper battery built-in indicator test procedures. Also refer to Standard Procedures for the proper battery charging procedures.

SPECIFICATIONS

BATTERY SYSTEM SPECIFICATIONS

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Battery sizes and ratings are discussed in more detail below.

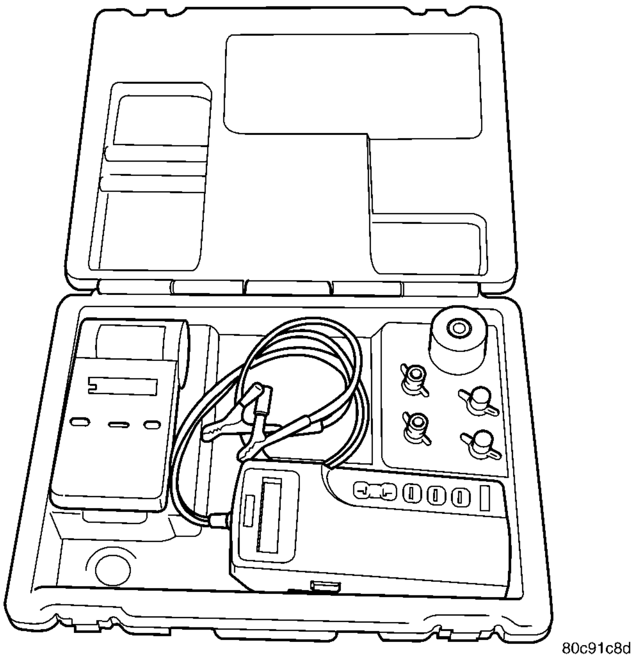
- **Group Size** - The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.
- **Cold Cranking Amperage** - The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.
- **Reserve Capacity** - The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.
- **Ampere-Hours** - The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

Battery Classifications and Ratings					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere-Hours	Load Test Amperage
04609365AC	34	600	120 Minutes	66	300

BATTERY SYSTEM (Continued)

SPECIAL TOOLS

BATTERY SYSTEM SPECIAL TOOLS



MICRO 420 BATTERY TESTER

BATTERY

DESCRIPTION

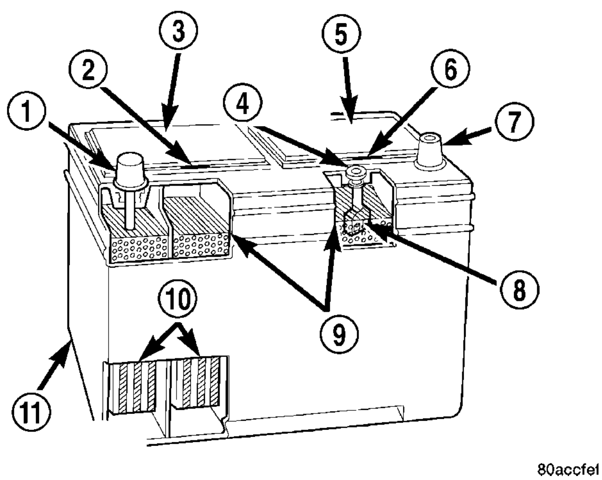


Fig. 4 Low-Maintenance Battery - Typical

1 - POSITIVE POST
2 - VENT
3 - CELL CAP
4 - VENT
5 - CELL CAP
6 - VENT
7 - NEGATIVE POST
8 - GREEN BALL
9 - ELECTROLYTE LEVEL
10 - PLATE GROUPS
11 - LOW-MAINTENANCE BATTERY

A large capacity, low-maintenance storage battery (Fig. 4) is standard factory-installed equipment on this model. Refer to Battery Specifications for the proper specifications of the factory-installed batteries available on this model. Male post type terminals made of a soft lead material protrude from the top of the molded plastic battery case to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post is physically larger in diameter than the negative terminal post to ensure proper battery connection. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for identification confirmation (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - DESCRIPTION).

The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

The factory-installed battery has a built-in test indicator (hydrometer). The color visible in the sight glass of the indicator will reveal the battery condition. Refer to Standard Procedures for the proper built-in indicator test procedures. **The factory-installed low-maintenance battery has removable battery cell caps.** Water can be added to this battery. The battery is not sealed and has vent holes in the cell caps. The chemical composition of the metal coated plates within the low-maintenance battery reduces battery gassing and water loss, at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service. If the electrolyte level in this battery does become low, water must be added. However, rapid loss of electrolyte can be caused by an overcharging condition. Be certain to diagnose the charging system after replenishing the water in the battery for a low electrolyte condition and before returning the vehicle to service (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING).

BATTERY (Continued)

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

DIAGNOSIS AND TESTING - BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery System Cleaning for the proper cleaning procedures, and Battery System Inspection for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING OR LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is faulty and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.

STANDARD PROCEDURE

STANDARD PROCEDURE - BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- All of the battery cells are gassing freely during battery charging.
- A green color is visible in the sight glass of the battery built-in test indicator.

BATTERY (Continued)

- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity of the battery electrolyte.
- Open-circuit voltage of the battery is 12.4 volts or above.

WARNING: NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C [30° F] OR LOWER) BATTERY. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

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WARNING: IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

CAUTION: Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

CAUTION: Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.

CAUTION: The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

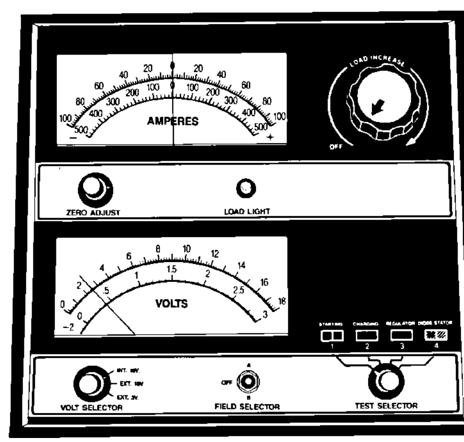
After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE). If the battery will endure a load test, return the battery to service. If the battery will not endure a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING), and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION).

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 5). If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.



898A-12

Fig. 5 Voltmeter - Typical

(2) Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it

BATTERY (Continued)

appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

(3) Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

CHARGE RATE TABLE	
Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **State-Of-Charge** - A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

BATTERY CHARGING TIME TABLE			
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
Below 10.00	18 hours	9 hours	4.5 hours

STANDARD PROCEDURE - BUILT-IN INDICATOR TEST

An indicator (hydrometer) built into the top of the battery case provides visual information for battery testing (Fig. 6). Like a hydrometer, the built-in indicator measures the specific gravity of the battery electrolyte. The specific gravity of the electrolyte reveals the battery state-of-charge; however, it will not reveal the cranking capacity of the battery. A load test must be performed to determine the battery cranking capacity. Refer to Standard Procedures for the proper battery load test procedures.

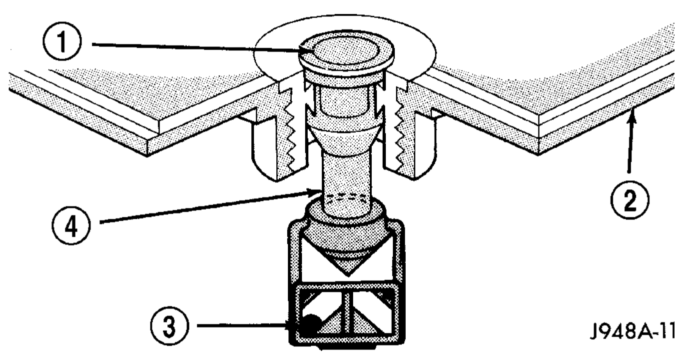


Fig. 6 Built-In Indicator

1 - SIGHT GLASS
2 - BATTERY TOP
3 - GREEN BALL
4 - PLASTIC ROD

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. In order to obtain correct indications from the built-in indicator, it is important that the battery be level and have a clean sight glass. Additional light may be required to view the indicator. **Do not use open flame as a source of additional light.**

BATTERY (Continued)

To read the built-in indicator, look into the sight glass and note the color of the indication (Fig. 7). The battery condition that each color indicates is described in the following list:

- **Green** - Indicates 75% to 100% battery state-of-charge. The battery is adequately charged for further testing or return to service. If the starter will not crank for a minimum of fifteen seconds with a fully-charged battery, the battery must be load tested. Refer to Standard Procedures for the proper battery load test procedures.
- **Black or Dark** - Indicates 0% to 75% battery state-of-charge. The battery is inadequately charged and must be charged until a green indication is visible in the sight glass (12.4 volts or more), before the battery is tested further or returned to service. Refer to Standard Procedures for the proper battery charging procedures. Also refer to Diagnosis and Testing for more information on the possible causes of the discharged battery condition.
- **Clear or Bright** - Indicates a low battery electrolyte level. The electrolyte level in the battery is below the built-in indicator. A maintenance-free battery with non-removable cell caps must be replaced if the electrolyte level is low. Water must be added to a low-maintenance battery with removable cell caps before it is charged. Refer to Standard Procedures for the proper battery filling procedures. A low electrolyte level may be caused by an overcharging condition. Refer to Charging System for the proper charging system diagnosis and testing procedures.

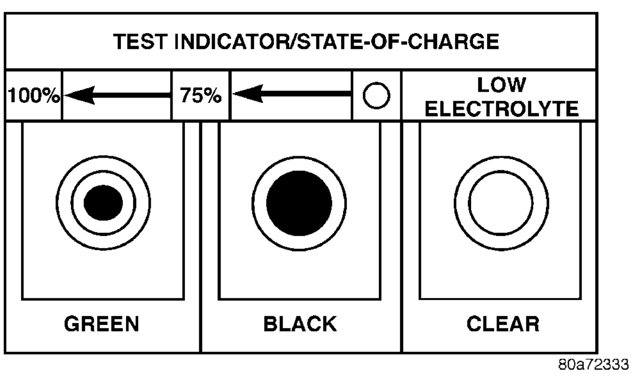


Fig. 7 Built-In Indicator Sight Glass Chart

STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate state-of-charge of a battery. This test can be used in place of the hydrometer test when a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

Before proceeding with this test, completely charge the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.

(2) Disconnect and isolate both battery cables, negative cable first.

(3) Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage (Fig. 8).

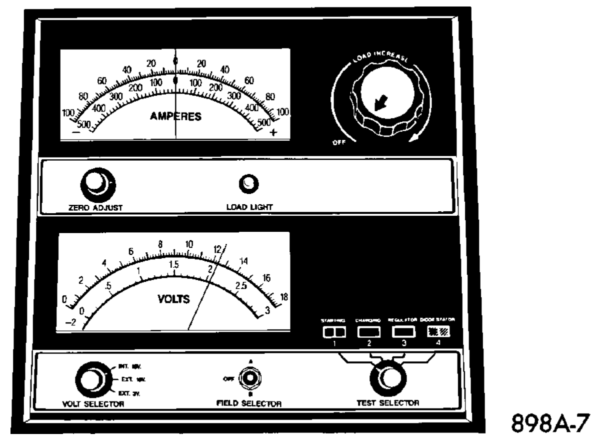


Fig. 8 Testing Open-Circuit Voltage - Typical

See the Open-Circuit Voltage Table. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

STANDARD PROCEDURE - IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Con-

BATTERY (Continued)

trol Module (PCM), digital clock, electronically tuned radio, and other modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Power Distribution Center (PDC). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Faulty or improperly adjusted switches.
- Faulty or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

If the IOD is over thirty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

(1) Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes.

(2) Determine that the underhood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.

(3) Disconnect the battery negative cable.

(4) Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multimeter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.

(5) After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC) and then in the Junction Block (JB), one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information in this service manual for complete PDC and JB fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to Charging System for the proper charging system diagnosis and testing procedures. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

(6) Observe the multi-meter reading. The low-amperage IOD should not exceed thirty-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER

Always use the Micro 420 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:

WARNING: ALWAYS WEAR APPROPRIATE EYE PROTECTION AND USE EXTREME CAUTION WHEN WORKING WITH BATTERIES.

BATTERY TESTING

(1) If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing. If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.

BATTERY (Continued)

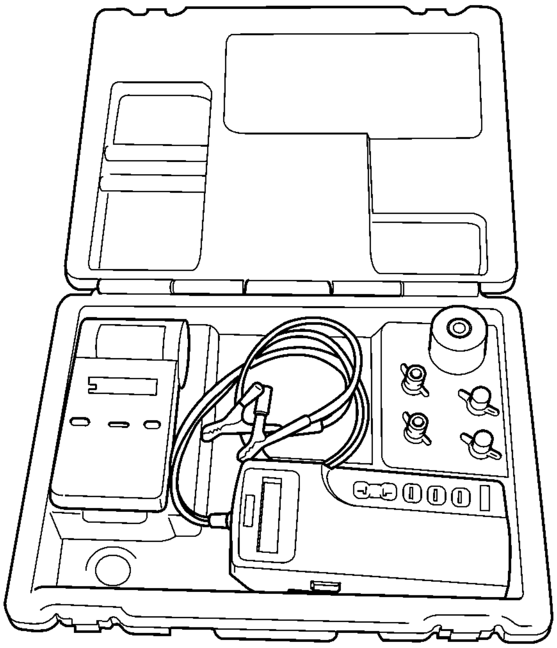


Fig. 9 Micro 420 Battery Tester

(2) If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition. **The preferred test position is at the battery terminal**. If the battery is not accessible, you may test using both the positive and negative jumper posts. Select TESTING AT JUMPER POST when connecting to that location.

(3) Connect the tester (Fig. 9) to the battery or jumper posts, the red clamp to positive (+) and the black clamp to negative (–).

NOTE: Multiple batteries connected in parallel must have the ground cable disconnected to perform a battery test. Failure to disconnect may result in false battery test readings.

(4) Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.

(5) If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the test result table noted below.

CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.

(6) While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

BATTERY TEST RESULTS	
GOOD BATTERY	Return to service
GOOD - RECHARGE	Fully charge battery and return to service
CHARGE & RETEST	Fully charge battery and retest battery
REPLACE BATTERY	Replace the battery and retest complete system
BAD-CELL REPLACE	Replace the battery and retest complete system

NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post (Fig. 10).

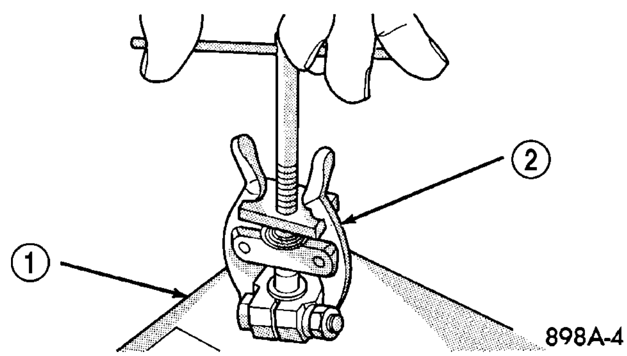


Fig. 10 Remove Battery Cable Terminal Clamp - Typical

1 - BATTERY
2 - BATTERY TERMINAL PULLER

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

BATTERY (Continued)

(6) Remove the battery holddowns from the battery. Refer to Battery Holddown for the proper battery holddown removal procedures.

WARNING: WEAR A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

(7) Remove the battery and the battery thermal guard from the battery tray as a unit.

(8) Remove the battery thermal guard from the battery case. Refer to Thermal Guard for the proper battery thermal guard removal procedures.

INSTALLATION

(1) Clean and inspect all of the battery system components. Refer to Battery System Cleaning for the proper cleaning procedures, and refer to Battery System Inspection for the proper inspection procedures.

(2) Reinstall the battery thermal guard onto the battery case. Refer to Thermal Guard for the proper battery thermal guard installation procedures.

(3) Position the battery and the battery thermal guard onto the battery tray as a unit. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables (Fig. 11).

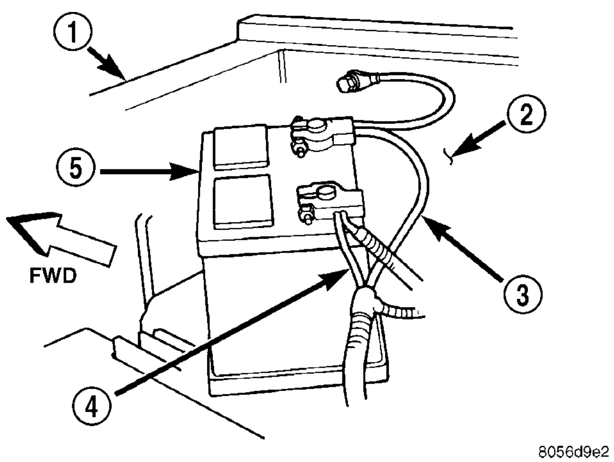


Fig. 11 Battery Cables - Typical

1 - RADIATOR CROSSMEMBER
2 - WHEELHOUSE INNER PANEL
3 - NEGATIVE CABLE
4 - POSITIVE CABLE
5 - BATTERY

(4) Reinstall the battery holddowns onto the battery. Refer to Battery Holddown for the proper installation procedure.

CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reversed battery polarity may damage electrical components of the vehicle.

(5) Clean the battery cable terminal clamps and the battery terminal posts. Refer to Battery System Cleaning for cleaning procedure.

(6) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

(7) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

(8) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

BATTERY HOLDDOWN

DESCRIPTION

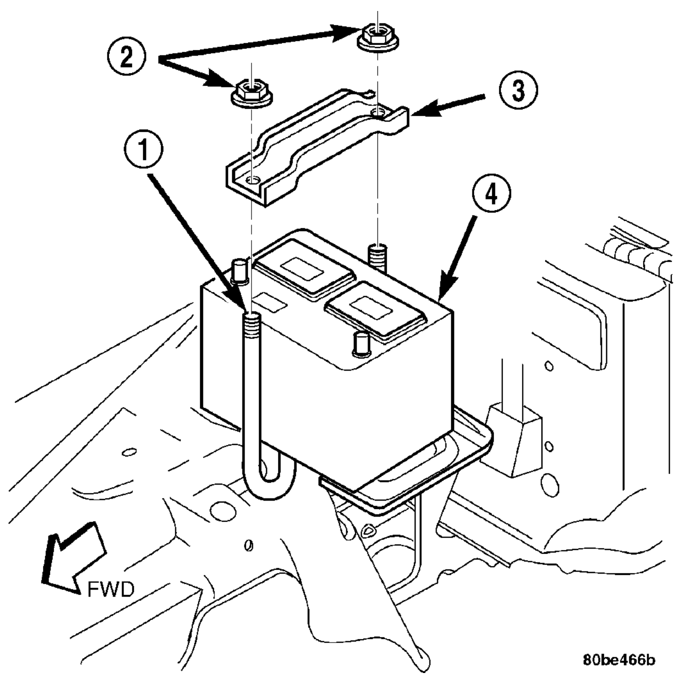


Fig. 12 Battery Hold Downs

1 - J-BOLT (2)
2 - NUT (2)
3 - BRACKET
4 - BATTERY

The battery hold down hardware (Fig. 12) includes two J-bolts, a hold down bracket and two hex nuts with coned washers. The battery hold down bracket consists of a stamped steel bracket that is then plastic-coated for corrosion protection.

BATTERY HOLDDOWN (Continued)

The hold down J-bolts are installed a hole in the front and rear flanges of the battery tray from the top, with the threaded ends of the bolts extending upward. The hooked end of each J-bolt is then engaged in a second hole in the front and rear flanges of the battery tray from the bottom. The battery hold down bracket is installed across the top of the battery case and over the two upright threaded ends of the J-bolts. A hex nut with coned washer is then installed and tightened onto each of the J-bolts to securely hold down the battery in the battery tray.

When installing a battery into the battery tray, be certain that the hold down hardware is properly installed and that the fasteners are tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle or both. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY HOLDDOWN - INSTALLATION) the proper hold down fastener tightness specifications.

OPERATION

The battery holddown secures the battery in the battery tray. This holddown is designed to prevent battery movement during the most extreme vehicle operation conditions. Periodic removal and lubrication of the battery holddown hardware is recommended to prevent hardware seizure at a later date.

CAUTION: Never operate a vehicle without a battery holddown device properly installed. Damage to the vehicle, components and battery could result.

REMOVAL

All of the battery hold down hardware can be serviced without removal of the battery or the battery tray.

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(4) Remove the nut with washer from the threaded end of each of the two J-bolts (Fig. 13).

(5) Remove the battery hold down bracket from the threaded ends of the two J-bolts and the top of the battery case.

(6) Disengage the hooked end of each J-bolt from the holes in the front or rear flange of the battery tray and remove the two J-bolts.

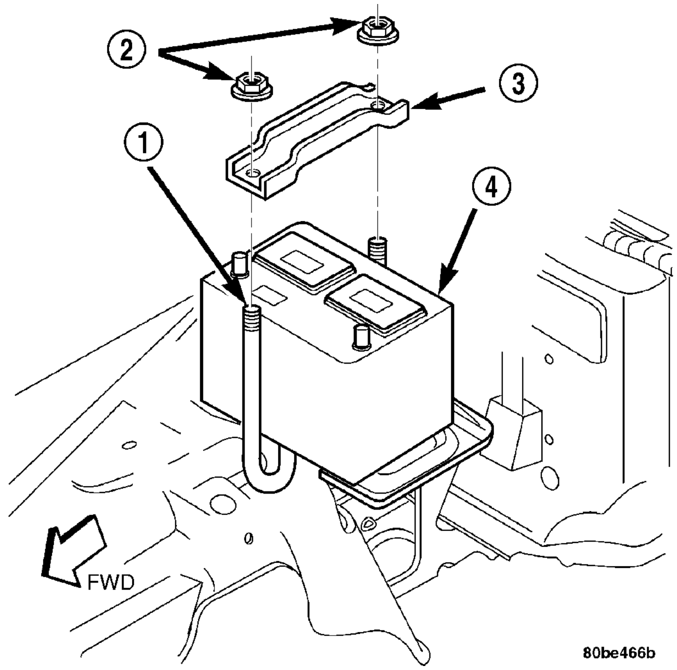


Fig. 13 Battery Hold Downs Remove/Install

1 - J-BOLT (2)
2 - NUT (2)
3 - BRACKET
4 - BATTERY

INSTALLATION

All of the battery hold down hardware can be serviced without removal of the battery or the battery tray.

(1) Clean and inspect the battery hold down hardware. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING).

(2) Engage the hooked end of each J-bolt into the holes in the front or rear flange of the battery tray and position the two J-bolts.

(3) Position the battery hold down bracket onto the threaded ends of the two J-bolts and across the top of the battery case.

(4) Install and tighten the nut with washer onto the threaded end of each of the two J-bolts. Tighten the nuts to 4.7 N·m (42 in. lbs.).

(5) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

BATTERY CABLES

DESCRIPTION

The battery cables are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. The battery cables feature a clamping type female battery terminal made of soft lead that is die cast onto one end of the battery cable wire. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a black insulating jacket and a smaller female battery terminal clamp.

The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement only as a unit with the battery wire harness, which may include portions of the wiring circuits for the generator and other components on some models. Refer to the appropriate wiring information in this service manual for the location of the proper battery cable wire harness diagrams. The wiring information also includes proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a path back to the battery for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the opposite ends of the battery cable wires from the female battery terminal clamps provide secure and reliable connection of the battery cables to the vehicle electrical system.

The battery positive cable terminal clamp is die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the Power Distribution Center (PDC), and the other wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp is also die cast onto the ends of two wires. One wire has an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a stud on the right side of the engine cylinder block. The other wire has an eyelet terminal that connects the battery negative cable to the vehicle body through a ground screw on the right front fender inner shield, near the battery.

DIAGNOSIS AND TESTING - BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cable. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

VOLTAGE DROP TEST

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to Standard Procedures for the proper battery charging and load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.

BATTERY CABLES (Continued)

- To prevent the engine from starting, remove the Automatic Shut Down (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable terminal clamp (Fig. 14). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

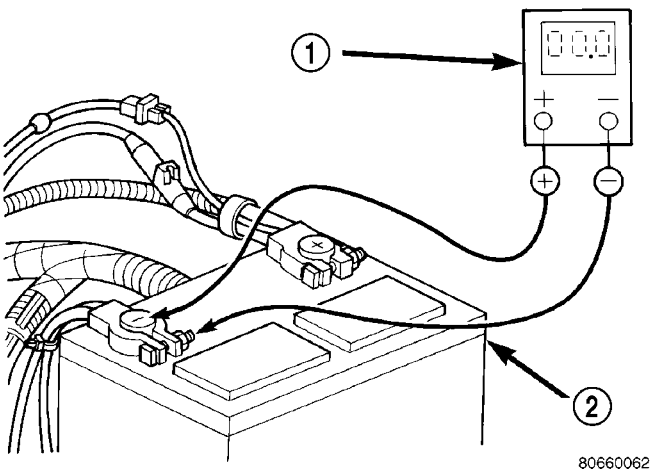


Fig. 14 Test Battery Negative Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp (Fig. 15). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 16). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

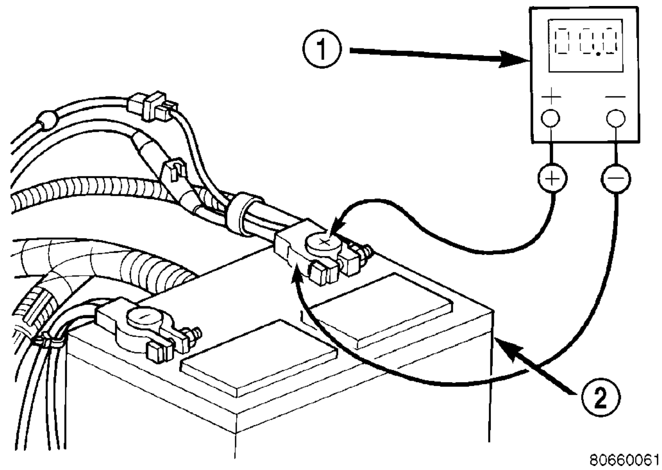


Fig. 15 Test Battery Positive Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

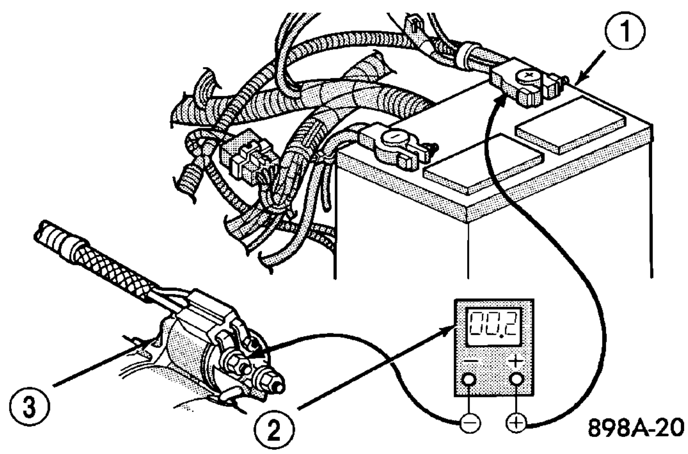


Fig. 16 Test Battery Positive Cable Resistance - Typical

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (Fig. 17). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

BATTERY CABLES (Continued)

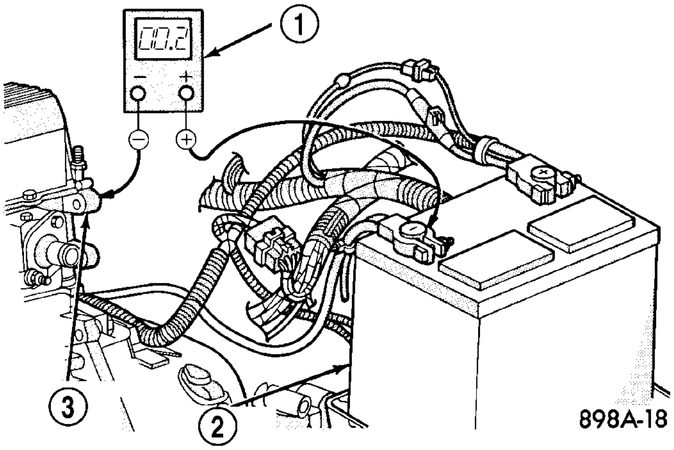


Fig. 17 Test Ground Circuit Resistance - Typical

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

REMOVAL

Both the battery negative cable and the battery positive cable are serviced in the battery wire harness. If either battery cable is damaged or faulty, the battery wire harness unit must be replaced.

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Unlatch and remove the B(+) terminal stud cover from the rear of the Power Distribution Center (PDC).

(7) Remove the two nuts that secure the battery positive cable and the generator output cable eyelet terminal to the two B(+) terminal studs on the PDC.

(8) Remove the battery positive cable and the generator output eyelet terminal from the two B(+) terminal studs on the PDC.

(9) Remove the screw that secures the battery negative cable eyelet terminal to the dash panel near the battery.

(10) Unlatch and remove the cover from the generator output terminal stud housing on the back of the generator.

(11) Remove the nut that secures the generator output cable eyelet terminal to the generator output terminal stud.

(12) Remove the generator output cable eyelet terminal from the generator output terminal stud.

(13) Remove the nut that secures the battery negative cable ground eyelet terminal to the stud on the right side of the engine block.

(14) Remove the battery negative cable ground eyelet terminal from the engine block stud.

(15) Remove the nut that secures the battery positive cable eyelet terminal to the B(+) terminal stud on the starter solenoid.

(16) Remove the battery positive cable eyelet terminal from the B(+) terminal stud on the starter solenoid.

(17) Remove the battery wire harness from the engine compartment.

INSTALLATION

Both the battery negative cable and the battery positive cable are serviced in the battery wire harness. If either battery cable is damaged or faulty, the battery wire harness unit must be replaced.

(1) Clean and inspect the battery cable terminal clamps and the battery terminal posts (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING), and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION).

(2) Position the battery wire harness into the engine compartment.

(3) Install the battery positive cable eyelet terminal onto the B(+) terminal stud on the starter solenoid.

(4) Install and tighten the nut that secures the battery positive cable eyelet terminal to the B(+) terminal stud on the starter solenoid. Tighten the nut to 10 N·m (90 in. lbs.).

(5) Install the battery negative cable ground eyelet terminal onto the stud on the right side of the engine block.

BATTERY CABLES (Continued)

(6) Install and tighten the nut that secures the battery negative cable ground eyelet terminal to the stud on the right side of the engine block. Tighten the nut to 16.9 N·m (150 in. lbs.).

(7) Install the generator output cable eyelet terminal onto the generator output terminal stud.

(8) Install and tighten the nut that secures the generator output cable eyelet terminal to the generator output terminal stud. Tighten the nut to 8.4 N·m (75 in. lbs.).

(9) Position the cover for the generator output terminal stud housing onto the back of the generator and snap it into place.

(10) Install and tighten the screw that secures the battery negative cable eyelet terminal to the dash panel near the battery. Tighten the screw to 48.7 N·m (36 ft. lbs.).

(11) Install the battery positive cable and the generator output cable eyelet terminal onto the PDC B(+) terminal studs.

(12) Install and tighten the two nuts that secure the battery positive cable and the generator output cable eyelet terminal to the PDC B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(13) Engage the tabs on the lower edge of the B(+) terminal stud cover in the slots on the rear of the PDC housing, then engage the latch on the top of the cover with the latch tabs on the PDC housing.

(14) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

(15) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 8.4 N·m (75 in. lbs.).

(16) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

BATTERY TRAY

DESCRIPTION

The battery is mounted in a stamped steel tray (Fig. 18) located in the passenger side rear corner of the engine compartment. The battery tray is secured by four hex screws with washers to the reinforcement located between the engine compartment side of the dash panel and the rear of the front fender wheelhouse inner panel.

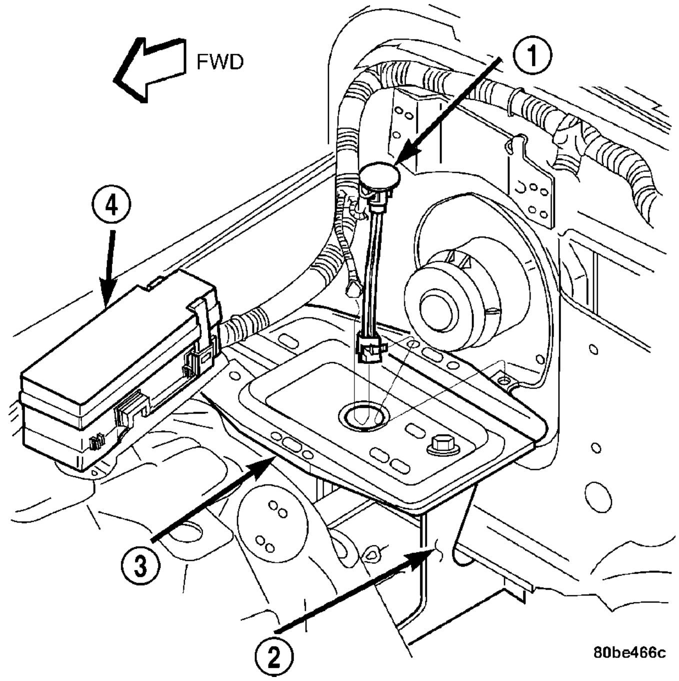


Fig. 18 Battery Tray

1 - BATTERY TEMPERATURE SENSOR
2 - REINFORCEMENT
3 - BATTERY TRAY
4 - POWER DISTRIBUTION CENTER

A hole in the bottom of the battery tray is fitted with a battery temperature sensor (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - DESCRIPTION).

OPERATION

The battery tray provides a secure mounting location and supports the battery. On some vehicles, the battery tray also provides the anchor point/s for the battery holddown hardware. The battery tray and the battery holddown hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation could result in damage to the vehicle, the battery, or both.

BATTERY TRAY (Continued)

REMOVAL

(1) Remove the battery from the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

(2) Remove the battery temperature sensor from the battery tray (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - REMOVAL).

(3) Remove the four screws with washers that secure the battery tray to the reinforcement located between the dash panel and the rear of the front wheelhouse inner panel in the engine compartment (Fig. 19).

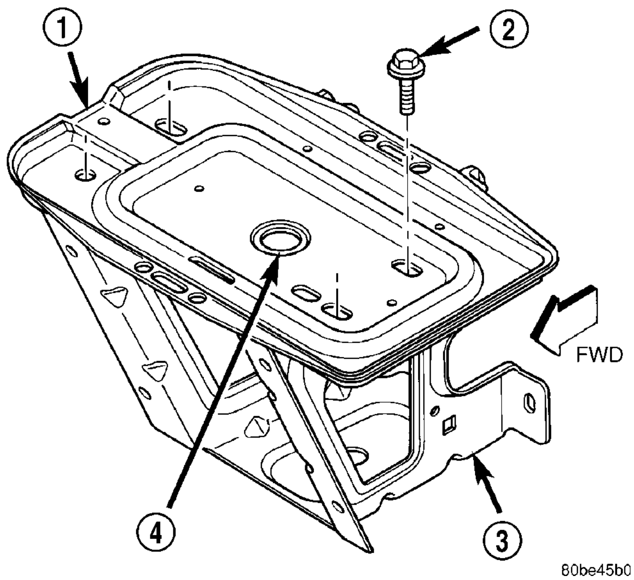


Fig. 19 Battery Tray Remove/Install

1 - BATTERY TRAY
2 - SCREW (4)
3 - REINFORCEMENT
4 - BATTERY TEMPERATURE SENSOR MOUNTING HOLE

(4) Remove the battery tray from the reinforcement in the engine compartment.

INSTALLATION

(1) Clean and inspect the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING), and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - INSPECTION).

(2) Position the battery tray onto the reinforcement in the engine compartment.

(3) Install and tighten the four screws with washers that secure the battery tray to the reinforcement located between the dash panel and the rear of the front wheelhouse inner panel in the engine compartment. Tighten the screws to 22.6 N·m (200 in. lbs.).

(4) Install the battery temperature sensor onto the battery tray (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - INSTALLATION).

(5) Install the battery onto the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

CHARGING

TABLE OF CONTENTS

CHARGING

DESCRIPTION

The charging system consists of:

- Generator
- Generator Decoupler Pulley (if equipped)
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch
- Battery (refer to 8, Battery for information)
- Battery temperature sensor
- Generator Lamp (if equipped)
- Check Gauges Lamp (if equipped)
- Voltmeter (refer to 8, Instrument Cluster for information)
- Wiring harness and connections (refer to 8, Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as reminder to check the three gauges. The signal to activate the lamp is sent via the CCD bus circuits. The lamp is located on the instrument panel. Refer to 8, Instrument Cluster for additional information.

CHARGING (Continued)

DIAGNOSIS AND TESTING - CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

• the check gauges lamp (if equipped) is illuminated with the engine running

• the voltmeter (if equipped) does not register properly

• an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

• accessories being left on with the engine not running

• a faulty or improperly adjusted switch that allows a lamp to stay on. Refer to Ignition-Off Draw Test in 8, Battery for more information.

INSPECTION

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

Refer to Diagnostic Trouble Codes in; Powertrain Control Module; Electronic Control Modules for more DTC information. This will include a complete list of DTC's including DTC's for the charging system.

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB® scan tool. Perform the following inspections before attaching the scan tool.

(1) Inspect the battery condition. Refer to 8, Battery for procedures.

(2) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

(3) Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to 7, Cooling System for information.

(7) Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

SPECIFICATIONS

GENERATOR RATINGS

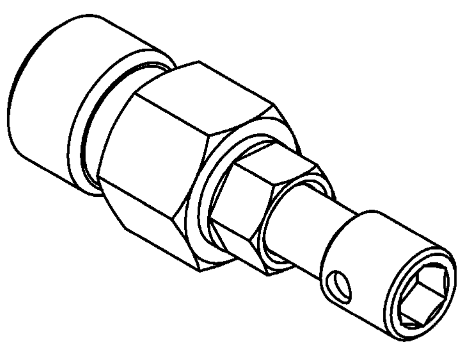
TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
DENSO	56044530AB	124	2.4L	88
DENSO	56044532AB	136	2.4	96
DENSO	56041685AA	117	4.0L	88
DENSO	56041565AA	81	4.0L	57
DENSO	56041822AA	124	4.0L	90

CHARGING (Continued)

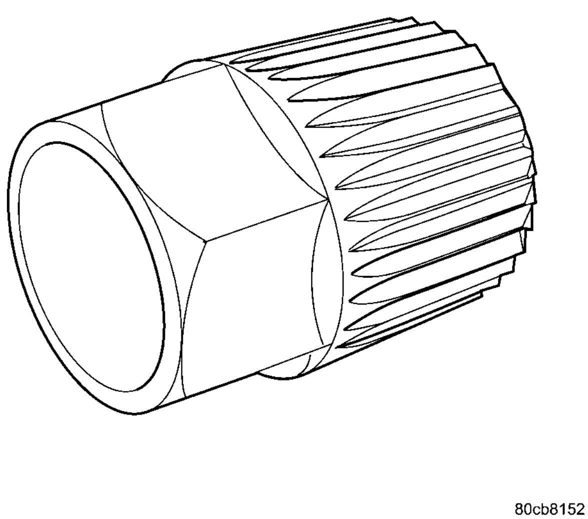
TORQUE

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Generator Mounting Bolts (2.4L)	57	42	-
Generator Mounting Bolt (4.0L)	55	41	-
Generator Pivot Bolt/Nut (4.0L)	55	41	-
Generator B+ Cable Nut	13	-	115

SPECIAL TOOLS



GENERATOR DECOUPLER TOOL #8433



GENERATOR DECOUPLER TOOL #8823

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The Battery Temperature Sensor (BTS) is attached to the battery tray located under the battery.

OPERATION

The BTS is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20 degrees F.

REMOVAL

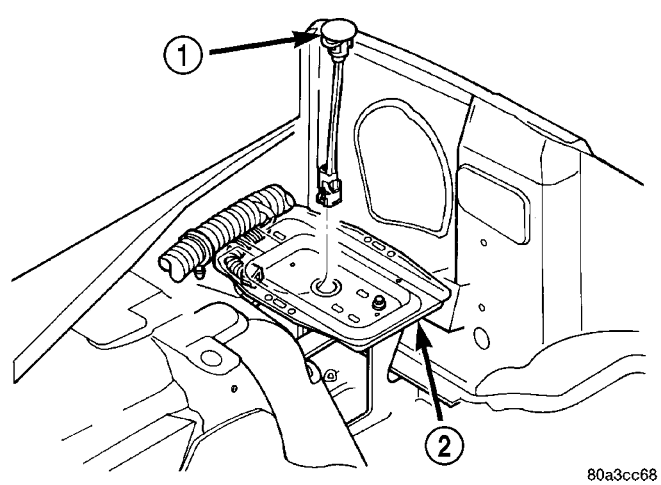


Fig. 1 Battery Temperature Sensor Remove/Install

1 - BATTERY TEMPERATURE SENSOR
2 - BATTERY TRAY

The battery temperature sensor is located under the vehicle battery (Fig. 1) and is attached to a mounting hole on battery tray.

BATTERY TEMPERATURE SENSOR (Continued)

(1) Remove battery. Refer to 8, Battery for procedures.

(2) Disconnect sensor pigtail harness from engine wire harness.

(3) Pry sensor straight up from battery tray mounting hole.

INSTALLATION

The battery temperature sensor is located under the vehicle battery and is attached to a mounting hole on battery tray.

(1) Feed pigtail harness through hole in top of battery tray and press sensor into top of battery tray.

(2) Connect pigtail harness.

(3) Install battery. Refer to 8, Battery for procedures.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

REMOVAL

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable at battery.

(2) Remove generator drive belt. Refer to 7, Cooling System for procedure.

(3) Remove generator pivot and mounting bolts/nut (Fig. 2) , or (Fig. 3). Position generator for access to wire connectors.

(4) If equipped, unsnap plastic cover from B+ terminal.

(5) Remove B+ cable output terminal mounting nut at rear of generator (Fig. 4), (Fig. 5), or (Fig. 6). Disconnect terminal from generator.

(6) Disconnect field wire connector at rear of generator by pushing on connector tab.

(7) Remove generator from vehicle.

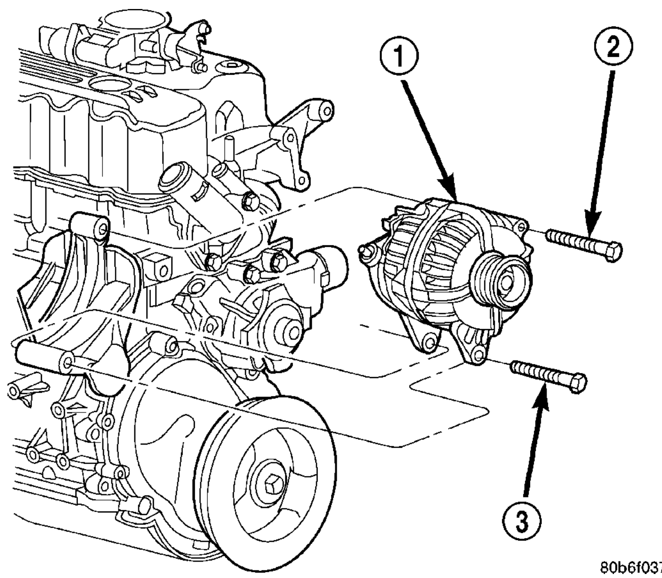


Fig. 2 GENERATOR REMOVE/INSTALL - 4.0L

1 - GENERATOR
2 - UPPER BOLT
3 - LOWER BOLT

INSTALLATION

(1) Position generator to engine and snap field wire connector into rear of generator.

(2) Install B+ terminal to generator mounting stud. Tighten mounting nut. Refer to Torque Specifications.

(3) If equipped, snap plastic cover to B+ terminal.

(4) Install generator mounting fasteners and tighten. Refer to Torque Specifications.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

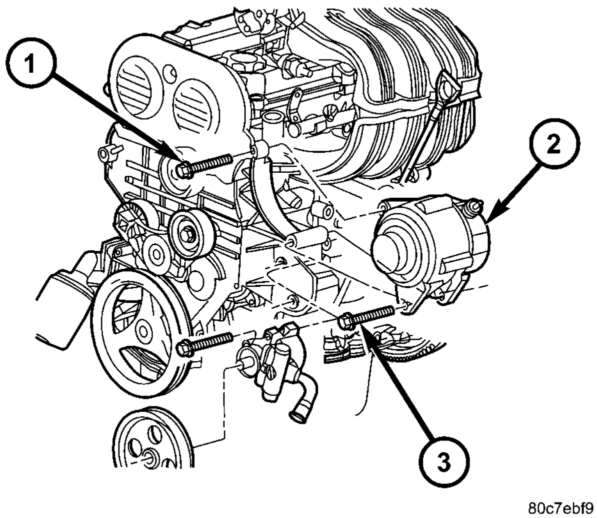


Fig. 3 GENERATOR MOUNTING- 2.4L

1 - UPPER MOUNTING BOLT
2 - GENERTOR
3 - LOWER MOUNTING BOLT

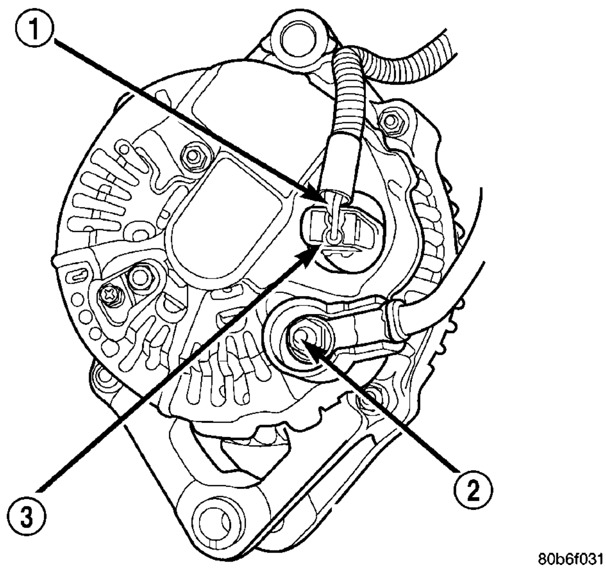


Fig. 4 GENERATOR CONNECTORS (TYPICAL DENSO)

1 - FIELD WIRES
2 - B+ (OUTPUT TERMINAL)
3 - FIELD WIRE CONNECTOR

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in 7, Cooling System.

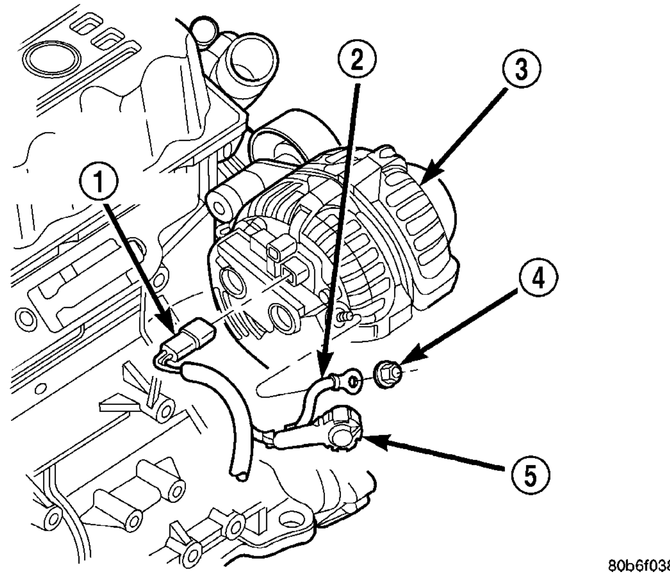


Fig. 5 GENERATOR CONNECTORS - 4.0L

1 - FIELD WIRE CONNECTOR
2 - B+ CABLE
3 - GENERATOR
4 - B+ CABLE MOUNTING NUT
5 - CABLE PROTECTOR

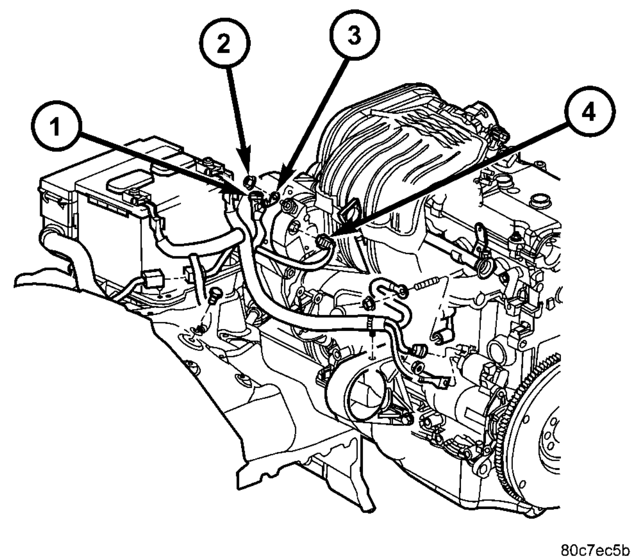


Fig. 6 GENERATOR ELECTRICAL CONNECTORS - 2.4L - TYPICAL

1 - PROTECTIVE CAP
2 - B+ NUT
3 - B+ TERMINAL
4 - FIELD ELECTRICAL CONNECTOR

(5) Install generator drive belt. Refer to 7, Cooling System for procedure.

(6) Install negative battery cable to battery.

GENERATOR DECOUPLER PULLEY

DESCRIPTION

The generator decoupler is used only with certain engines. The decoupler is used in place of the standard generator drive pulley (Fig. 7).

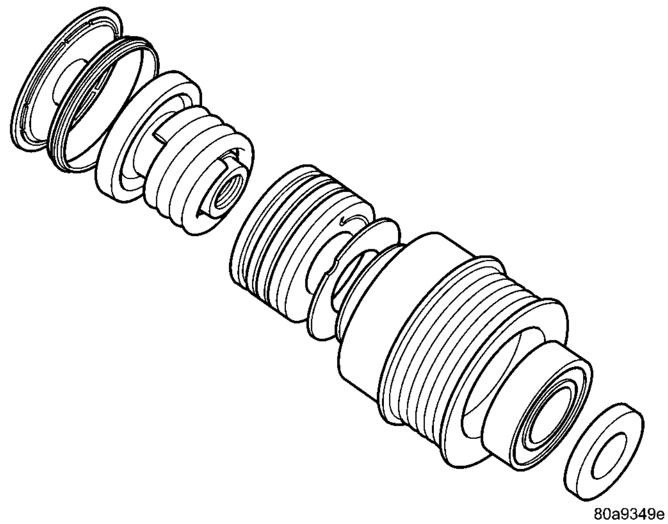


Fig. 7 GENERATOR DECOUPLER PULLEY

OPERATION

The generator decoupler is used only with certain engines. The decoupler (Fig. 7) is a one-way clutch designed to help reduce belt tension fluctuation, vibration, reduce fatigue loads, improve belt life, reduce hubloads on components, and reduce noise. Dry operation is used (no grease or lubricants). The decoupler is not temperature sensitive and also has a low sensitivity to electrical load. The decoupler is a non-serviceable item and is to be replaced as an assembly.

DIAGNOSIS AND TESTING - GENERATOR DECOUPLER

CONDITION	POSSIBLE CAUSES	CORRECTION
Does not drive generator (generator not charging)	Internal failure	Replace decoupler
Noise coming from decoupler	Internal failure	Replace decoupler

REMOVAL

The generator decoupler is used only with certain engines.

Two different type generator decoupler pulleys are used. One can be identified by the use of machined splines (Fig. 8). The other can be identified by a hex opening (Fig. 9) and will not use splines.

Different special tools are required to service each different decoupler. Refer to following procedure.

INA Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

(3) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 10).

(4) Determine if end of generator shaft is hex shaped (Fig. 11) or is splined (Fig. 12). If hex is used, insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 13). If splined, insert a 5/16” 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 14).

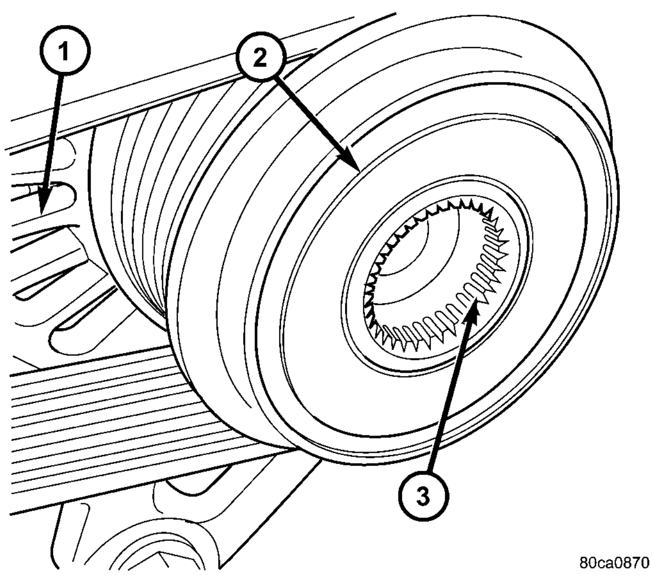


Fig. 8 GENERATOR DECOUPLER PULLEY (INA)

1 - GENERATOR
2 - DECOUPLER (INA)
3 - MACHINED SPLINES

GENERATOR DECOUPLER PULLEY (Continued)

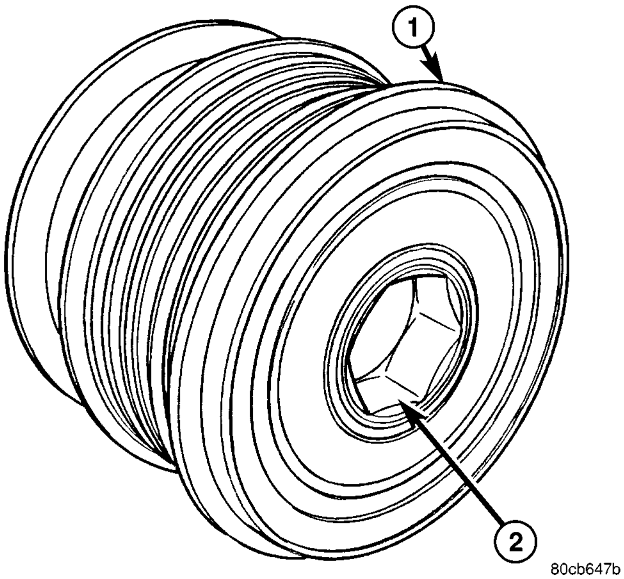


Fig. 9 GENERATOR DECOUPLER PULLEY (LITENS)

1 - DECOUPLER (LITENS)
2 - HEX OPENING

(5) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 13) or, (Fig. 14).

(6) After breaking loose with tool, unthread decoupler by hand from generator.

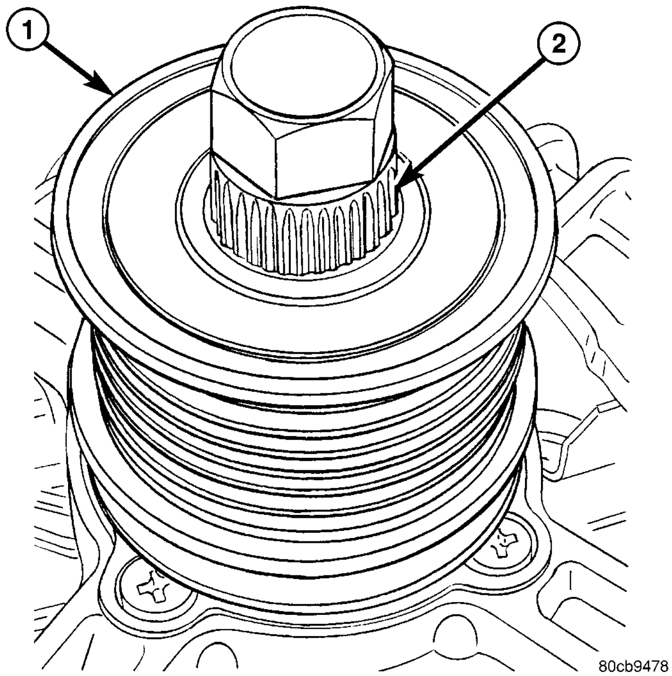


Fig. 10 #8823 TOOL AND INA DECOUPLER

1 - INA DECOUPLER
2 - TOOL #8823 (VM.1048)

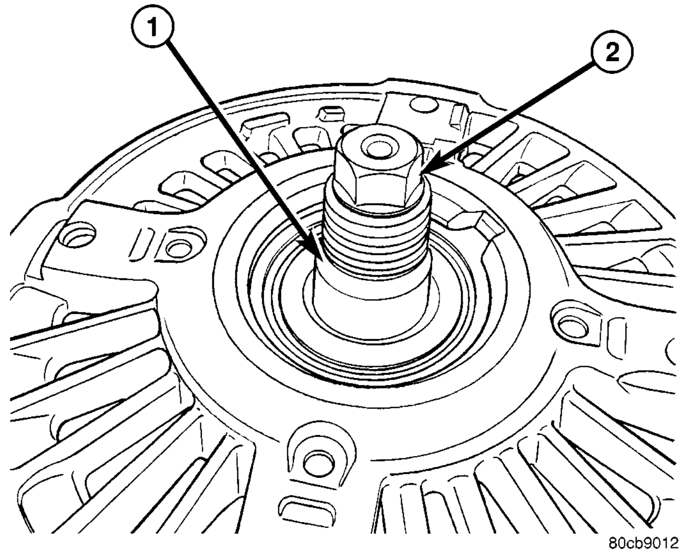


Fig. 11 END OF GENERATOR SHAFT (HEX)

1 - GENERATOR SHAFT
2 - HEX

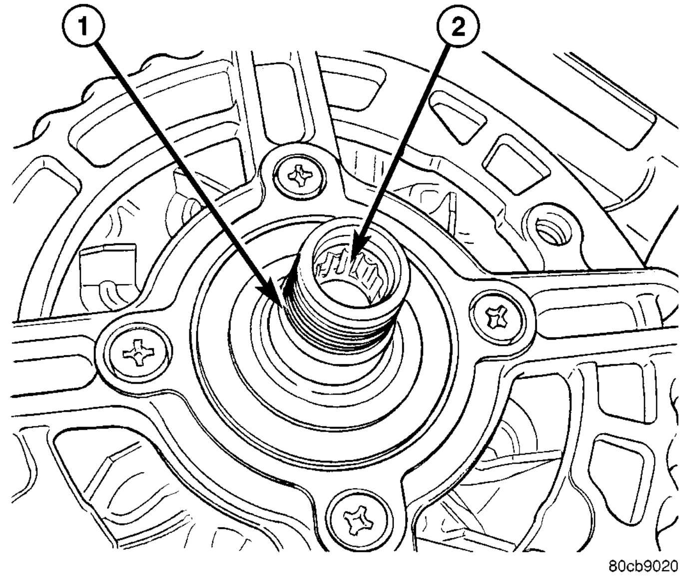


Fig. 12 END OF GENERATOR SHAFT (SPLINED)

1 - GENERATOR SHAFT
2 - SPLINES

GENERATOR DECOUPLER PULLEY (Continued)

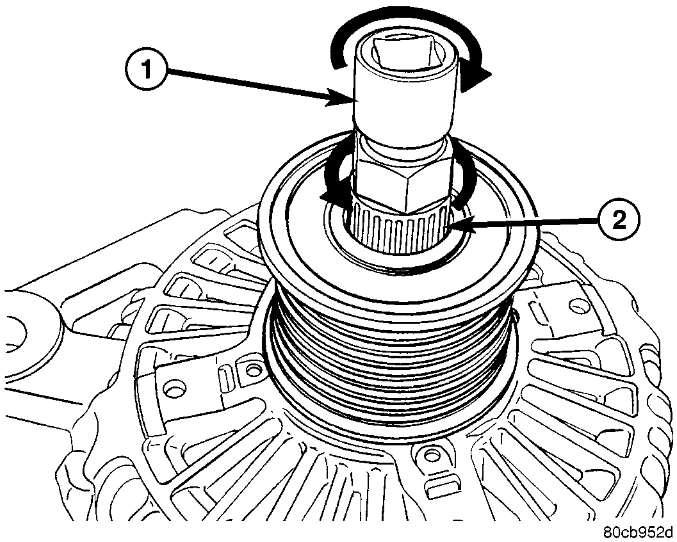


Fig. 13 DECOUPLER REMOVAL (INA-HEX)

1 - DEEP 10 MM SOCKET
2 - TOOL #8823 (VM.1048)

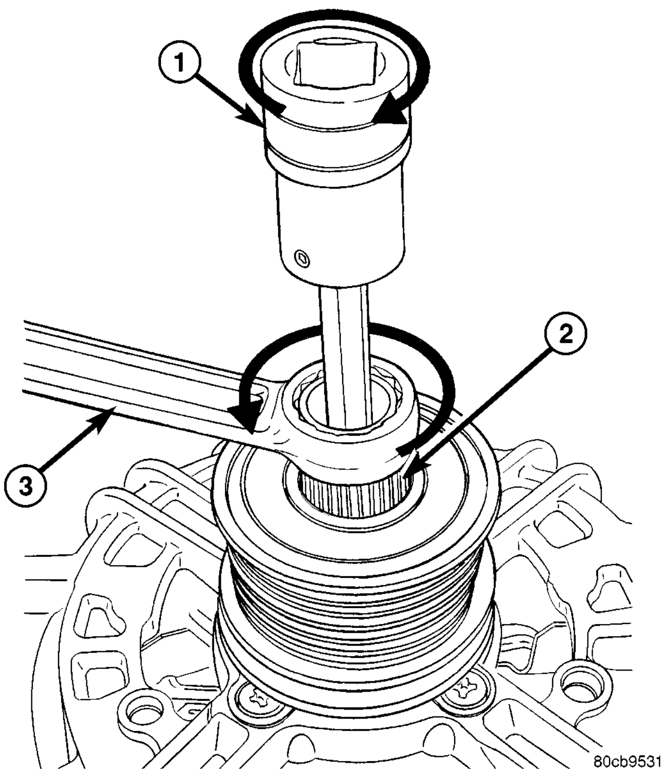


Fig. 14 DECOUPLER REMOVAL (INA-SPLINED)

1 - DRIVER
2 - TOOL #8823 (VM.1048)
3 - 17 MM WRENCH

Litens Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

(3) Position Special Tool #8433 (Fig. 15) into decoupler. Align to hex end of generator shaft.

(4) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 16).

(5) After breaking loose with tool, unthread decoupler by hand from generator.

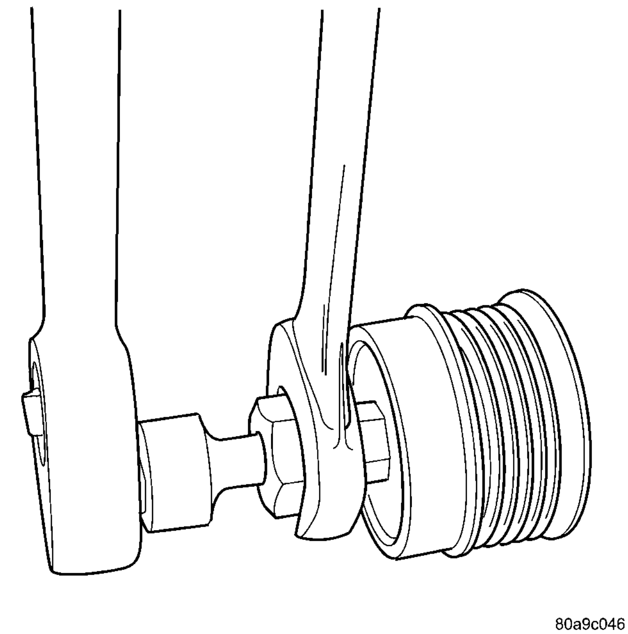


Fig. 15 # 8433 TOOL AND LITENS DECOUPLER

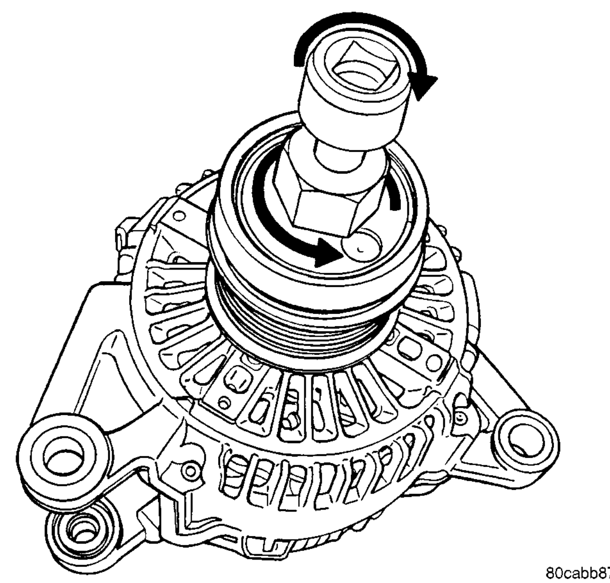


Fig. 16 DECOUPLER REMOVAL (LITENS)

GENERATOR DECOUPLER PULLEY (Continued)

INSTALLATION

INA Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

(2) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 10).

(3) Determine if end of generator shaft is hex shaped (Fig. 11) or is splined (Fig. 12). If hex is used, insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 17). If splined, insert a 5/16” 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 18).

(4) **Do not use an adjustable, ratcheting “click type” torque wrench. Most “click type” wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counter-clockwise rotation (Fig. 17) or, (Fig. 18). Refer to torque specifications.

(5) Install accessory drive belt, and generator. Refer to Generator Installation.

(6) Connect negative battery cable.

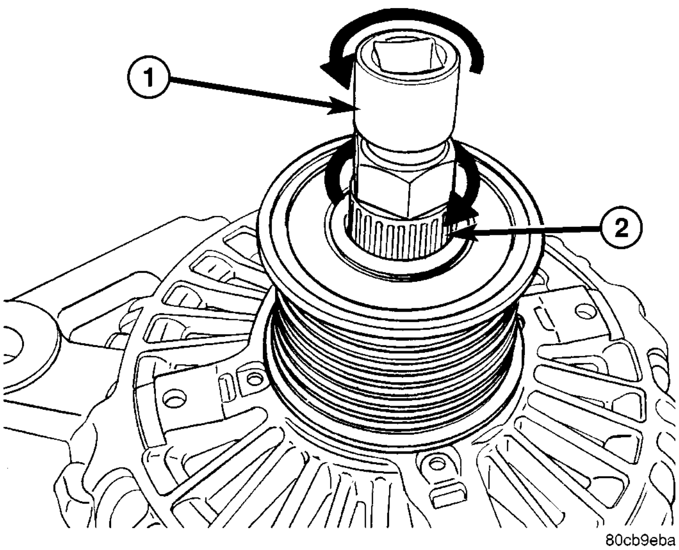


Fig. 17 DECOUPLER INSTALLATION (INA-HEX)

1 - 10MM DEEP SOCKET
2 - TOOL # 8823 (VM.1048)

Litens Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

(2) Position Special Tool 8433 (Fig. 15) into decoupler. Align tool to hex end of generator shaft.

(3) **Do not use an adjustable, ratcheting “click type” torque wrench. Most “click type” wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or**

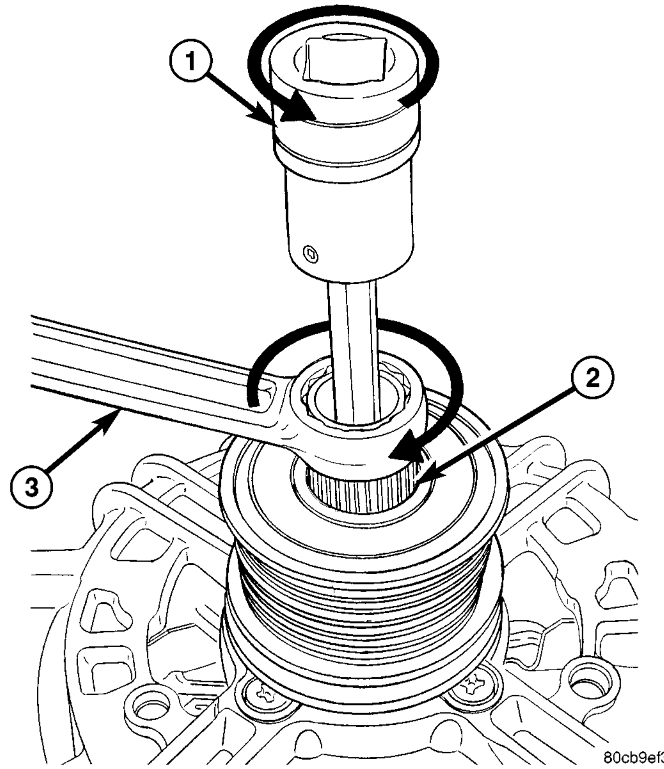


Fig. 18 DECOUPLER INSTALLATION (INA SPLINED)

1 - DRIVER
2 - TOOL # 8823 (VM.1048)

beam-type wrench. Tighten in counter-clockwise rotation (Fig. 19). Refer to torque specifications.

(4) Install accessory drive belt, and generator. Refer to Generator Installation.

(5) Connect negative battery cable.

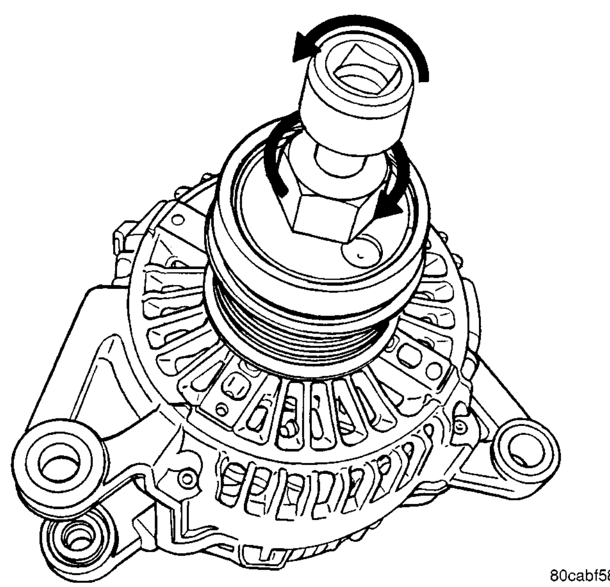


Fig. 19 DECOUPLER INSTALLATION (Litens)

VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

STARTING

TABLE OF CONTENTS

STARTING

DESCRIPTION

The starting system consists of:

- Starter relay
- Starter motor (including an integral starter solenoid)

Other components to be considered as part of starting system are:

- Battery
- Battery cables
- Ignition switch and key lock cylinder
- Clutch pedal position switch (manual transmission)
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections.

The Battery, Starting, and Charging systems operate in conjunction with one another, and must be tested as a complete system. For correct operation of starting/charging systems, all components used in these 3 systems must perform within specifications. When attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

Certain starting system components are monitored by the PCM and may produce a Diagnostic Trouble Code (DTC).

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes (700 amperes - diesel engine), and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the clutch pedal position switch (manual transmission), the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with a manual transmission, it has a clutch pedal position switch installed in series between the ignition switch and the coil battery terminal of the starter relay. This normally open switch prevents the starter relay from being energized when the ignition switch is turned to the momentary Start position, unless the clutch pedal is depressed. This feature prevents starter motor operation while the clutch disc and the flywheel are engaged. The starter relay coil ground terminal is always grounded on vehicles with a manual transmission.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the momentary Start position. The park/

STARTING (Continued)

neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the manual transmission flywheel or on the automatic transmission torque converter or torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

DIAGNOSIS AND TESTING - STARTING SYSTEM

The battery, starting system and charging system in the vehicle operate with one another, and must be tested as a complete system. In order for the engine to start and the battery to charge properly, all of the components that are used in these systems must perform within specifications. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting system and charging system include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **Charging System, On-Board Diagnostic Test** for on-board diagnostic test procedures.

Starting System Diagnosis		
Condition	Possible Cause	Correction
Starter fails to operate.	1. Battery discharged or faulty.	1. Refer to 8, Battery. Replace faulty battery as required.
	2. Starting circuit wiring faulty.	2. Refer to Wiring. Test and repair faulty starter feed and/or control circuits, as required.
	3. Starter relay faulty.	3. Refer to Starter Relay. Replace faulty starter relay as required.
	4. Ignition switch faulty.	4. Refer to Ignition Switch and Key Lock Cylinder. Replace faulty ignition switch as required.
	5. Clutch pedal position switch faulty.	5. Refer to Clutch Pedal Position Switch. Replace faulty clutch hydraulic linkage unit as required.
	6. Park/Neutral position switch faulty or misadjusted.	6. Refer to Park/Neutral Position Switch. Replace faulty park/neutral position switch as required.
	7. Starter solenoid faulty.	7. Refer to Starter Motors. Replace faulty starter motor as required.

STARTING (Continued)

Starting System Diagnosis		
Condition	Possible Cause	Correction
	8. Starter motor faulty.	8. Refer to Starter Motor. Replace faulty starter motor as required.
Starter engages, fails to turn engine.	1. Battery discharged or faulty.	1. Refer to Battery. Replace faulty battery as required.
	2. Starting circuit wiring faulty.	2. Refer to Wiring. Test and repair faulty starter feed and/or control circuits as required.
	3. Starter motor faulty.	3. Refer to Starter Motor. Replace faulty starter motor as required.
	4. Engine seized.	4. Refer to 9, Engine Diagnosis. Repair or replace faulty engine as required.
Starter engages, spins out before engine starts.	1. Starter ring gear faulty.	1. Refer to Starter Motor. Remove starter motor to inspect starter ring gear. Replace faulty starter ring gear as required.
	2. Starter motor faulty.	2. Refer to Starter Motor. Replace faulty starter motor as required.
Starter does not disengage.	1. Starter motor improperly installed.	1. Refer to Starter Motor. Tighten starter motor mounting hardware to correct tightness specifications as required.
	2. Starter relay faulty.	2. Refer to Starter Relay. Replace faulty starter relay as required.
	3. Ignition switch faulty.	3. Refer to Ignition Switch and Key Lock Cylinder. Replace faulty ignition switch as required.
	4. Starter motor faulty.	4. Refer to Starter Motor. Replace faulty starter motor as required.

TESTING

Before testing the starting system perform a visual inspection of the starting system components and connections.

COLD CRANKING TEST

Refer to **Starting System** in the index of this service manual for the location of complete starting system wiring diagrams. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to **Battery Charging** for battery charging procedures. Refer to **Battery** for battery diagnosis and testing procedures, including battery load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect a suitable volt-ampere tester to the battery terminals (Fig. 1). See the instructions provided by the manufacturer of the volt-ampere tester being used.

(2) Rotate and hold the ignition switch in the Start position. Note the cranking voltage and current (amperage) draw readings shown on the volt-ampere tester.

(a) If the voltage reads below 9.6 volts, refer to **Starter Motor** for starter motor diagnosis and testing procedures. If the starter motor tests OK, refer to **Engine Diagnosis** engine diagnosis and testing procedures. If the starter motor is not OK, replace faulty starter motor.

(b) If the voltage reads above 9.6 volts and the current (amperage) draw reads below specifications, refer to the **Feed Circuit Test**in this section.

STARTING (Continued)

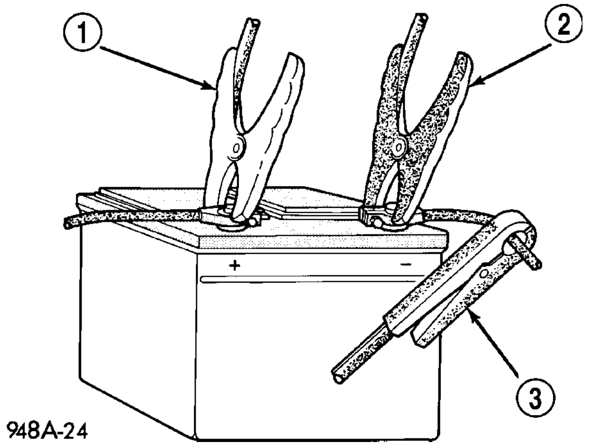


Fig. 1 Volts-Amps Tester Connections - Typical

1 - POSITIVE CLAMP
2 - NEGATIVE CLAMP
3 - INDUCTION AMMETER CLAMP

(c) If the voltage reads 12.5 volts or greater and the starter motor does not turn, refer to the **Control Circuit Test** in this section.

(d) If the voltage reads 12.5 volts or greater and the starter motor turns very slowly, refer to the **Feed Circuit Test** in this section.

NOTE: A cold engine will increase the starter current (amperage) draw reading, and reduce the battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in the high-amperage starter feed circuit.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:**When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to **Battery Charging** for battery charging procedures. Refer to **Battery** for battery diagnosis and testing procedures, including battery load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable terminal clamp (Fig. 2). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the battery negative cable terminal clamp and the battery negative terminal post.

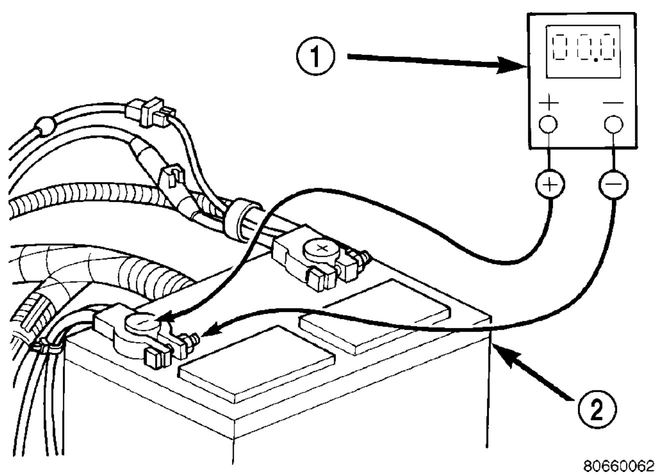


Fig. 2 Test Battery Negative Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp (Fig. 3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

STARTING (Continued)

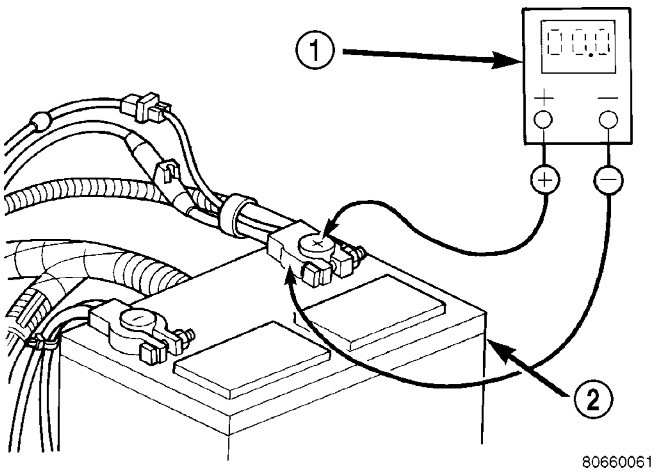


Fig. 3 Test Battery Positive Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 4). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

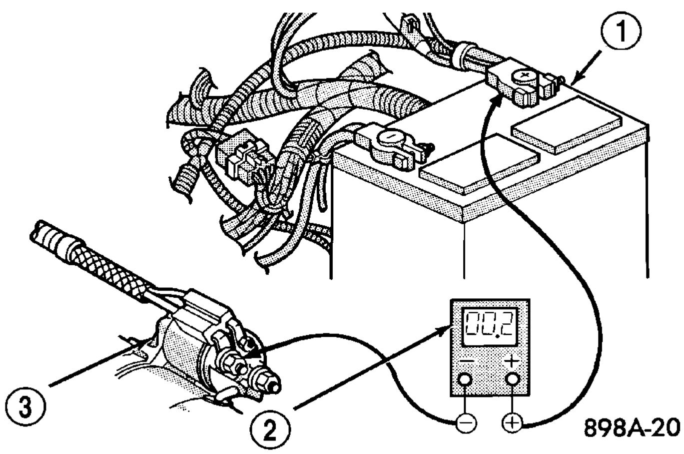


Fig. 4 Test Battery Positive Cable Resistance - Typical

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (Fig. 5). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

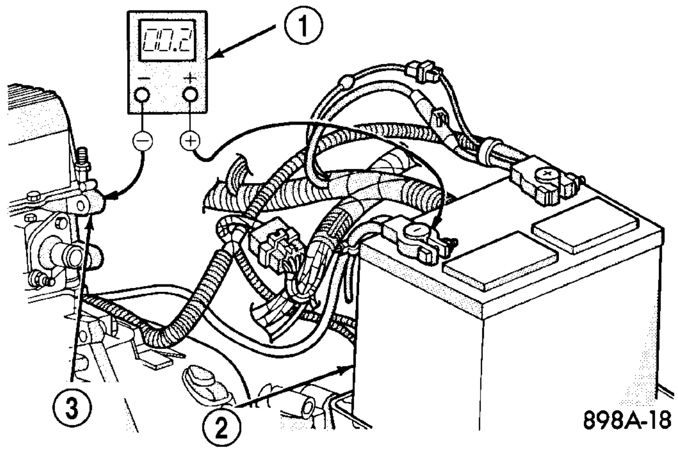


Fig. 5 Test Ground Circuit Resistance - Typical

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

(5) Connect the positive lead of the voltmeter to the starter housing. Connect the negative lead of the voltmeter to the battery negative terminal post (Fig. 6). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, correct the poor starter to engine block ground contact.

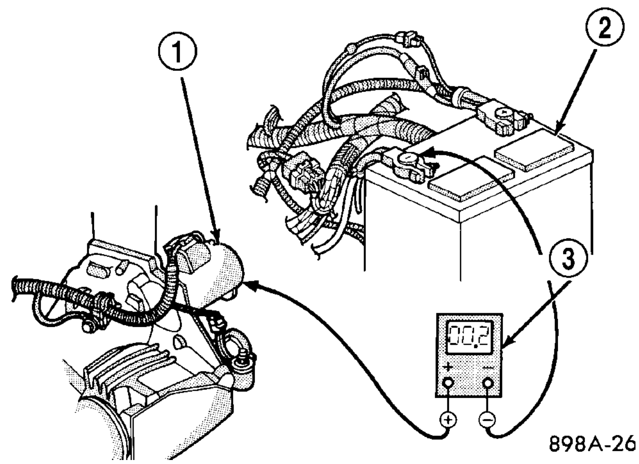


Fig. 6 Test Starter Ground - Typical

1 - STARTER MOTOR
2 - BATTERY
3 - VOLTMETER

If the resistance tests detect no feed circuit problems, refer to **Starter Motor**.

STARTING (Continued)

CONTROL CIRCUIT TEST

The starter control circuit components should be tested in the order in which they are listed, as follows:

Starter Relay

• Refer to **Starter Relay**.

Starter Solenoid

• Refer to **Starter Motor**.

Ignition Switch

• Refer to **Ignition Switch and Key Lock Cylinder** for ignition switch diagnosis and testing procedures.

Clutch Pedal Position Switch

• If the vehicle is equipped with a manual transmission, refer to **Clutch Pedal Position Switch** for clutch pedal position switch diagnosis and testing procedures.

Park/Neutral Position Switch

• If the vehicle is equipped with an automatic transmission, refer to **Park/Neutral Position Switch** for park/neutral position switch diagnosis and testing procedures.

INSPECTION - STARTING SYSTEM

The following starting system components should be carefully inspected whenever any starting system problem is encountered.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE AIRBAG SYSTEM. FAILURE TO TAKE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Battery

• Visually inspect battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery, if required. Refer to **Battery** for battery cleaning and inspection procedures.

Ignition Switch

• Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Wiring Diagrams**. Refer to **Ignition Switch and Key Lock Cylinder** for ignition switch service procedures.

Clutch Pedal Position Switch

• If vehicle is equipped with a manual transmission, visually inspect clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Clutch Hydraulic Linkage** for clutch pedal position switch service procedures.

Park/Neutral Position Switch

• If vehicle is equipped with an automatic transmission, visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Park/Neutral Position Switch** for park/neutral position switch service procedures.

Starter Relay

• Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Relay** for starter relay service procedures.

Starter Motor

• Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. If problem being diagnosed involves improper starter engagement, disengagement or noise complaints, starter motor should be removed. With starter motor removed, inspect starter pinion and ring gears for damaged or missing teeth. Replace faulty components as required. Refer to **Starter Motor** for removal/installation procedures.

Starter Solenoid

• Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections. Clean corroded connections as required. Refer to **Starter Motor** for starter solenoid service procedures.

Wiring

• Visually inspect starting system wire harnesses for indications of physical damage. Repair or replace any faulty wiring, as required. Refer to **Wiring Diagrams** for repair or connector and terminal service procedures.

STARTING (Continued)

SPECIFICATIONS

STARTER

Starter Motor and Solenoid	
Manufacturer	Mitsubishi
Engine Application	2.4L, 4.0L
Power Rating	2.4L - 1.4 Kilowatt (1.9 Horsepower) 4.0L - 1.4 Kilowatt (1.9 Horsepower)
Voltage	12 Volts
** Number of Permanent Magnets	6
Number of Brushes	4
Drive Type	Planetary Gear Reduction
Free Running Test Voltage	11.2 Volts
Free Running Test Maximum Amperage Draw	90 Amperes
Free Running Test Minimum Speed	2.4L - 24400 rpm 4.0L - 2500 rpm
Solenoid Closing Maximum Voltage Required	7.8 Volts
*Cranking Amperage Draw Test	2.4L - 160 Amperes 4.0L - 160 Amperes
* Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	
** The starter is equipped with permanent magnets. Never strike the starter case to attempt to loosen a sticking/ stuck armature as permanent magnets may crack or break.	

TORQUE

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Starter Solenoid B+ Terminal Nut	11.3	-	100
Starter Mounting Bolts (2.4L)	54	40	-
Starter Heat Shield Mounting Bolts	6	-	55
Starter Mounting Bolt (forward facing 4.0L)	41	30	-
Starter Mounting Bolt (rearward facing 4.0L)	48	35	-

STARTER MOTOR

DIAGNOSIS AND TESTING - STARTER MOTOR/SOLENOID

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with starter motor removed from vehicle. Refer to starter motor specifications.

CAUTION: Permanent magnets are used in the starter. Permanent magnet starters are highly sensitive to hammering, shocks, external pressure and reverse polarity. This starter motor must never be clamped in a vise by starter field frame. The starter should only be clamped by mounting flange. Do not reverse battery cable connections to starter motor when testing. The permanent magnets may be damaged and starter rendered unserviceable if it is subjected to any of these conditions.

STARTER MOTOR (Continued)

STARTER MOTOR TESTING

(1) Remove starter motor from vehicle. Refer to Starter Motor Removal / Installation.

(2) Mount starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on mounting flange of starter motor. Never clamp on starter motor by field frame.

(3) Connect a suitable volt-ampere tester and12-volt battery to starter motor in series, and set ammeter to 100 ampere scale. See instructions provided by manufacturer of volt-ampere tester being used.

(4) Install a jumper wire from solenoid terminal to solenoid B(+) terminal stud. The starter motor should operate. If starter motor fails to operate, replace faulty starter motor.

(5) Adjust carbon pile load of tester to obtain free running test voltage. Refer to starter motor free running test voltage specifications.

(6) Note reading on ammeter and compare reading to free running test maximum amperage draw. Refer to starter motor free running test maximum amperage draw specifications.

(7) If ammeter reading exceeds maximum amperage draw specification, replace faulty starter motor.

STARTER SOLENOID TESTING

This test can only be performed with starter motor removed from vehicle.

(1) Remove starter motor from vehicle. Refer to **Starter Motor** for removal/installation.

(2) Disconnect wire from solenoid field coil terminal.

(3) Check for continuity between solenoid terminal and solenoid field coil terminal with a continuity tester (Fig. 7). There should be continuity. If OK, go to Step 4. If not OK, replace faulty starter motor.

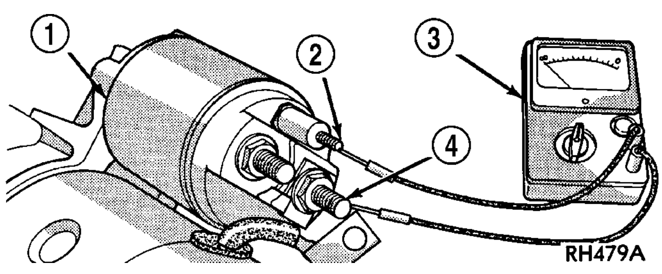


Fig. 7 CONTINUITY TEST BETWEEN SOLENOID TERMINAL AND FIELD COIL TERMINAL

1 - SOLENOID
2 - SOLENOID TERMINAL
3 - OHMMETER
4 - FIELD COIL TERMINAL

(4) Check for continuity between solenoid terminal and solenoid case (Fig. 8). There should be continuity. If not OK, replace faulty starter motor.

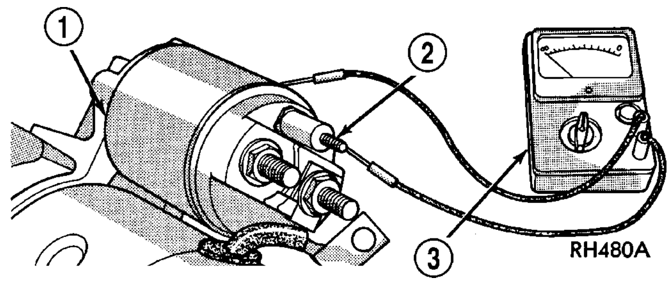


Fig. 8 CONTINUITY TEST BETWEEN SOLENOID TERMINAL AND SOLENOID CASE - TYPICAL

1 - SOLENOID
2 - SOLENOID TERMINAL
3 - OHMMETER

REMOVAL

2.4L

(1) Disconnect and isolate negative battery cable.

(2) Raise and support vehicle.

(3) While supporting starter motor, remove two bolts securing starter motor to transmission (Fig. 9).

(4) Lower starter motor far enough to access and remove nut securing battery cable to starter solenoid B(+) terminal stud (Fig. 10). Always support starter motor during this process. Do not let starter motor hang from wire harness.

(5) Remove battery cable at starter.

(6) Disconnect solenoid terminal wire harness connector from starter solenoid.

(7) Remove starter motor.

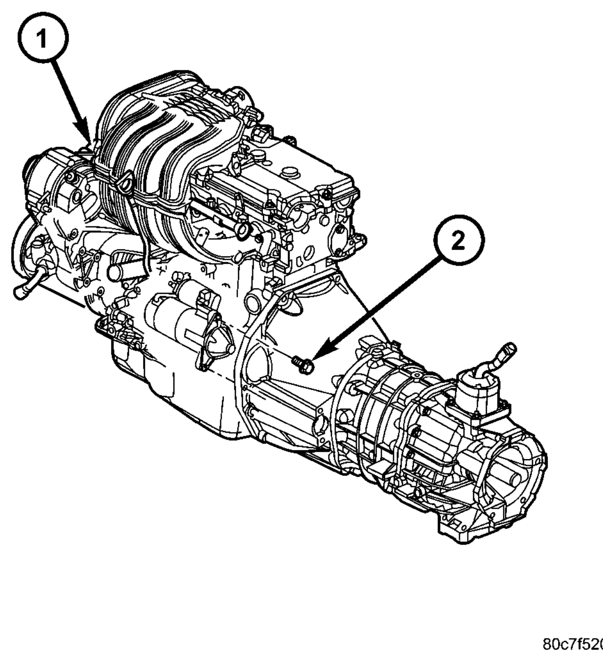


Fig. 9 STARTER - 2.4L

1 - STARTER
2 - MOUNTING BOLTS (2)

STARTER MOTOR (Continued)

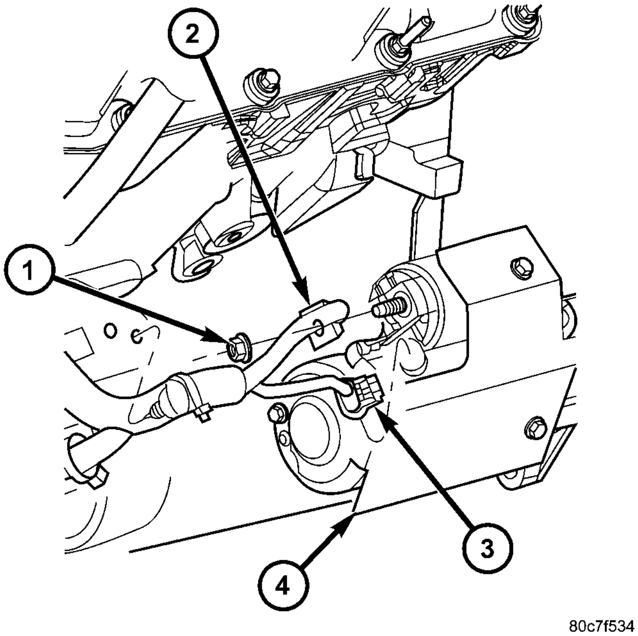


Fig. 10 STARTER ELECTRICAL CONNECTORS (2.4L SHOWN)

1 - BATERY CABLE NUT
2 - BATTERY CABLE
3 - SOLENOID CONNECTOR
4 - HEAT SHIELD (IF USED)

4.0L

(1) Disconnect and isolate negative battery cable.

(2) Raise and support vehicle.

(3) **4.0L With Manual Transmission:** Remove lower bolt (forward facing) securing starter motor to transmission housing (Fig. 11).

(4) **4.0L With Manual Transmission:** While supporting starter motor, remove upper bolt (rearward facing) securing starter motor to transmission housing.

(5) **4.0L With 42 RLE Automatic Transmission:** Remove 2 starter mounting bolts (Fig. 12).

(6) Lower starter motor from front of transmission housing far enough to access and remove nut securing battery to starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.

(7) Remove battery cable at starter solenoid.

(8) Disconnect solenoid terminal wire harness connector from starter solenoid.

(9) Remove starter motor from transmission housing.

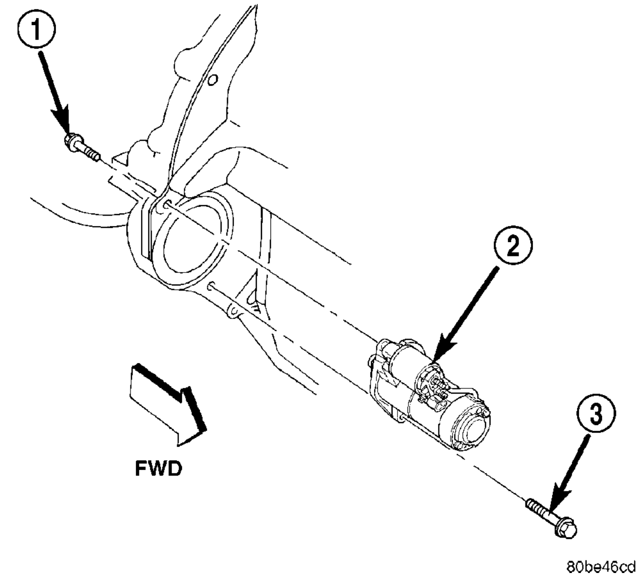


Fig. 11 STARTER - 4.0L - MAN. TRANS.

1 - BOLT
2 - STARTER MOTOR
3 - BOLT

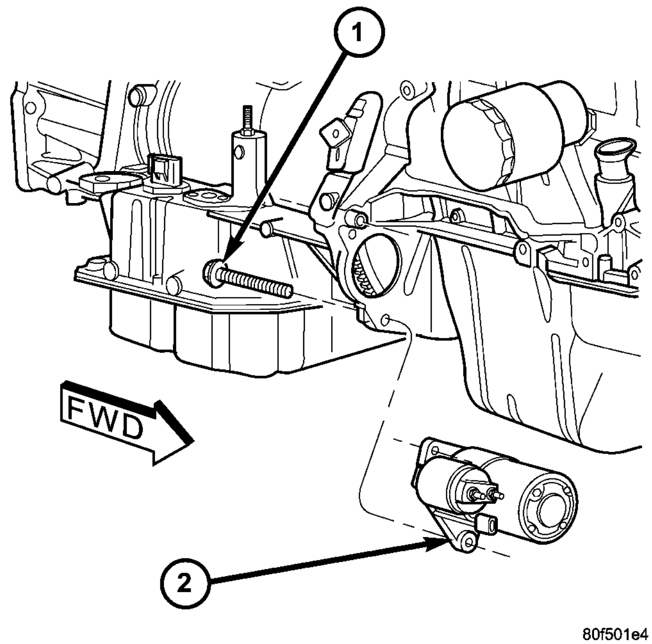


Fig. 12 STARTER - 4.0L - 42RLE AUTO. TRANS.

1 - BOLT
2 - STARTER MOTOR

STARTER MOTOR (Continued)

INSTALLATION

2.4L

(1) Connect solenoid terminal wire harness connector to starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.

(2) Install battery cable eyelet onto starter solenoid stud. Refer to Torque Specifications.

(3) Position starter motor to transmission. Install and tighten 2 bolts. Refer to Torque Specifications.

(4) Lower vehicle.

(5) Connect negative battery cable.

4.0L

(1) Connect solenoid terminal wire harness connector to starter solenoid. Always support starter motor during this process. Do not let starter motor hang from wire harness.

(2) Install battery cable eyelet onto starter solenoid stud. Refer to Torque Specifications.

(3) Position starter motor to transmission housing. Loosely install two mounting bolts.

(4) Tighten upper (rearward facing) mounting bolt to 47.5 N·m (35 ft. lbs.).

(5) Tighten lower (forward facing) mounting bolt to 40.7 N·m (30 ft. lbs.).

(6) Lower vehicle.

(7) Connect negative battery cable.

STARTER MOTOR RELAY

DESCRIPTION

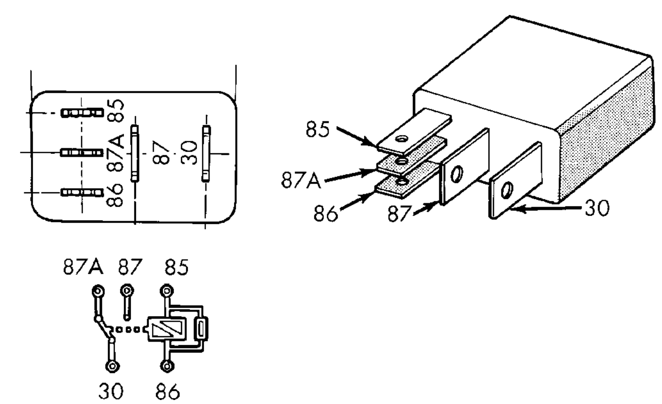


Fig. 13 Starter Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

The starter relay (Fig. 13) is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when the ignition switch is turned to the Start position. The starter relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for starter relay identification and location.

The starter relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - STARTER RELAY

The starter relay (Fig. 14) is located in the Power Distribution Center (PDC), in engine compartment. Refer to fuse and relay layout label affixed to underside of PDC cover starter relay identification and location.

RELAY TEST

(1) Remove starter relay from PDC. Refer to **Starter Relay**.

(2) A relay in de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform Relay Circuit Test that follows. If not OK, replace faulty relay.

STARTER MOTOR RELAY (Continued)

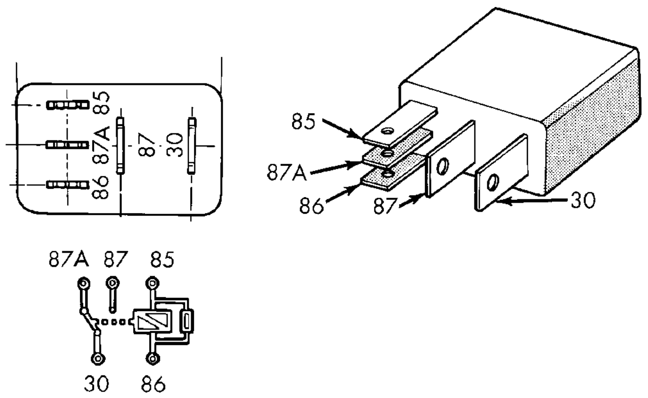


Fig. 14 Starter Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair open circuit to fused B(+) fuse in PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in energized position. This terminal supplies battery voltage to starter solenoid field coil. There should be continuity between cavity for relay terminal 87 and starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair open engine starter motor relay output circuit to starter solenoid as required.

(4) The coil battery terminal (86) is connected to electromagnet in relay. It is energized when ignition switch is held in Start position. On vehicles with a manual transmission, the clutch pedal must be blocked in fully depressed position for this test. Check for battery voltage at cavity for relay terminal 86 with ignition switch in Start position, and no voltage when ignition switch is released to On position. If OK, go to Step 5. If not OK with a manual transmission, disconnect clutch pedal position switch wire harness connector and install a jumper wire between two cavities in body half of connector and check for battery voltage again at cavity for relay terminal 86. If now OK, replace faulty clutch pedal position switch. If still not OK with a manual transmission or if not OK with an automatic transmission, check for open or shorted fused ignition switch output (start) circuit to ignition switch and repair, as required. If fused ignition switch output (start) circuit is OK, refer to **Ignition Switch and Key Lock Cylinder**.

(5) The coil ground terminal (85) is connected to electromagnet in relay. On vehicles with a manual transmission, it is grounded at all times. On vehicles with an automatic transmission, it is grounded through park/neutral position switch only when gearshift selector lever is in Park or Neutral positions. Check for continuity to ground at cavity for relay terminal 85. If not OK with a manual transmission, repair open park/neutral position switch sense circuit to ground as required. If not OK with an automatic transmission, check for an open or shorted park/neutral position switch sense circuit to park/neutral position switch and repair, as required. If park/neutral position switch sense circuit checks OK, refer to **Park/Neutral Position Switch**.

REMOVAL

(1) Disconnect and isolate battery negative cable.

(2) Unlatch and open cover on Power Distribution Center (PDC) (Fig. 15).

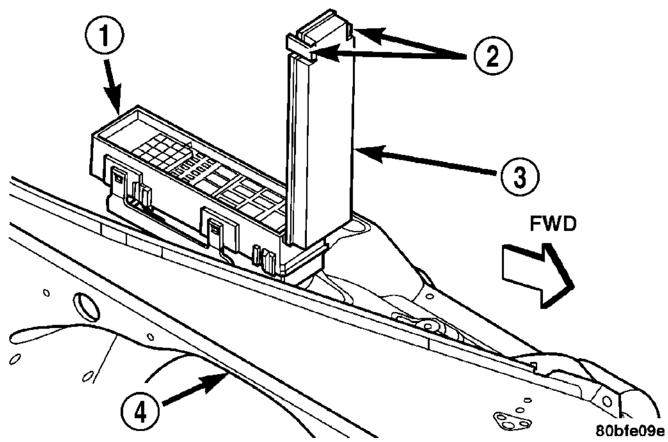


Fig. 15 Power Distribution Center

1 - POWER DISTRIBUTION CENTER (PDC)
2 - LATCHES
3 - COVER
4 - RIGHT FRONT FENDER

(3) See fuse and relay layout label affixed to underside of PDC cover for starter relay identification and location.

(4) Remove starter relay from PDC.

INSTALLATION

(1) See fuse and relay layout label affixed to underside of PDC cover for proper starter relay location.

(2) Position starter relay in proper receptacle in PDC.

(3) Align starter relay terminals with terminal cavities in PDC receptacle.

(4) Push down firmly on starter relay until terminals are fully seated in terminal cavities in PDC receptacle.

(5) Close and latch PDC cover.

(6) Connect negative battery cable.

HEATED SYSTEMS

TABLE OF CONTENTS

HEATED GLASS

TABLE OF CONTENTS

HEATED GLASS

DESCRIPTION

CAUTION: Grid lines can be damaged or scraped off with sharp instruments. Care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

The rear window defogger system, also known as electric backlight (EBL), consists of two vertical bus bars linked by a series of grid lines fired onto the inside surface of the rear window (Fig. 1).

The EBL system is turned On or Off by a control switch mounted into the accessory switch bezel in the instrument panel and the timer and logic circuitry in the instrument cluster assembly (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER SWITCH - DESCRIPTION).

Circuit protection is provided by a 40 amp fuse located in the fuse block for the heated grid circuit, and by a 10 amp fuse located in the fuse block for the control circuit.

OPERATION

The electric backlight (EBL) system is controlled by a momentary switch located in the accessory switch bezel on the instrument panel (Fig. 2). When the defogger switch for the EBL system is pressed to the On position, current is directed to the rear defogger grid lines and the heated power mirrors (if equipped). The heated grid lines heat the glass to help clear the rear window and side mirror surfaces of fog or frost.

An amber indicator lamp in the defogger switch will illuminate to indicate when the EBL system is turned on. The instrument cluster contains the EBL system control circuitry.

NOTE: The EBL system turns off automatically after approximately ten minutes of initial operation. Each following activation cycle of the EBL system will last approximately five minutes.

HEATED GLASS (Continued)

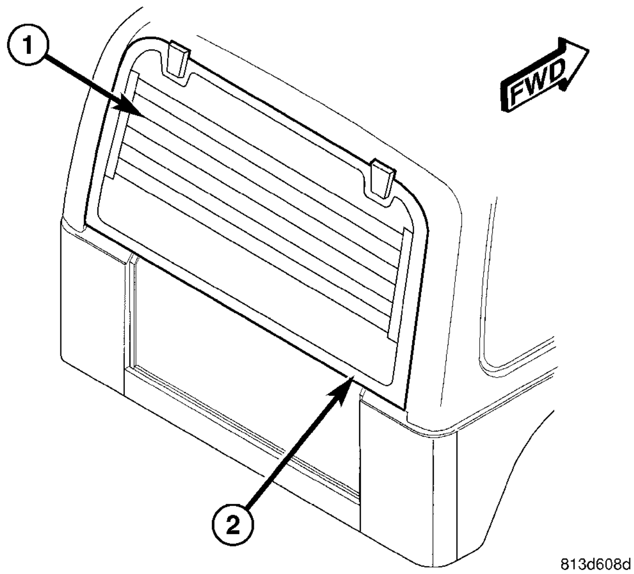


Fig. 1 Rear Window Defogger

1 - REAR DEFOGGER GRID
2 - REAR WINDOW

The EBL system will be automatically turned off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the defogger system will automatically turn off after about five minutes.

The EBL system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by depressing the defogger switch a second time.

The rear window defogger timer and logic circuitry cannot be adjusted or repaired and, if faulty or damaged, the instrument cluster assembly must be replaced.

DIAGNOSIS AND TESTING

REAR WINDOW DEFOGGER SYSTEM

NOTE: Illumination of the defogger switch indicator lamp means that there is electrical current available at the output of the rear window defogger logic circuitry, but does not confirm that the electrical current is reaching the rear glass heating grid lines.

NOTE: For circuit descriptions and diagrams of the rear window defogger system, refer to 8W - WIRING DIAGRAM INFORMATION.

Operation of the electrical backlight (EBL) system can be confirmed by the following:

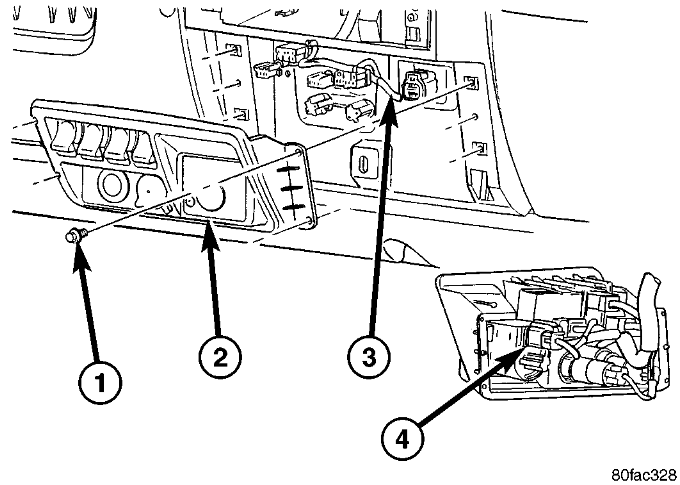


Fig. 2 03 ACCESSORY SWITCH BEZEL

1 - BEZEL SCREWS (4)
2 - BEZEL
3 - WIRE HARNESS
4 - ELECTRICAL CONNECTORS (7)

(1) Use a scan tool and check for diagnostic trouble codes (DTCs) related to the A/C-heater control and the instrument cluster. If no DTCs are found, go to Step 2. If any DTCs are found, repair as required, then proceed to Step 2

(2) Turn the ignition switch to the On position.

(3) Set the defogger switch in the On position. The rear window defogger operation can be checked by feeling the rear window or outside rear view mirror glass. A distinct difference in temperature between the grid lines and the adjacent clear glass or the mirror glass can be detected within three to four minutes of operation. If the indicator light is not illuminated, check the 10 amp indicator fuse and the 40 amp defogger grid power feed fuse located in the fuse block.

(4) If a temperature difference is not detected, use a 12-volt DC voltmeter and contact the rear glass heating grid terminal A with the negative lead, and terminal B with the positive lead (Fig. 3). The voltmeter should read battery voltage. If the voltmeter does not read battery voltage, check the following:

- Confirm that the ignition switch is in the On position.
- Check the 10 amp EBL control circuit fuse located in the fuse block.
- Make sure that the EBL feed wire and ground wire are connected to the terminals. Confirm that the ground wire has continuity to ground.
- Check the EBL relay located in the power distribution center (PDC) in the engine compartment. The relay must be tight in it's receptacle and all electrical connections must be secure (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER RELAY - REMOVAL).

HEATED GLASS (Continued)

(5) When the above steps have been completed and the system is still inoperative, one or more of the following is faulty:

- Rear window defogger switch in the instrument panel.
- Rear window defogger relay control circuity in the instrument cluster.
- Rear window defogger grid lines (all grid lines would have to be broken, or the power feed or ground wire disconnected, for the entire heated grid to be inoperative).

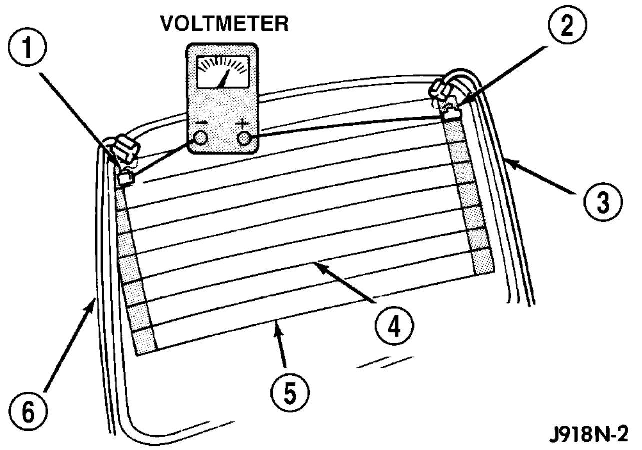


Fig. 3 Rear Window Glass Grid Test

1 - POINT A
2 - POINT B
3 - FEED WIRE
4 - MID-POINT C (TYPICAL)
5 - HEATED REAR WINDOW DEFOGGER GRID
6 - GROUND WIRE

REAR WINDOW DEFOGGER RELAY

DESCRIPTION

The rear window defogger (EBL) relay (Fig. 4) is a International Standards Organization (ISO)-type relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal functions and patterns. The EBL relay is a electromechanical device. When the EBL timer and logic circuitry in the instrument cluster grounds the relay coil, the rear window defogger relay switches battery current through a 40 amp fuse located in the fuse block to the rear window defogger grid and to the light-emitting diode (LED) indicator of the rear window defogger switch and also to the heating elements of the outside mirrors (when equipped).

The rear window defogger (EBL) relay is located in the power distribution center (PDC) in the engine compartment. See the fuse and relay layout map on the inner surface of the cover of the PDC for rear window defogger relay identification and location.

The rear window defogger (EBL) relay cannot be adjusted or repaired and, if damaged or faulty, it must be replaced.

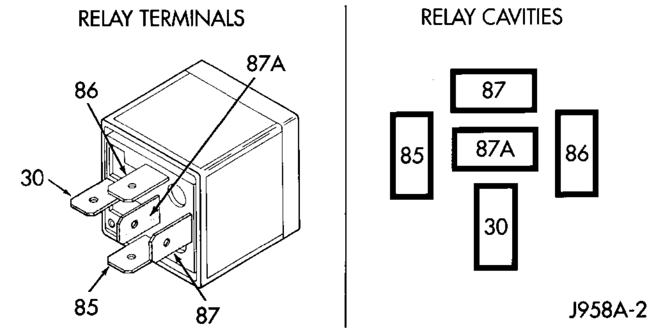


Fig. 4 Rear Window Defogger (EBL) Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

OPERATION

The ISO-standard rear window defogger (EBL) relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

Refer to the appropriate wiring information for diagnosis and testing of the EBL relay and for complete EBL system wiring diagrams.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Open the cover of the power distribution center (PDC) located in the engine compartment (Fig. 5).

NOTE: Refer to the fuse and relay map on the inner surface of the PDC cover for EBL relay identification and location.

REAR WINDOW DEFOGGER RELAY (Continued)

(3) Remove the EBL relay from the PDC.

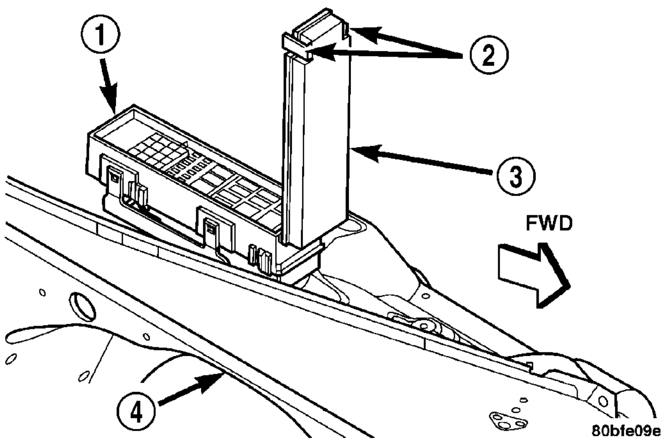


Fig. 5 Power Distribution Center (PDC)

1 - POWER DISTRIBUTION CENTER (PDC)
2 - LATCHES
3 - COVER
4 - RIGHT FRONT FENDER

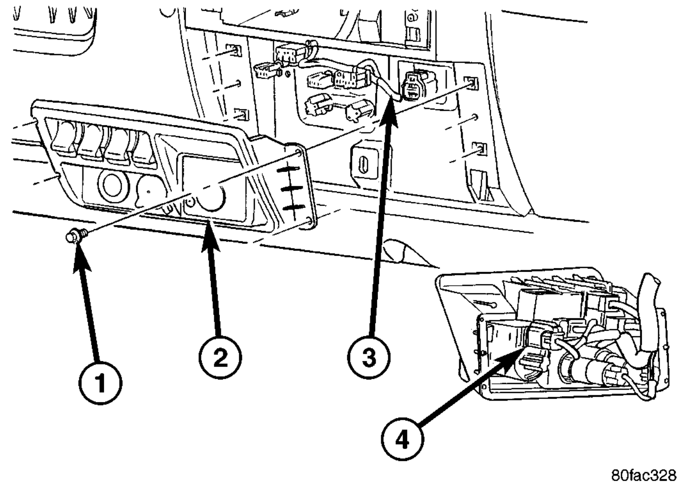


Fig. 6 03 ACCESSORY SWITCH BEZEL

1 - BEZEL SCREWS (4)
2 - BEZEL
3 - WIRE HARNESS
4 - ELECTRICAL CONNECTORS (7)

INSTALLATION

NOTE: Refer to the fuse and relay map on the inner surface of the power distribution center (PDC) cover for EBL relay identification and location.

(1) Position the EBL relay to the proper receptacle of the PDC.
(2) Align the EBL relay terminals with the terminal cavities in the PDC and push down firmly on the relay until the terminals are fully seated.
(3) Close the cover of the PDC.
(4) Reconnect the negative battery cable.

REAR WINDOW DEFOGGER SWITCH

DESCRIPTION

The switch for the EBL system is located in the instrument panel accessory switch bezel, which is mounted near the bottom of the instrument panel center bezel (Fig. 6).

When the rear window defogger switch is turned to the ON position, current is directed to the rear defogger grid lines and the heated power mirrors (if equipped). The heated grid lines heat the glass to help clear the surface of fog or frost.

OPERATION

Depressing the rear window defogger switch sends a request signal to the instrument cluster rear window defogger timer and logic circuitry which responds by energizing or de-energizing the EBL relay. The EBL relay controls the current to flow to the grids of the rear window defogger and the heated power side view mirrors, when equipped.

NOTE: After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the EBL system will automatically turn off after about five minutes.

The EBL relay will be on for approximately 10 minutes or until the control switch or ignition is turned off. An LED indicator will illuminate when the EBL system is on.

The EBL system will be on for approximately ten minutes or until the control switch or the ignition switch is turned off.

The rear window defogger switch and indicator lamp cannot be repaired and, if faulty or damaged, the defogger switch must be replaced.

DIAGNOSIS AND TESTING

REAR WINDOW DEFOGGER SWITCH

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

REAR WINDOW DEFOGGER SWITCH (Continued)

NOTE: For circuit descriptions and diagrams, refer to Rear Window Defogger in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the negative battery cable. Remove the accessory switch bezel from the instrument panel and disconnect the wire harness connector from the defogger switch.

(2) Check for continuity between the ground circuit cavity of the defogger switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit as required.

(3) Check for continuity between the ground circuit terminal and the rear window defogger switch sense circuit terminal on the back of the defogger switch housing (Fig. 7). There should be momentary continuity as the defogger switch is pressed, and then no continuity. If OK, test the instrument cluster (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If not OK, replace the faulty rear window defogger switch (Refer to 8 - ELECTRICAL/HEATED GLASS/REAR WINDOW DEFOGGER SWITCH - REMOVAL).

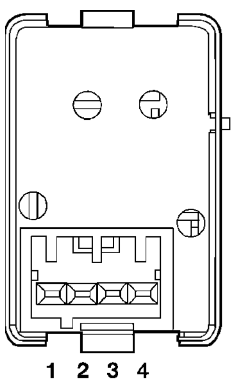


Fig. 7 Rear Window Defogger Switch Continuity

SWITCH POSITION	CONTINUITY BETWEEN
OFF	LAMPS
ON	MOMENTARY 1 AND 2
ILLUMINATION LAMP	1 AND 4
INDICATOR LAMP	1 AND 3

REMOVAL

WARNING: On vehicles equipped with airbags, disable the airbag system before attempting any steering wheel, steering column, or instrument panel component diagnosis or service. Disconnect and isolate the battery negative (ground) cable, then wait two minutes for the airbag system capacitor to discharge before performing further diagnosis or service. Failure to take the proper precautions could result in accidental airbag deployment and possible personal injury or death.

(1) Disconnect and isolate the negative battery cable.

(2) Remove the center bezel from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the four screws that secure the accessory switch bezel to the instrument panel (Fig. 8).

(4) Pull the accessory switch bezel out from the instrument panel far enough to access the wire harness connectors.

(5) Disconnect the wire harness connectors from the rear of the accessory switches and the cigar lighter/power outlet.

(6) Remove the accessory switch bezel from the instrument panel.

(7) Using a small thin-bladed screwdriver, gently pry the snap clips at the top and at the bottom of the rear window defogger switch receptacle on the back of the accessory switch bezel and pull the switch out of the bezel.

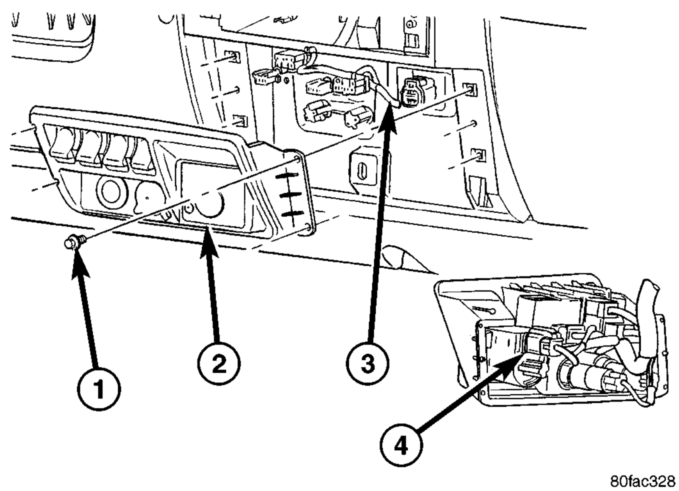


Fig. 8 Accessory Switch Bezel

1 - BEZEL SCREWS (4)
2 - BEZEL
3 - WIRE HARNESS
4 - ELECTRICAL CONNECTORS (7)

INSTALLATION

(1) Install the rear window defogger switch into the back of the accessory switch bezel by pushing the switch firmly into the bezel.

(2) Connect the wire harness connectors to the rear of the accessory switches and the cigar lighter/power outlet.

REAR WINDOW DEFOGGER SWITCH (Continued)

(3) Install the accessory switch bezel to the instrument panel.

(4) Install the four screws that secure the accessory switch bezel to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the center bezel to the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(6) Reconnect the negative battery cable.

REAR WINDOW DEFOGGER GRID

STANDARD PROCEDURE

GRID LINE AND TERMINAL REPAIR PROCEDURE

WARNING: Materials contained in the Repair Kit (Part Number 04549275) may cause skin or eye irritation. The kit contains epoxy resin and amine type hardener, which are harmful if swallowed. Avoid contact with the skin and eyes. For skin contact, wash the affected areas with soap and water. For contact with the eyes, flush with plenty of water. Do not take internally. If taken internally, induce vomiting and call a physician immediately. Use with adequate ventilation. Do not use near fire or flame. Contains flammable solvents. Keep out of the reach of children. Failure to follow the warnings could result in possible personal injury or death.

Repair of the rear glass heating grid lines, bus bars or terminals can be accomplished using the Mopar® Rear Window Defogger Repair Kit (Part Number 04549275) or equivalent.

(1) Mask the repair area with masking tape so that the conductive epoxy can be applied neatly (Fig. 9). Extend the epoxy application onto the grid line or the bus bar on each side of the break.

(2) Follow the instructions in the repair kit for preparing the damaged area.

(3) Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.

(4) For grid line repairs, mask the area to be repaired with masking tape or use a template.

(5) Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).

(6) For a terminal replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as the bus bar. Apply a thin layer of epoxy to the area where the terminal was fastened and onto the adjacent grid line.

(7) Apply a thin layer of conductive epoxy to the terminal and place it in the proper location on the bus bar. To prevent the terminal from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove the masking tape or template.

CAUTION: Do not allow the glass surface to exceed 204° C (400° F) when using a heat gun, or the glass may fracture.

(9) Allow the epoxy to cure 24 hours at room temperature, or carefully use a heat gun for fifteen minutes. When using a heat gun, hold it approximately 25.4 centimeters (10 inches) from the repair and do not allow the glass surface to exceed 204° C (400° F).

NOTE: Do not attach the wire harness connectors to the terminals until the curing process is complete.

(10) After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal.

(11) Connect the wire harness leads to the grid terminals and verify EBL operation.

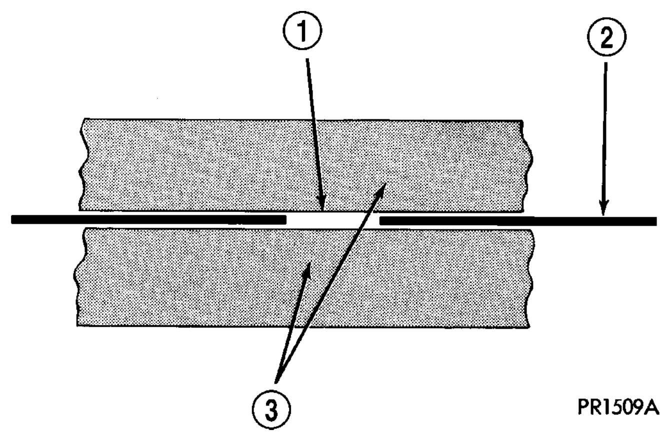


Fig. 9 Grid Line Repair

1 - BREAK
2 - GRID LINE
3 - MASKING TAPE

HEATED MIRRORS

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HEATED MIRRORS

DESCRIPTION

The optional heated mirror system is controlled by the momentary rear window defogger switch in the accessory switch bezel (Fig. 1). An amber indicator lamp in the switch will illuminate to indicate when the rear window defogger (EBL) system is turned on.

The heated mirror system only operates in concert with the EBL system, and will be automatically shut off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is pressed again during the same ignition cycle, the heated mirror system will automatically shut off after about five minutes.

The heated mirror system will automatically shut off if the ignition switch is turned to the Off position, or it can be shut off manually by pressing the rear window defogger switch a second time.

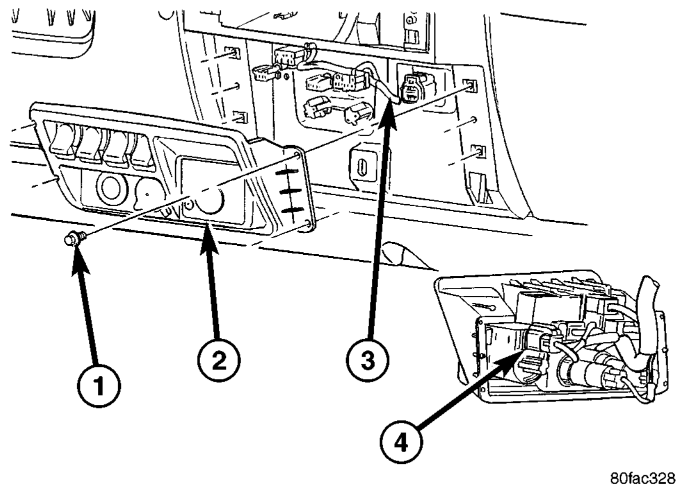

Fig. 1 03 ACCESSORY SWITCH BEZEL

1 - BEZEL SCREWS (4)
2 - BEZEL
3 - WIRE HARNESS
4 - ELECTRICAL CONNECTORS (7)

OPERATION

When the rear window defogger switch is pressed, the rear window defogger (EBL) system becomes activated and an electric heater grid located behind the glass of each of the outside rear view mirrors is energized. When energized, each of these heater grids produce heat to help clear the outside rear view mirrors of ice, snow, or fog.

If the outside mirror heating grids are both inoperative, refer to DIAGNOSIS AND TESTING - REAR WINDOW DEFOGGER SYSTEM in his group. If only one of the outside mirror heating grids is inoperative, refer to 8 - ELECTRICAL/POWER MIRRORS - DIAGNOSIS AND TESTING.

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the entire power mirror assembly must be replaced.

HORN

TABLE OF CONTENTS

HORN SYSTEM

DESCRIPTION

The horn system features one low-note horn unit. The horn system uses a non-switched source of battery current so that the system will remain functional, regardless of the ignition switch position. The horn system includes the following components:

- Clockspring
- Horn
- Horn relay
- Horn switch

OPERATION

The horn system is activated by a horn switch concealed beneath the driver side airbag module trim cover in the center of the steering wheel. Depressing the center of the driver side airbag module trim cover closes the horn switch. Closing the horn switch activates the horn relay. The activated horn relay then switches the battery current needed to energize the horns.

HORN

DESCRIPTION

The horn is secured with a bracket to the left front inner fender shield just ahead of the left front wheel house in the engine compartment.

The horn cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

Within the two halves of the molded plastic horn housing are a flexible diaphragm, a plunger, an electromagnetic coil and a set of contact points. The diaphragm is secured in suspension around its perimeter by the mating surfaces of the horn housing. The plunger is secured to the center of the diaphragm and extends into the center of the electromagnet. The contact points control the current flow through the electromagnet.

When the horn is energized, electrical current flows through the closed contact points to the electromagnet. The resulting electromagnetic field draws the plunger and diaphragm toward it until that movement mechanically opens the contact points. When the contact points open, the electromagnetic field collapses allowing the plunger and diaphragm to return to their relaxed positions and closing the contact points again. This cycle continues repeating at a very rapid rate producing the vibration and movement of air that creates the sound that is directed through the horn outlet.

DIAGNOSIS AND TESTING - HORN

For complete circuit diagrams, refer to the appropriate wiring information.

(1) Disconnect the wire harness connectors from the horn connector receptacles. Measure the resistance between the ground circuit cavity of the horns wire harness connectors and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open ground circuit to ground as required.

(2) Check for battery voltage at the horn relay output circuit cavity of the horns wire harness connectors. There should be zero volts. If OK, go to Step 3. If not OK, repair the shorted horn relay output circuit or replace the faulty horn relay as required.

(3) Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the horns wire harness connectors. If OK, replace the faulty horns. If not OK, repair the open horn relay output circuit to the horn relay as required.

HORN (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the horn (Fig. 1).

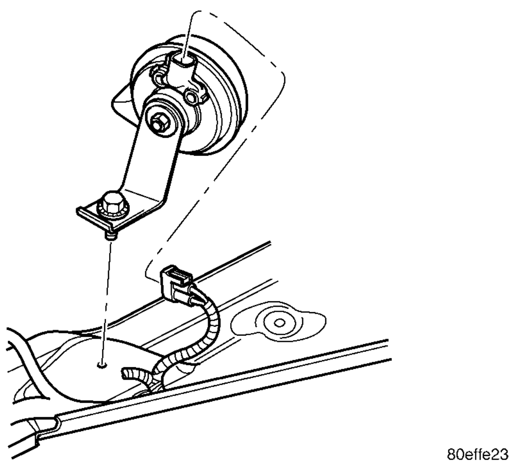

Fig. 1 HORN

(3) Remove the screw that secures the horn and mounting bracket to the left front inner fender shield.

(4) Remove the horn and mounting bracket from the left front inner fender shield.

INSTALLATION

(1) Position the horn and mounting bracket onto the left front inner fender shield.

(2) Install the mounting screw. Tighten the screw to 8.5 N·m (75 in. lbs.).

(3) Reconnect the wire harness connector.

(4) Connect the battery negative cable.

HORN SWITCH

DESCRIPTION

A center-blow, normally open, resistive membrane-type horn switch is secured in a plastic tray that is inserted in a pocket sewn on the front of the driver side airbag retainer strap. The horn switch is concealed behind the driver side airbag module trim cover.

The steering wheel and steering column must be properly grounded in order for the horn switch to function properly. The horn switch and plastic tray are serviced as a unit. If the horn switch is damaged or faulty, or if the driver side airbag is deployed, the horn switch and tray must be replaced as a unit.

OPERATION

When the center area of the driver side airbag trim cover is depressed, the electrically conductive grids on the facing surfaces of the horn switch membranes contact each other, closing the switch circuit. The completed horn switch circuit provides a ground for the control coil side of the horn relay, which activates the relay. When the horn switch is released, the resistive tension of the convex membrane separates the two electrically conductive grids and opens the switch circuit.

DIAGNOSIS AND TESTING - HORN SWITCH

For complete circuit diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the steering column opening cover from the instrument panel.

(2) Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to Step 3. If not OK, refer to Steering, Column for proper installation of the steering column.

(3) Remove the driver side airbag module from the steering wheel. Disconnect the horn switch wire harness connectors from the driver side airbag module.

(4) Remove the horn relay from the Power Distribution Center (PDC). Check for continuity between the steering column half of the horn switch feed wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted horn relay control circuit to the horn relay in the PDC as required.

(5) Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the PDC. There should be continuity. If OK, go to Step 6. If not OK, repair the open relay control circuit to the horn relay in the PDC as required.

(6) Check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should be no continuity. If OK, go to Step 7. If not OK, replace the faulty horn switch.

HORN SWITCH (Continued)

(7) Depress the center of the driver side airbag module trim cover and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch.

REMOVAL

WARNING:

• ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim cover from the driver side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(3) Remove the horn switch and tray as a unit from the pouch on the retaining strap of the driver side airbag module (Fig. 2).

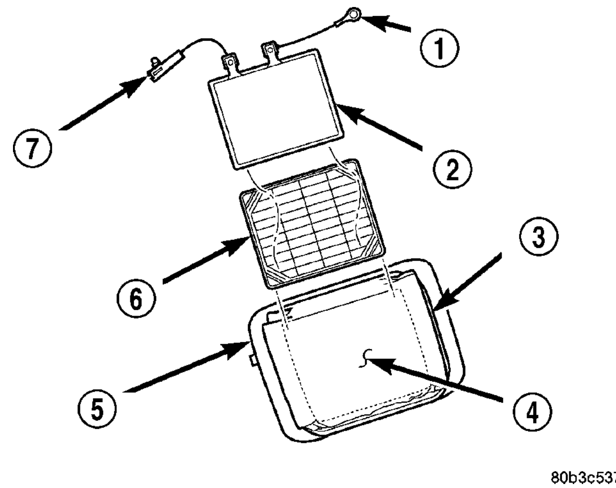

Fig. 2 HORN SWITCH

1 - HORN SWITCH GROUND WIRE EYELET
2 - HORN SWITCH
3 - AIRBAG RETAINING STRAP
4 - POUCH
5 - DRIVER SIDE AIRBAG MODULE (TRIM COVER REMOVED)
6 - TRAY
7 - HORN SWITCH FEED WIRE CONNECTOR

INSTALLATION

WARNING:

• ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL, RESTRAINTS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Install the horn switch and tray as a unit into the pouch on the retaining strap of the driver side airbag module. Be certain that the tray is facing the airbag module, that the horn switch is facing the trim cover, that the horn switch feed wire is on the left, and that the horn switch ground wire is on the right.

(2) Install the trim cover onto the driver side airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION) for the procedure.

(3) Reconnect the battery negative cable.

IGNITION CONTROL

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IGNITION CONTROL

DESCRIPTION

The ignition systems used on both the 2.4L 4–cylinder and 4.0L 6–cylinder engines are a distributorless type.

The ignition system consists of:

- Spark Plugs
- Spark Plug Cables (secondary wires)
- Ignition Coil(s)
- Powertrain Control Module (PCM)
- Crankshaft Position Sensor
- Camshaft Position Sensor
- The MAP, TPS, IAC and ECT also have an effect on the control of the ignition system.

OPERATION

2.4L

A common ignition coil divided into 2 halves is used. Secondary, high-tension spark plug cables are also used. One half of the coil fires two spark plugs simultaneously (one plug is the cylinder under compression, and the other plug is the cylinder on the exhaust stroke). Coil half number one fires cylinders 1 and 4. Coil half number two fires cylinders 2 and 3. The PCM determines which of the coils to charge and fire at the correct time.

The Auto Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil. When the PCM breaks the contact, the energy in the coil

IGNITION CONTROL (Continued)

primary transfers to the secondary causing a spark. The PCM will de-energize the ASD relay if it does not receive inputs from either the crankshaft or camshaft position sensors.

A distributor is not used with the 2.4L engine.

4.0L

The 4.0L 6-cylinder engine uses a one-piece coil rail containing three independent coils. Although cylinder firing order is the same as 4.0L engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1-6, 2-5 and/or 3-4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke). The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. One electrical connector (located at the rear end of the coil rail) is used for all three coils.

Because of coil design, spark plug cables (secondary cables) are not used. A **distributor is not used** with the 4.0L engine.

The ignition system is controlled by the Powertrain Control Module (PCM).

SPECIFICATIONS

SPECIFICATIONS - IGNITION TIMING

Ignition timing is not adjustable on any engine.

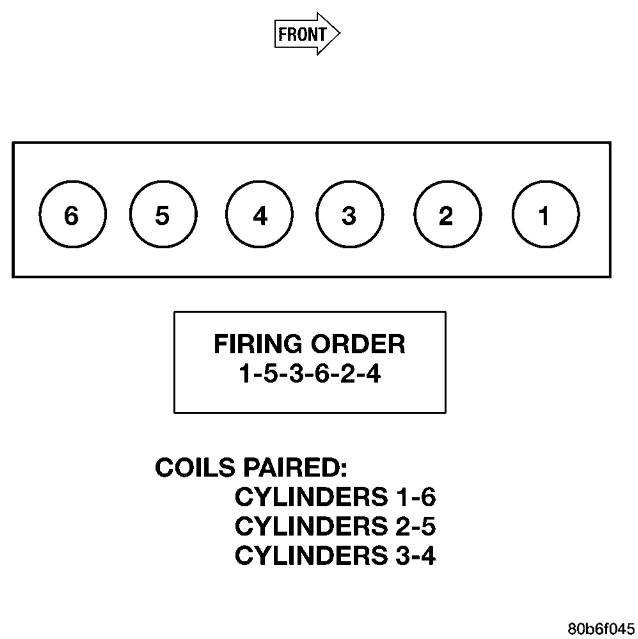
IGNITION COIL RESISTANCE - 2.4L

Engine	Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
2.4L	Toyodenso or Diamond	0.51 to 0.61 Ohms	11,500 to 13,500 Ohms

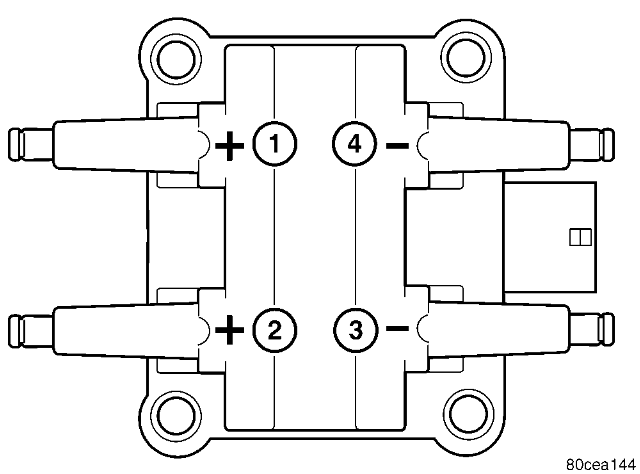
ENGINE FIRING ORDER - 2.4L 4-CYLINDER

1 - 3 - 4 - 2

ENGINE FIRING ORDER - 4.0L 6-CYLINDER ENGINE



FIRING ORDER - 4.0L



IGNITION COIL - 2.4L

IGNITION CONTROL (Continued)

IGNITION COIL RESISTANCE - 4.0L ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)
0.71 - 0.88 Ohms

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
2.4L 4-Cylinder	RE14MCC5 (Champion #)	1.24 to 1.37 mm (0.048 to 0.053 in.)
4.0L 6-Cylinder	ZFR5N (NGK #)	1.00 mm (0.040 in.)

SPECIFICATIONS - SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

SPECIFICATIONS - TORQUE - IGNITION SYSTEM

DESCRIPTION	**N·m**	**Ft. Lbs.**	**In. Lbs.**
Camshaft Position Sensor Mounting Bolts – 4.0L	2	-	15
Camshaft Position Sensor – 2.4L	12	-	106
Ignition Coil Rail Mounting Bolts – 4.0L	29	-	250
Ignition Coil Mounting Bolts – 2.4L	11	-	105
Oil Pump Drive Hold-down Bolt – 4.0L	23	17	-
** Spark Plugs - 2.4L 4-Cylinder	15	11	-
Spark Plugs - 4.0L 6-cylinder	30	22	-
** Torque critical tapered design. Do not exceed 15 ft. lbs. torque.			

AUTO SHUT DOWN RELAY

DESCRIPTION - PCM OUTPUT

The 5–pin, 12–volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

OPERATION - ASD SENSE - PCM INPUT

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the Powertrain Control Module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a Diagnostic Trouble Code (DTC).

OPERATION - PCM OUTPUT

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12–volts to the oxygen sensor heating elements.

The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

The ASD relay will be shut–down, meaning the 12–volt power supply to the ASD relay will be de-activated by the PCM if:

- the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.
- there is a crankshaft position sensor signal to the PCM that is lower than pre-determined values.

DIAGNOSIS AND TESTING - ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the Automatic Shutdown (ASD) and fuel pump relays. The terminals on the bottom of each relay are numbered. Two different types of relays may be used, (Fig. 1) or (Fig. 2).

- Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.
- The PCM grounds the coil side of the relay through terminal number 85.
- Terminal number 86 supplies voltage to the coil side of the relay.
- When the PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.
- When the PCM energizes the ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

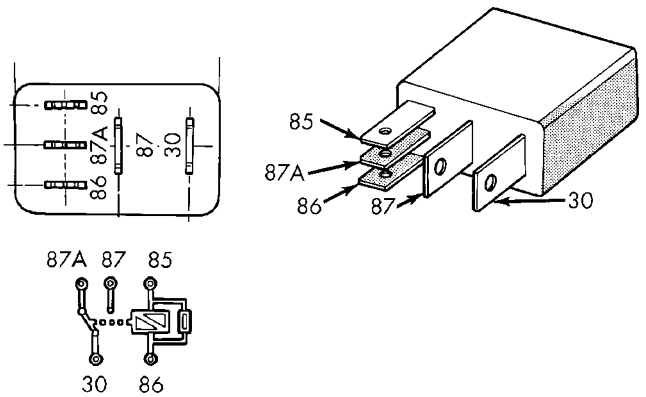


Fig. 1 ASD and Fuel Pump Relay Terminals—Type 1

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

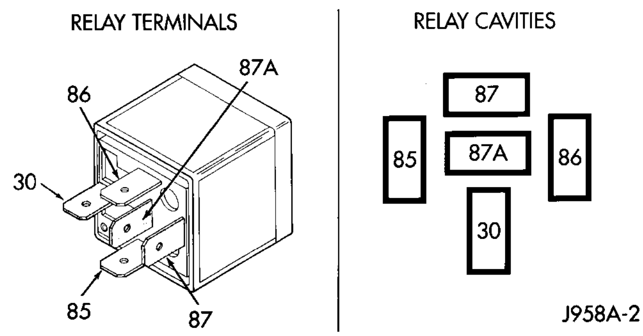


Fig. 2 ASD and Fuel Pump Relay Terminals—Type 2

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

The following procedure applies to the ASD and fuel pump relays.

(1) Remove relay from connector before testing.

(2) With the relay removed from the vehicle, use an ohmmeter to check the resistance between terminals 85 and 86. The resistance should be 75 ohms +/- 5 ohms.

(3) Connect the ohmmeter between terminals 30 and 87A. The ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect the ohmmeter between terminals 87 and 30. The ohmmeter should not show continuity at this time.

AUTO SHUT DOWN RELAY (Continued)

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST. DAMAGE TO OHMMETER MAY RESULT.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and fuel pump relay circuits. Refer to 8, Wiring Diagrams.

REMOVAL

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 3). Refer to label on PDC cover for relay location.

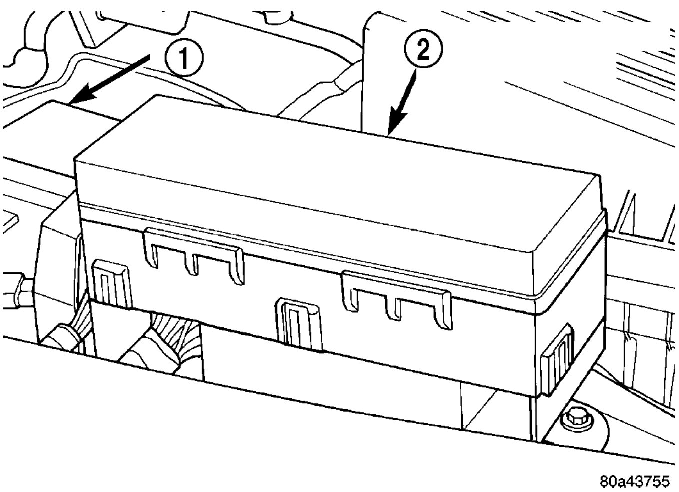


Fig. 3 Power Distribution Center (PDC)

1 - BATTERY
2 - POWER DISTRIBUTION CENTER (PDC)

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 3). Refer to label on PDC cover for relay location.

(1) Install relay to PDC.

(2) Install cover to PDC.

CAMSHAFT POSITION SENSOR - 2.4L

DESCRIPTION - 2.4L

The Camshaft Position Sensor (CMP) on the 2.4L 4–cylinder engine is bolted to the right-front side of the cylinder head (Fig. 4).

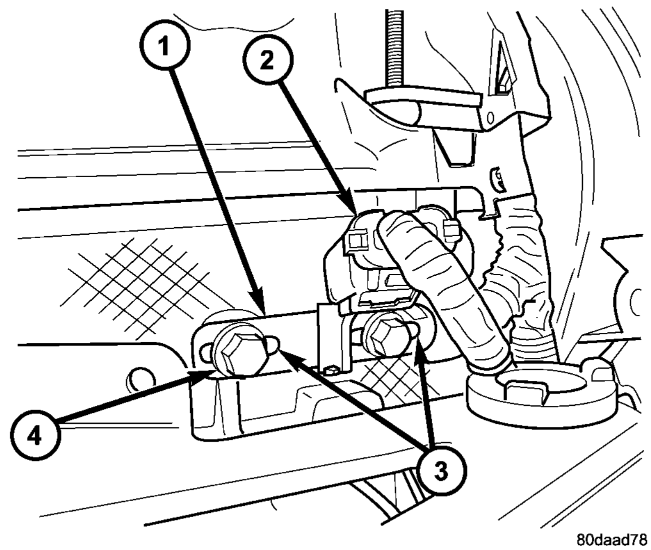


Fig. 4 CMP LOCATION - 2.4L

1 - CMP SENSOR
2 - ELECTRICAL CONNECTOR
3 - SLOTTED HOLES
4 - MOUNTING BOLTS (2)

OPERATION - 2.4L

The Camshaft Position Sensor (CMP) sensor contains a hall effect device referred to as a sync signal generator. A rotating target wheel (tonewheel) for the CMP is located behind the exhaust valve-camshaft drive gear (Fig. 5). The target wheel is equipped with a cutout (notch) around 180 degrees of the wheel. The CMP detects this cutout every 180 degrees of camshaft gear rotation. Its signal is used in conjunction with the Crankshaft Position Sensor (CKP) to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the target wheel cutout enters the tip of the CMP, the interruption of mag-

CAMSHAFT POSITION SENSOR - 2.4L (Continued)

netic field causes the voltage to switch high, resulting in a sync signal of approximately 5 volts.

When the trailing edge of the target wheel cutout leaves the tip of the CMP, the change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

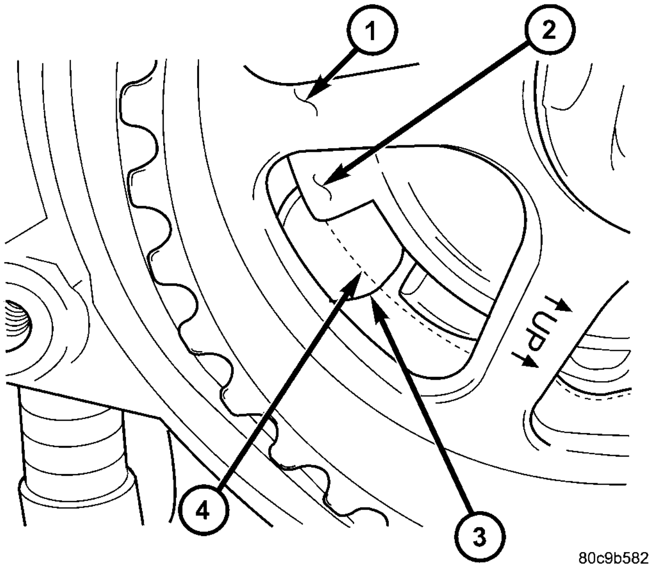


Fig. 5 CMP FACE AT TARGET WHEEL-2.4L

1 - CAMSHAFT DRIVE GEAR
2 - TARGETWHEEL (TONEWHEEL)
3 - FACE OF CMP SENSOR
4 - CUTOUT (NOTCH)

REMOVAL - 2.4L

The Camshaft Position Sensor (CMP) on the 2.4L 4–cylinder engine is bolted to the right-front side of the cylinder head (Fig. 6). Sensor position (depth) is adjustable.

(1) Disconnect electrical connector at CMP sensor.

(2) Remove 2 sensor mounting bolts.

(3) Remove sensor from cylinder head by sliding towards rear of engine.

INSTALLATION - 2.4L

The Camshaft Position Sensor (CMP) on the 2.4L 4–cylinder engine is bolted to the right-front side of the cylinder head. **Sensor position (depth) is adjustable.**

(1) Remove plastic, upper timing belt cover (timing gear cover) (Fig. 7) by removing 3 bolts. Before attempting to remove cover, remove electrical connector from Engine Coolant Temperature (ECT) sensor (Fig. 7). This will prevent damage to sensor.

(2) Rotate (bump over) engine until camshaft timing gear and target wheel (tonewheel) are positioned and aligned to face of sensor as shown in (Fig. 8). **If not positioned as shown in (Fig. 8), damage to both sensor and target wheel will occur when attempting to start engine. Face of sensor MUST be behind target wheel while adjusting.**

(3) Position sensor to cylinder head and install 2 sensor mounting bolts finger tight.

(4) **SENSOR AIR GAP: .030”** Set air gap between rear of target wheel and face of sensor to .030”. This can best be accomplished using an L-shaped, wire-type spark plug gapping gauge (Fig. 9). A piece of .030” brass shim stock may also be used.

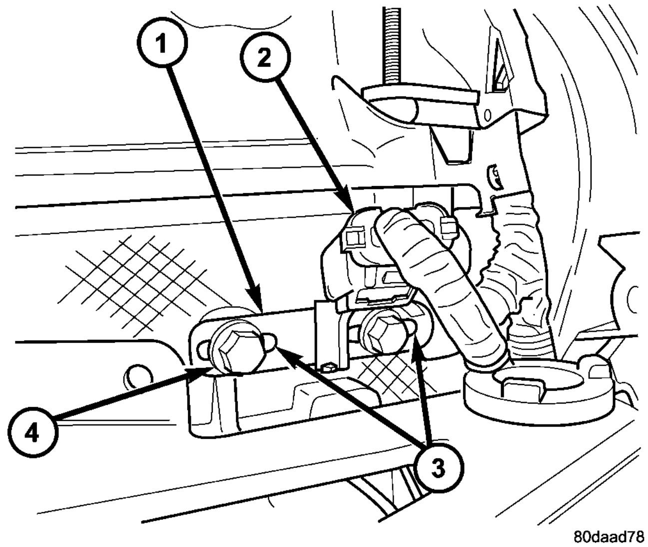


Fig. 6 CMP LOCATION - 2.4L

1 - CMP SENSOR
2 - ELECTRICAL CONNECTOR
3 - SLOTTED HOLES
4 - MOUNTING BOLTS (2)

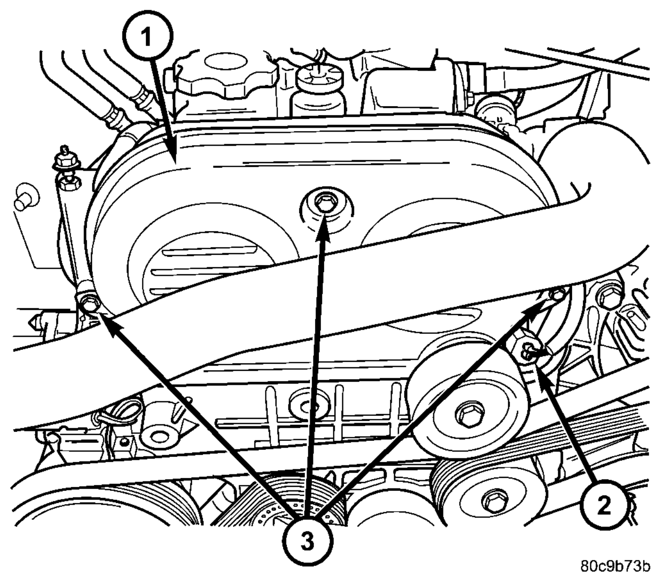


Fig. 7 UPPER TIMING BELT COVER/BOLTS-2.4L

1 - UPPER TIMING BELT COVER
2 - ELECTRICAL CONNECTOR (ECT)
3 - MOUNTING BOLTS (3)

CAMSHAFT POSITION SENSOR - 2.4L (Continued)

(5) Gently push sensor forward until it contacts gapping gauge. **Do not push hard on sensor.** Tighten 2 sensor mounting bolts. Refer to torque specifications.

CAUTION: After tightening sensor mounting bolts, recheck air gap and adjust as necessary. Retorque bolts.

(6) Install upper timing belt cover and 3 bolts.
(7) Connect electrical connector to ECT sensor.
(8) Connect electrical connector to CMP sensor.

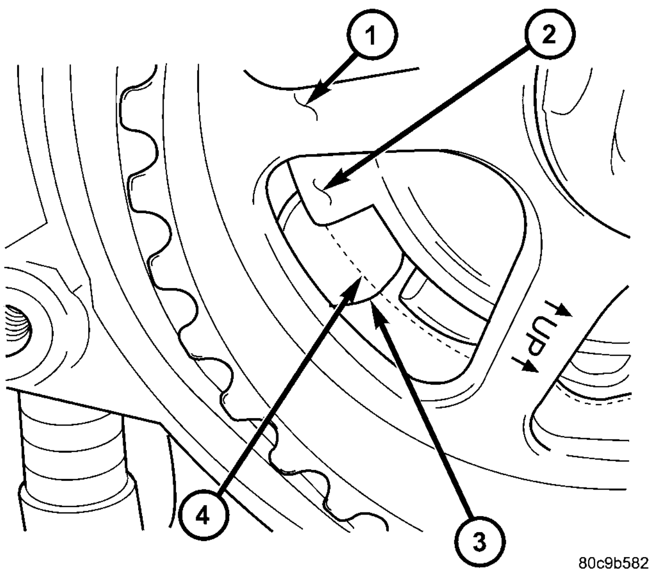


Fig. 8 CMP FACE AT TARGET WHEEL-2.4L

1 - CAMSHAFT DRIVE GEAR
2 - TARGETWHEEL (TONEWHEEL)
3 - FACE OF CMP SENSOR
4 - CUTOUT (NOTCH)

CAMSHAFT POSITION SENSOR - 4.0L

DESCRIPTION - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 10). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 11).

OPERATION - 4.0L

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects a rotating pulse ring (shutter) on the oil pump drive shaft (Fig. 10). The pulse ring rotates 180 degrees through the sync signal generator. Its signal is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also

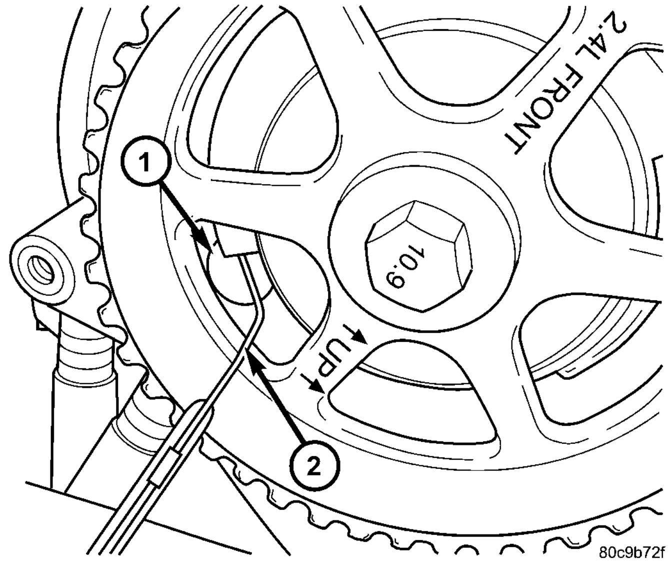


Fig. 9 CMP ADJUSTMENT - 2.4L

1 - FACE OF SENSOR
2 - WIRE GAPPING TOOL

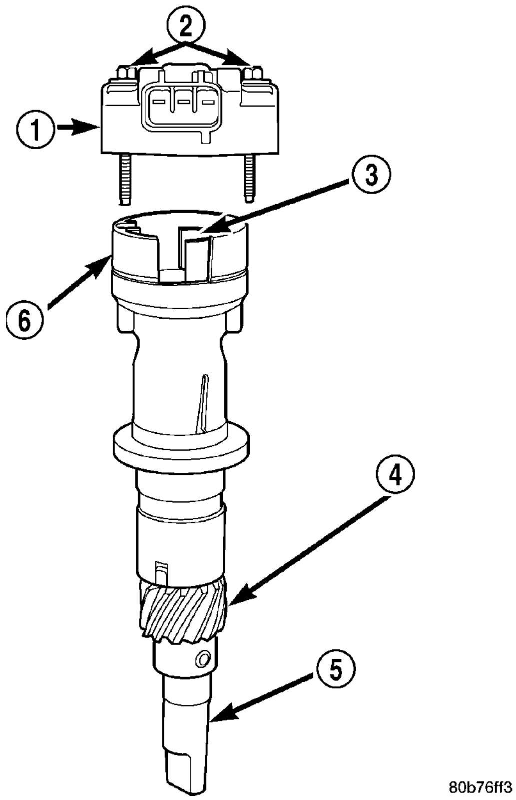


Fig. 10 CMP and Oil Pump Drive Shaft—4.0L Engine

1 - CAMSHAFT POSITION SENSOR
2 - MOUNTING BOLTS (2)
3 - PULSE RING
4 - DRIVE GEAR (TO CAMSHAFT)
5 - OIL PUMP DRIVESHAFT
6 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

CAMSHAFT POSITION SENSOR - 4.0L (Continued)

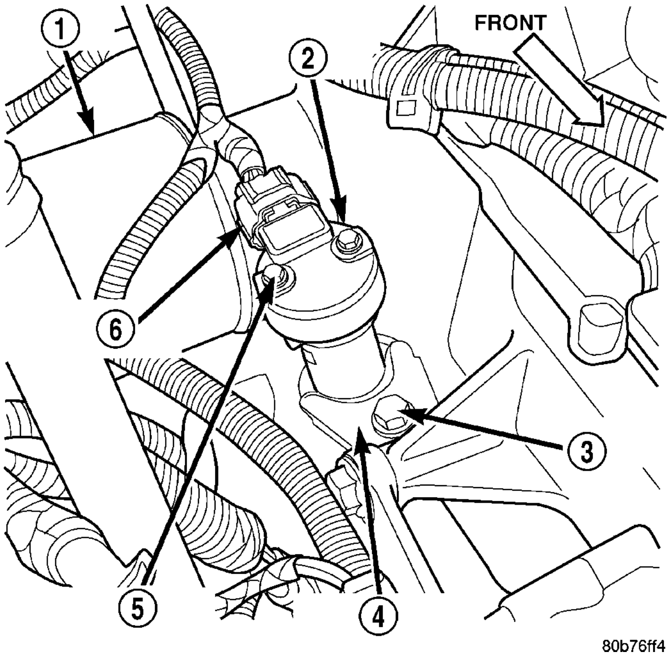


Fig. 11 CMP Location—4.0L Engine

1 - OIL FILTER
2 - CAMSHAFT POSITION SENSOR
3 - CLAMP BOLT
4 - HOLD-DOWN CLAMP
5 - MOUNTING BOLTS (2)
6 - ELEC. CONNECTOR

used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the pulse ring (shutter) enters the sync signal generator, the following occurs: The interruption of magnetic field causes the voltage to switch high resulting in a sync signal of approximately 5 volts.

When the trailing edge of the pulse ring (shutter) leaves the sync signal generator, the following occurs: The change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

REMOVAL - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 12). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 13).

The rotational position of oil pump drive determines fuel synchronization only. It does not determine ignition timing.

NOTE: Do not attempt to rotate the oil pump drive to modify ignition timing.

Two different procedures are used for removal and installation. The first procedure will detail removal and installation of the sensor only. The second procedure will detail removal and installation of the sensor and oil pump drive shaft assembly. The second procedure is to be used if the engine has been disassembled.

An internal oil seal is used in the drive shaft housing that prevents engine oil at the bottom of the sensor. The seal is not serviceable.

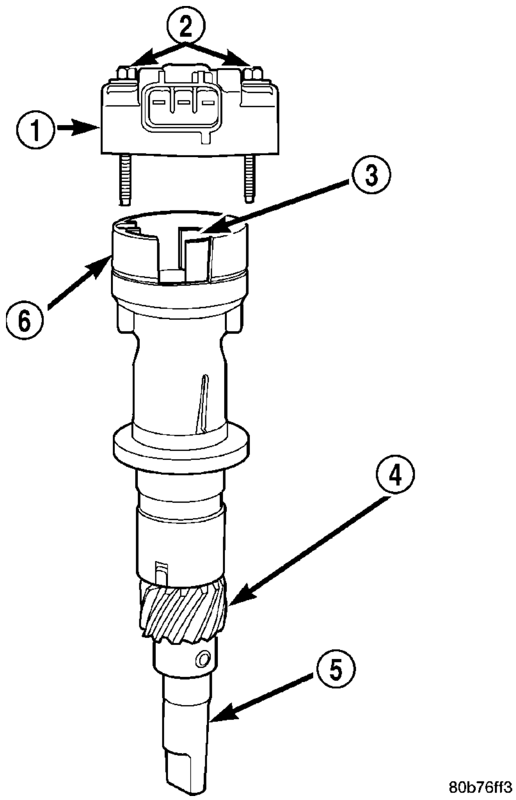


Fig. 12 CMP and Oil Pump Drive Shaft - 4.0L Engine

1 - CAMSHAFT POSITION SENSOR
2 - MOUNTING BOLTS (2)
3 - PULSE RING
4 - DRIVE GEAR (TO CAMSHAFT)
5 - OIL PUMP DRIVESHAFT
6 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

SENSOR ONLY - 4.0L

(1) Disconnect electrical connector at CMP sensor (Fig. 13).

(2) Remove 2 sensor mounting bolts (Fig. 12) or (Fig. 13).

(3) Remove sensor from oil pump drive.

OIL PUMP DRIVE AND SENSOR - 4.0L

If the CMP and oil pump drive are to be removed and installed, do not allow engine crankshaft or camshaft to rotate. CMP sensor relationship will be lost.

(1) Disconnect electrical connector at CMP sensor (Fig. 13).

(2) Remove 2 sensor mounting bolts (Fig. 12) or (Fig. 13).

(3) Remove sensor from oil pump drive.

CAMSHAFT POSITION SENSOR - 4.0L (Continued)

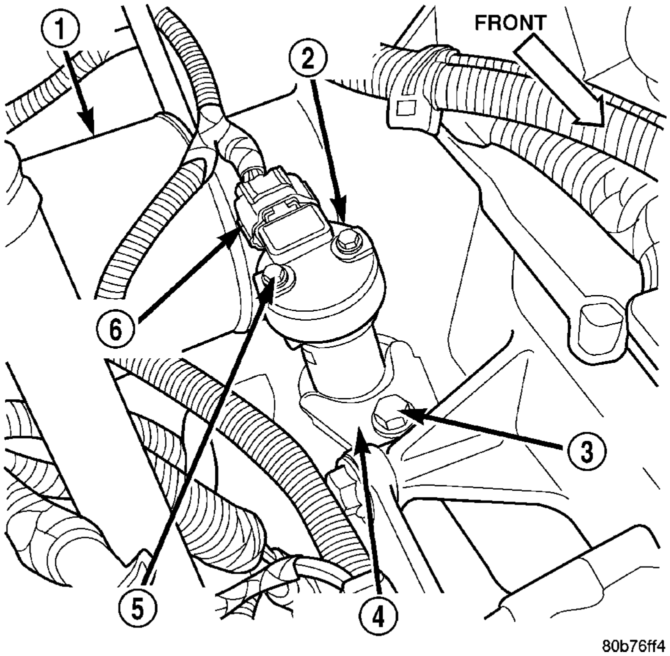


Fig. 13 CMP Location - 4.0L Engine

1 - OIL FILTER
2 - CAMSHAFT POSITION SENSOR
3 - CLAMP BOLT
4 - HOLD-DOWN CLAMP
5 - MOUNTING BOLTS (2)
6 - ELEC. CONNECTOR

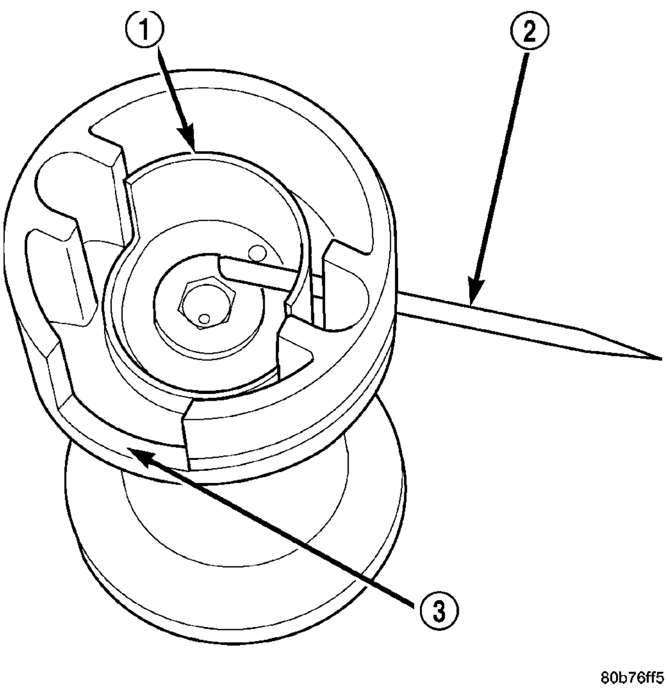


Fig. 14 CMP Pulse Ring Alignment - 4.0L Engine

1 - PULSE RING (SHUTTER)
2 - TOOTHPICK
3 - SENSOR BASE (OIL PUMP DRIVESHAFT ASSEMBLY)

(4) Before proceeding to next step, mark and note rotational position of oil pump drive in relationship

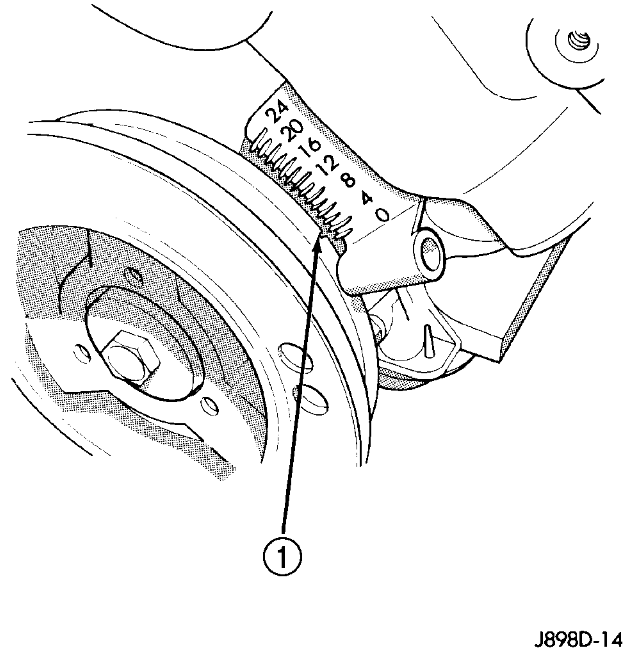


Fig. 15 Align Timing Marks - 4.0L Engine

1 - CRANKSHAFT VIBRATION DAMPER TIMING MARK

to engine block. After installation, the CMP sensor should face rear of engine 0°.

(5) Remove hold-down bolt and clamp (Fig. 13).

(6) While pulling assembly from engine, note direction and position of pulse ring (Fig. 12). After removal, look down into top of oil pump and note direction and position of slot at top of oil pump gear.

(7) Remove and discard old oil pump drive-to-engine block gasket.

INSTALLATION - 4.0L

SENSOR ONLY - 4.0L

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 12). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 13).

(1) Install sensor to oil pump drive.

(2) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(3) Connect electrical connector to CMP sensor.

OIL PUMP DRIVE AND SENSOR - 4.0L

(1) Clean oil pump drive mounting hole area of engine block.

(2) Install new oil pump drive-to-engine block gasket.

(3) Temporarily install a toothpick or similar tool through access hole at side of oil pump drive housing. Align toothpick into mating hole on pulse ring (Fig. 14).

(4) Install oil pump drive into engine while aligning into slot on oil pump. Rotate oil pump drive back to its original position and install hold-down clamp

CAMSHAFT POSITION SENSOR - 4.0L (Continued)

and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(5) If engine crankshaft or camshaft has been rotated, such as during engine tear-down, CMP sensor relationship must be reestablished.

(a) Remove ignition coil rail assembly. Refer to Ignition Coil Removal/Installation.

(b) Remove cylinder number 1 spark plug.

(c) Hold a finger over the open spark plug hole. Rotate engine at vibration dampener bolt until compression (pressure) is felt.

(d) Slowly continue to rotate engine. Do this until timing index mark on vibration damper pulley aligns with top dead center (TDC) mark (0 degree) on timing degree scale (Fig. 15). Always rotate engine in direction of normal rotation. Do not rotate engine backward to align timing marks.

(e) Install oil pump drive into engine while aligning into slot on oil pump. If pump drive will not drop down flush to engine block, the oil pump slot is not aligned. Remove oil pump drive and align slot in oil pump to shaft at bottom of drive. Install into engine. Rotate oil pump drive back to its original position and install hold-down clamp and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(f) Remove toothpick from housing.

(6) Install sensor to oil pump drive. After installation, the CMP sensor should face rear of engine 0°.

(7) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(8) Connect electrical connector to CMP sensor.

(9) If removed, install spark plug and ignition coil rail.

To verify correct rotational position of oil pump drive, the DRB scan tool must be used.

WARNING: WHEN PERFORMING THE FOLLOWING TEST, THE ENGINE WILL BE RUNNING. BE CAREFUL NOT TO STAND IN LINE WITH THE FAN BLADES OR FAN BELT. DO NOT WEAR LOOSE CLOTHING.

(10) Connect DRB scan tool to data link connector. The data link connector is located in passenger compartment, below and to left of steering column.

(11) Gain access to SET SYNC screen on DRB.

(12) Follow directions on DRB screen and start engine. Bring to operating temperature (engine must be in “closed loop” mode).

(13) With engine running at **idle speed**, the words IN RANGE should appear on screen along with 0°. This indicates correct position of oil pump drive.

(14) If a plus (+) or a minus (-) is displayed next to degree number, and/or the degree displayed is not zero, loosen but do not remove hold-down clamp bolt. Rotate oil pump drive until IN RANGE appears on screen. Continue to rotate oil pump drive until achieving as close to 0° as possible.

The degree scale on SET SYNC screen of DRB is referring to fuel synchronization only. **It is not referring to ignition timing.** Because of this, do not attempt to adjust ignition timing using this method. Rotating oil pump drive will have no effect on ignition timing. All ignition timing values are controlled by powertrain control module (PCM).

(15) Tighten hold-down clamp bolt to 23 N·m (17 ft. lbs.) torque.

COIL RAIL - 4.0L

DESCRIPTION - 4.0L

A one-piece coil rail assembly containing three individual coils is used on the 4.0L 6–cylinder engine (Fig. 16). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 16) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

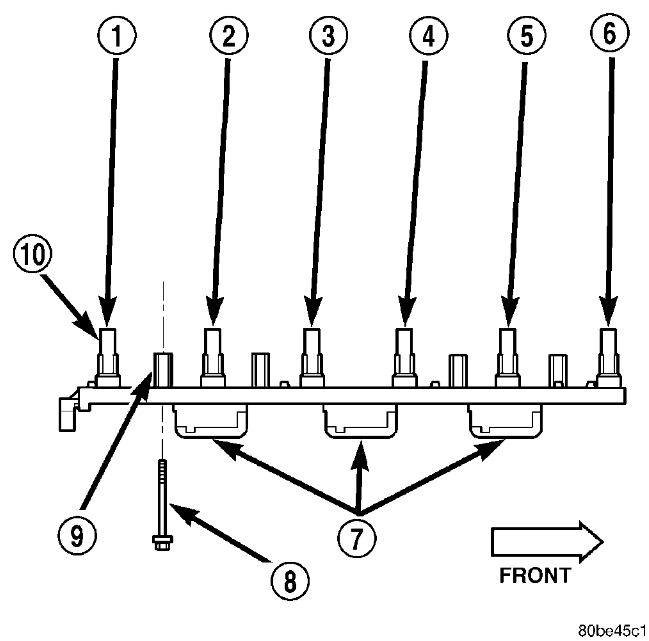


Fig. 16 Ignition Coil Assembly—4.0L 6–Cylinder Engine

1 - CYL. #6
2 - CYL. #5
3 - CYL. #4
4 - CYL. #3
5 - CYL. #2
6 - CYL. #1
7 - COILS (3)
8 - MOUNTING BOLTS (4)
9 - BOLT BASES (4)
10 - RUBBER BOOTS (6)

COIL RAIL - 4.0L (Continued)

(1) The coil is bolted directly to the cylinder head (Fig. 17). One electrical connector (located at rear of coil) is used for all three coils.

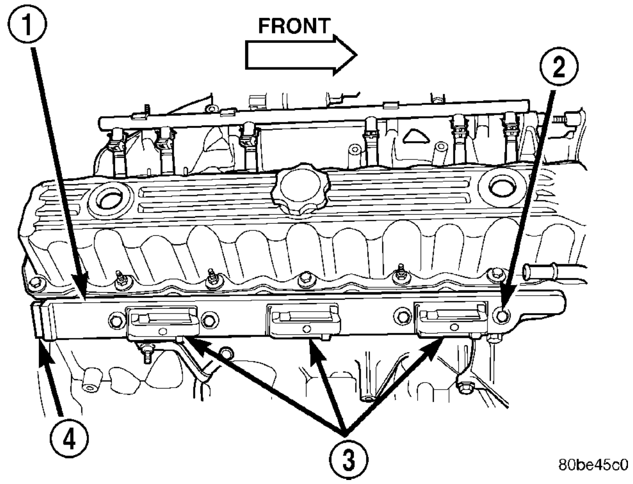


Fig. 17 Coil Location—4.0L Engine

1 - COIL RAIL
2 - COIL MOUNTING BOLTS (4)
3 - COIL
4 - COIL ELECTRICAL CONNECTION

OPERATION - 4.0L

Although cylinder firing order is the same as 4.0L Jeep engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1-6, 2-5 and/or 3-4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke).

Battery voltage is supplied to the three ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes the ignition coil ground circuit for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used. The cables are integral within the coil rail.

REMOVAL - 4.0L

A one-piece coil rail assembly containing three individual coils is used on the 4.0L engine (Fig. 18). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 18) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for an electrical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

(1) Disconnect negative battery cable at battery.

(2) The coil is bolted directly to the cylinder head. Remove 4 coil mounting bolts (Fig. 19).

(3) Carefully pry up coil assembly from spark plugs. Do this by prying alternately at each end of coil until rubber boots have disengaged from all spark plugs. If boots will not release from spark plugs, use a commercially available spark plug boot removal tool. Twist and loosen a few boots from a few spark plugs to help remove coil.

(4) After coil has cleared spark plugs, position coil for access to primary electrical connector. Disconnect connector from coil by pushing slide tab outwards to right side of vehicle (Fig. 20). After slide tab has been positioned outwards, push in on secondary release lock (Fig. 20) on side of connector and pull connector from coil.

(5) Remove coil from vehicle.

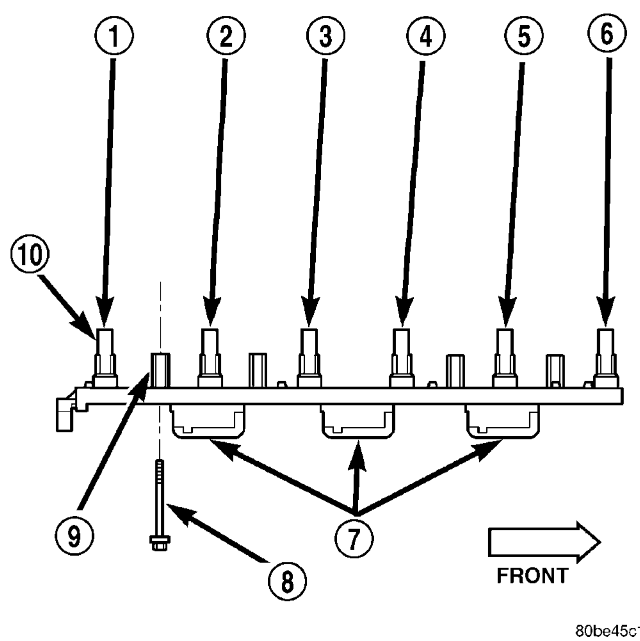


Fig. 18 Ignition Coil Assembly—4.0L 6–Cylinder Engine

1 - CYL. #6
2 - CYL. #5
3 - CYL. #4
4 - CYL. #3
5 - CYL. #2
6 - CYL. #1
7 - COILS (3)
8 - MOUNTING BOLTS (4)
9 - BOLT BASES (4)
10 - RUBBER BOOTS (6)

INSTALLATION - 4.0L

(1) Connect engine harness connector to coil by snapping into position. Move slide tab towards engine (Fig. 20) for a positive lock.

COIL RAIL - 4.0L (Continued)

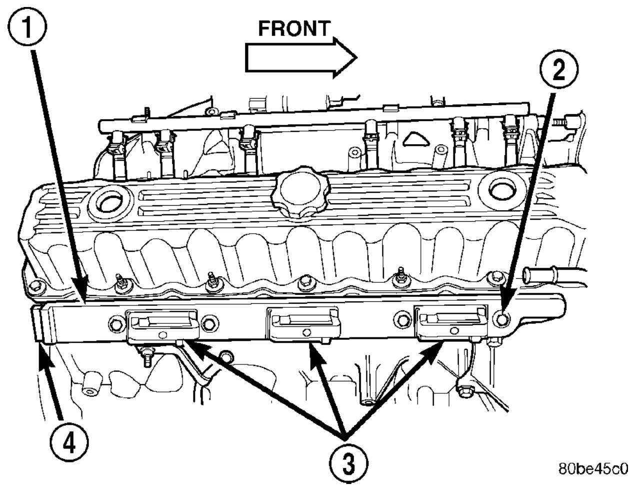


Fig. 19 Ignition Coil Rail Location—4.0L 6–Cylinder Engine

1 - COIL RAIL
2 - COIL MOUNTING BOLTS (4)
3 - COIL
4 - COIL ELECTRICAL CONNECTION

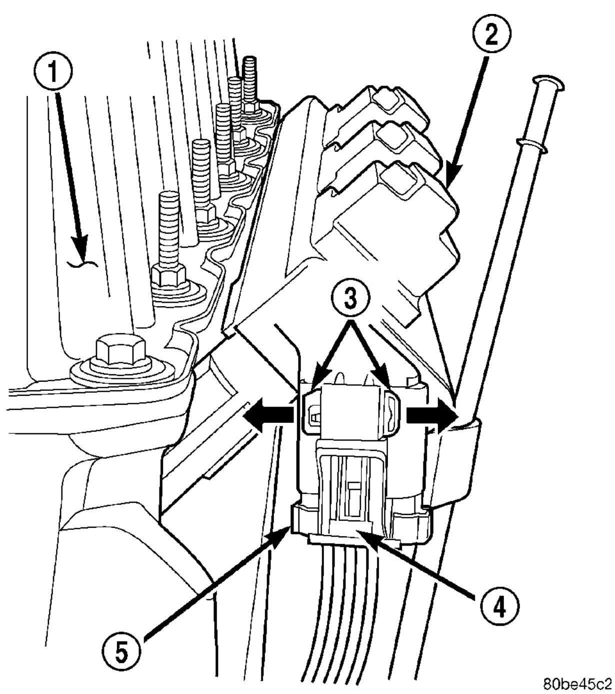


Fig. 20 Ignition Coil Electrical Connector—4.0L 6–Cylinder Engine

1 - REAR OF VALVE COVER
2 - COIL RAIL
3 - SLIDE TAB
4 - RELEASE LOCK
5 - COIL CONNECTOR

(2) Position ignition coil rubber boots to all spark plugs. Push down on coil assembly until bolt bases have contacted cylinder head

(3) Install 4 coil mounting bolts. Loosely tighten 4 bolts just enough to allow bolt bases to contact cylinder head. Do a final tightening of each bolt in steps down to 29 N·m (250 in. lbs.) torque. Do not apply full torque to any bolt first.

(4) Connect negative battery cable to battery.

IGNITION COIL - 2.4L

DESCRIPTION - 2.4L

The coil assembly consists of 2 different coils molded together. The assembly is mounted to the top of the engine (Fig. 21).

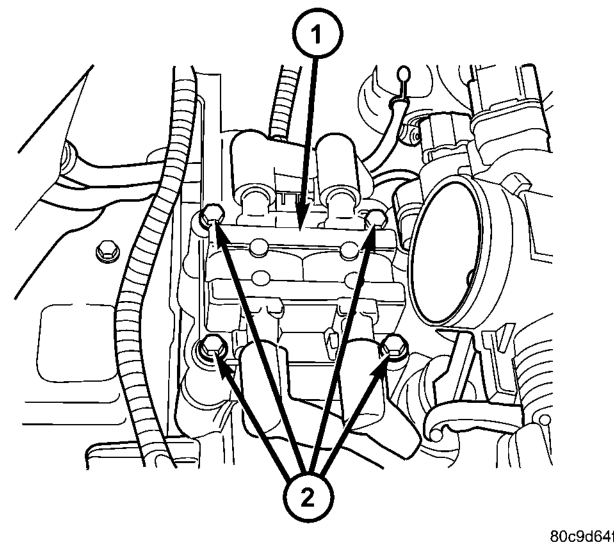


Fig. 21 IGNITION COIL - 2.4L

1 - IGNITION COIL
2 - MOUNTING BOLTS (4)

OPERATION - 2.4L

The coil fires two spark plugs simultaneously. One plug is under compression, the other plug fires on the exhaust stroke (lost spark). Coil number one fires cylinders 1 and 4, and coil number two fires cylinders 2 and 3.

The Auto Shutdown (ASD) relay provides battery voltage to the ignition coil. The PCM provides a ground contact (circuit) for energizing the coil(s). The PCM will de-energize the ASD relay if it does not receive the crankshaft position sensor and camshaft position sensor inputs.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

IGNITION COIL - 2.4L (Continued)

Spark plug cables (secondary wires or cables) are used with the 2.4L engine.

REMOVAL - 2.4L

(1) Disconnect electrical connector at rear of coil.
(2) Remove all secondary cables from coil.
(3) Remove 4 coil mounting bolts (Fig. 22).
(4) Remove coil from vehicle.

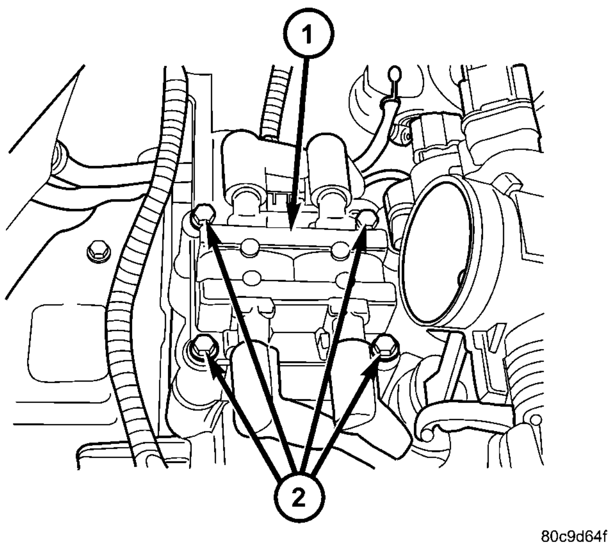


Fig. 22 IGNITION COIL - 2.4L

1 - IGNITION COIL
2 - MOUNTING BOLTS (4)

INSTALLATION - 2.4L

(1) Position coil to engine.
(2) Install 4 mounting bolts. Refer to torque specifications.
(3) Install secondary cables.
(4) Install electrical connector at rear of coil.
(5) Install air cleaner tube and housing.

SPARK PLUG

DESCRIPTION

Resistor type spark plugs are used.

Spark plug resistance values range from 6,000 to 20,000 ohms (when checked with at least a 1000 volt spark plug tester). **Do not use an ohmmeter to check the resistance values of the spark plugs. Inaccurate readings will result.**

OPERATION

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used.

Always use the recommended torque when tightening spark plugs. Incorrect torque can distort the spark plug and change plug gap. It can also pull the plug threads and do possible damage to both the spark plug and the cylinder head.

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in Group O, Lubrication and Maintenance

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Also refer to Spark Plug Conditions.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

DIAGNOSIS AND TESTING - SPARK PLUG CONDITIONS

NORMAL OPERATING

The few deposits present on the spark plug will probably be light tan or slightly gray in color. This is evident with most grades of commercial gasoline (Fig. 23). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 3200 km (2000 miles) of operation. Spark plugs that have normal wear can usually be cleaned, have the electrodes filed, have the gap set and then be installed.

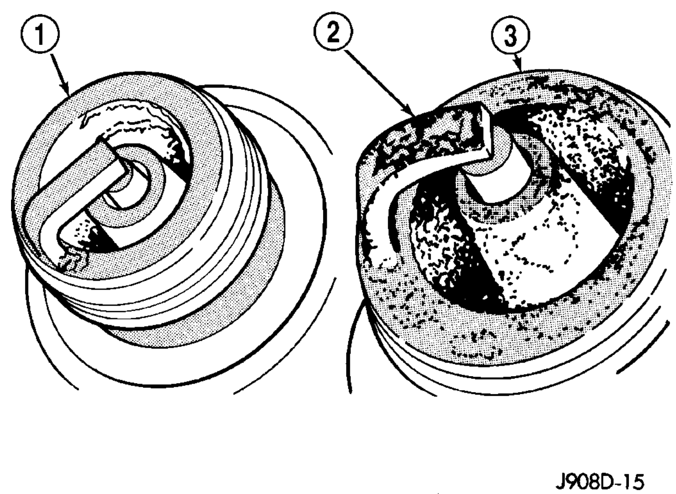


Fig. 23 Normal Operation and Cold (Carbon) Fouling

1 - NORMAL
2 - DRY BLACK DEPOSITS
3 - COLD (CARBON) FOULING

SPARK PLUG (Continued)

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust colored deposit. This rust color can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance may be affected by MMT deposits.

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 23). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set of spark plugs may be caused by a clogged air cleaner element or repeated short operating times (short trips).

WET FOULING OR GAS FOULING

A spark plug coated with excessive wet fuel or oil is wet fouled. In older engines, worn piston rings, leaking valve guide seals or excessive cylinder wear can cause wet fouling. In new or recently overhauled engines, wet fouling may occur before break-in (normal oil control) is achieved. This condition can usually be resolved by cleaning and reinstalling the fouled plugs.

OIL OR ASH ENCRUSTED

If one or more spark plugs are oil or oil ash encrusted (Fig. 24), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

ELECTRODE GAP BRIDGING

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, deposits partially liquefy and bridge the gap between electrodes (Fig. 25). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

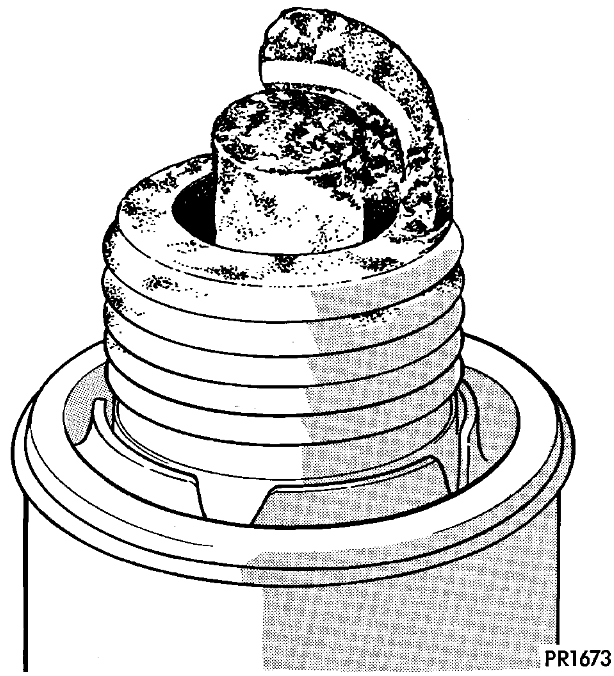


Fig. 24 Oil or Ash Encrusted

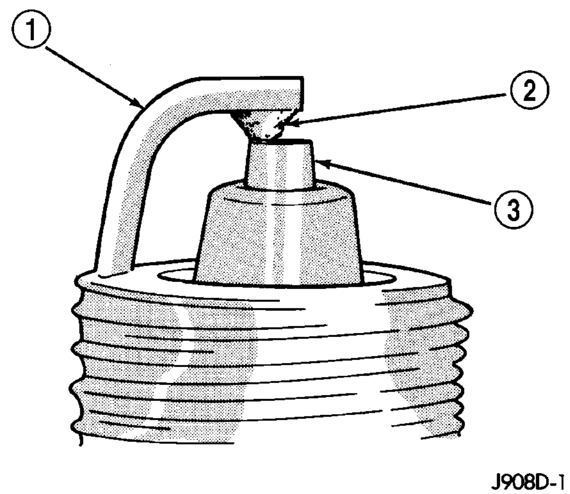


Fig. 25 Electrode Gap Bridging

1 - GROUND ELECTRODE
2 - DEPOSITS
3 - CENTER ELECTRODE

SPARK PLUG (Continued)

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 26). They may appear to be harmful, but this is a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy, but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and can be cleaned using standard procedures.

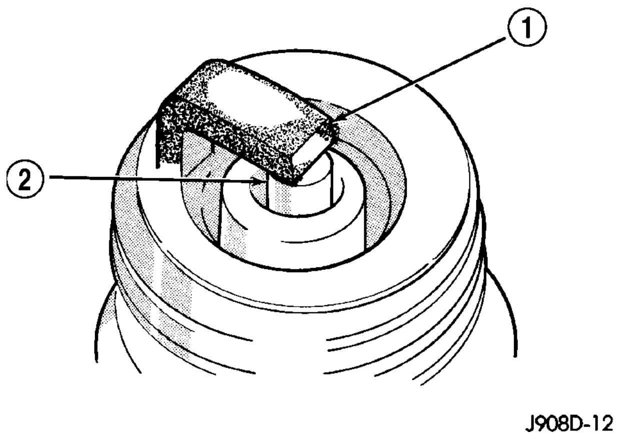


Fig. 26 Scavenger Deposits

1 - GROUND ELECTRODE COVERED WITH WHITE OR YELLOW DEPOSITS
2 - CENTER ELECTRODE

CHIPPED ELECTRODE INSULATOR

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap. Under certain conditions, severe detonation can also separate the insulator from the center electrode (Fig. 27). Spark plugs with this condition must be replaced.

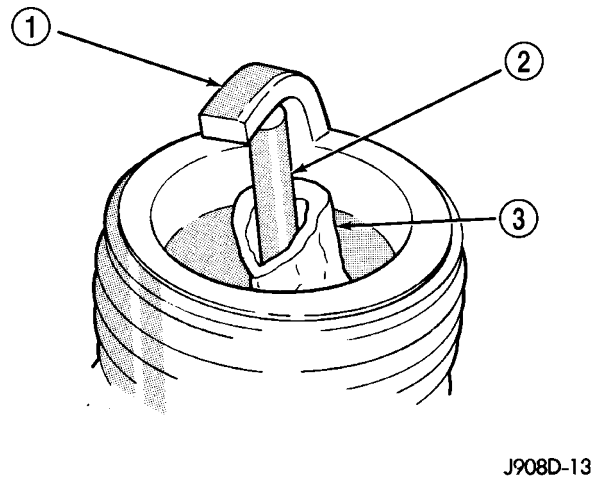


Fig. 27 Chipped Electrode Insulator

1 - GROUND ELECTRODE
2 - CENTER ELECTRODE
3 - CHIPPED INSULATOR

PREIGNITION DAMAGE

Preignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 28). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine. Determine if ignition timing is over advanced or if other operating conditions are causing engine overheating. (The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

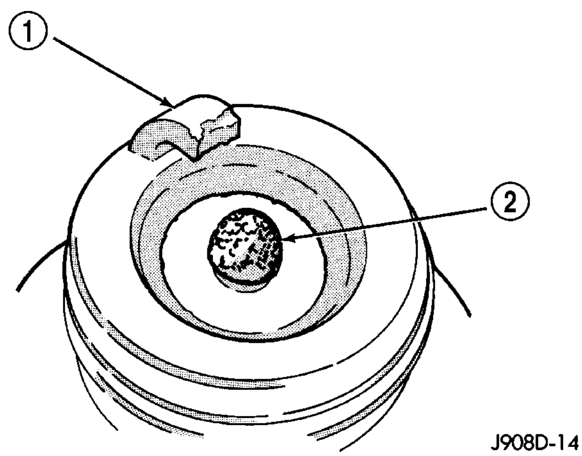


Fig. 28 Preignition Damage

1 - GROUND ELECTRODE STARTING TO DISSOLVE
2 - CENTER ELECTRODE DISSOLVED

SPARK PLUG (Continued)

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 29). The increase in electrode gap will be considerably in excess of 0.001 inch per 2000 miles of operation. This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

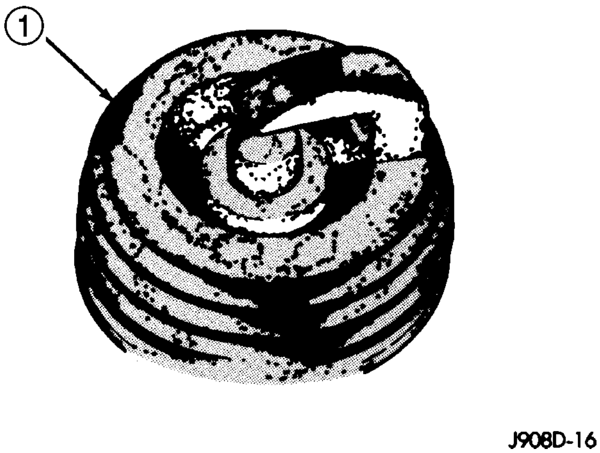


Fig. 29 Spark Plug Overheating

1 - BLISTERED WHITE OR GRAY COLORED INSULATOR

REMOVAL

2.4L

If spark plug for #2 or #3 cylinder is being removed, throttle body must be removed. Refer to Throttle Body Removal.

(1) Remove air cleaner tube and housing.

(2) Twist secondary cable at cylinder head to break loose at spark plug. Remove cable from plug.

(3) Prior to removing spark plug, spray compressed air into cylinder head opening. This will help prevent foreign material from entering combustion chamber.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert.

(5) Inspect spark plug condition. Refer to Spark Plug Conditions.

4.0L

On the 4.0L 6–cylinder engine the spark plugs are located below the coil rail assembly. To gain access to any/all spark plug(s), refer to Ignition Coil-4.0L Engine Removal/Installation.

(1) Prior to removing the spark plug, spray compressed air around the spark plug hole and the area around the spark plug. This will help prevent foreign material from entering the combustion chamber.

(2) Remove the spark plug using a quality socket with a rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plugs Conditions.

CLEANING

CLEANING SPARK PLUGS

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file the center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

INSTALLATION

Always tighten spark plugs to the specified torque. Over tightening can cause distortion. This may result in a change in the spark plug gap, or a cracked porcelain insulator.

When replacing the spark plug and ignition coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could cause cross ignition of the spark plugs, or short circuit the cables to ground.

2.4L

CAUTION: Spark plug tightening on the 2.4L is torque critical. The plugs are equipped with tapered seats. Do not exceed 15 ft. lbs. torque.

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Tighten spark plugs. Refer to torque specifications.

(3) Install throttle body (if necessary). Refer to Throttle Body Installation.

(4) Install air cleaner tube and housing.

SPARK PLUG (Continued)

4.0L

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Tighten spark plugs. Refer to torque specifications.

(3) Install coil rail. Refer to Ignition Coil-4.0L Engine Removal/Installation.

SPARK PLUG CABLE

DESCRIPTION

Spark plug cables are used only on the 2.4L 4–cylinder engine. They are sometimes referred to as secondary ignition wires.

OPERATION

2.4L 4–cylinder engine only: The spark plug cables transfer electrical current from the ignition coil(s) and/or distributor, to individual spark plugs at each cylinder. The resistive spark plug cables are of non-metallic construction. The cables provide suppression of radio frequency emissions from the ignition system.

DIAGNOSIS AND TESTING

TESTING

Check the spark plug cable connections for good contact at the coil(s) and spark plugs. Terminals should be fully seated. The insulators should be in good condition and should fit tightly on the coil and spark plugs. Spark plug cables with insulators that are cracked or torn must be replaced.

Clean high voltage ignition cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

When testing secondary cables for damage with an oscilloscope, follow the instructions of the equipment manufacturer.

If an oscilloscope is not available, spark plug cables may be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected for longer than necessary during testing. This may cause possible heat damage to the catalytic converter. Total test time must not exceed ten minutes.

With the engine running, remove spark plug cable from spark plug (one at a time) and hold next to a good engine ground. If the cable and spark plug are in good condition, the engine rpm should drop and the engine will run poorly. If engine rpm does not drop, the cable and/or spark plug may not be operating properly and should be replaced. Also check engine cylinder compression.

With the engine not running, connect one end of a test probe to a good ground. Start the engine and run the other end of the test probe along the entire length of all spark plug cables. If cables are cracked or punctured, there will be a noticeable spark jump from the damaged area to the test probe. Cracked, damaged or faulty cables should be replaced with resistance type cable. This can be identified by the words ELECTRONIC SUPPRESSION printed on the cable jacket.

Use an ohmmeter to test for open circuits, excessive resistance or loose terminals. Remove the cable at ignition coil, and from spark plug. Connect ohmmeter to each end of cable. Resistance should be 250 to 1000 Ohms per inch of cable. If resistance is not within specifications as found in the SPARK PLUG CABLE RESISTANCE chart, replace the cable. Test all spark plug cables in this manner.

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

SPARK PLUG CABLE (Continued)

REMOVAL - 2.4L

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose (Fig. 30).

(1) Grasp the boot (not the cable) and pull it off with a steady, even force.

INSTALLATION

(1) Push the cable firmly onto the sparkplug.

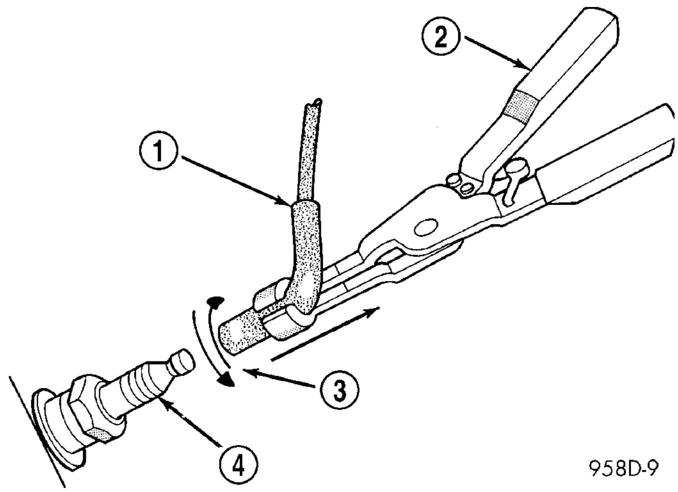


Fig. 30 CABLE REMOVAL

1 - SPARK PLUG CABLE AND BOOT
2 - SPARK PLUG BOOT PULLER
3 - TWIST AND PULL
4 - SPARK PLUG

INSTRUMENT CLUSTER

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INSTRUMENT CLUSTER

DESCRIPTION

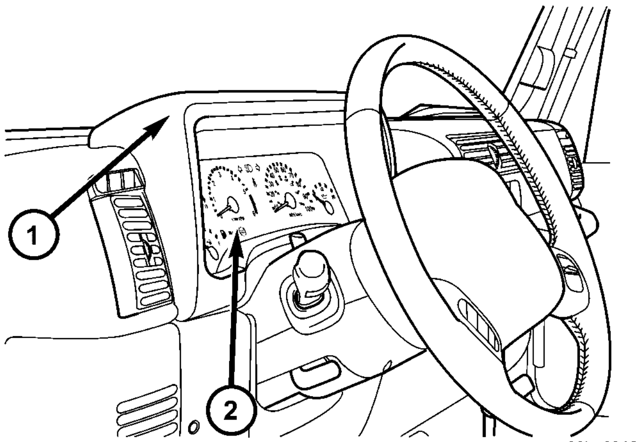

Fig. 1 Instrument Cluster

1 - CLUSTER BEZEL
2 - INSTRUMENT CLUSTER

The instrument cluster for this model is an ElectroMechanical Instrument Cluster (EMIC) that is located in the instrument panel above the steering column opening, directly in front of the driver (Fig. 1). The remainder of the EMIC, including the mounts and the electrical connections, are concealed within the instrument panel behind the cluster bezel. Besides analog gauges and indicators, the EMIC module incorporates a blue-green digital Vacuum Fluorescent Display (VFD) unit for displaying odometer/trip odometer information and certain diagnostic information. The instrument cluster for this model also includes the hardware and software necessary to serve as an electronic body control module.

The EMIC gauges and indicators are visible through a dedicated opening in the cluster bezel on the instrument panel and are protected by a clear plastic cluster lens (Fig. 2). Eight integral latch formations around the outer perimeter of the lens secure the lens unit to the cluster hood and the cluster housing. On the lower edge of the cluster lens just right of center, a small molded rubber boot covers the odometer/trip odometer switch button and seals a dedicated pocketed hole in the lens through which the switch button protrudes. Just behind the cluster lens is the cluster hood and an integral cluster mask, which are constructed of molded black plastic. The cluster hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare, while the cluster mask trims the outside perimeter of the cluster overlay. The cluster hood and mask unit is secured to the cluster housing with five integral latch formations around its perimeter.

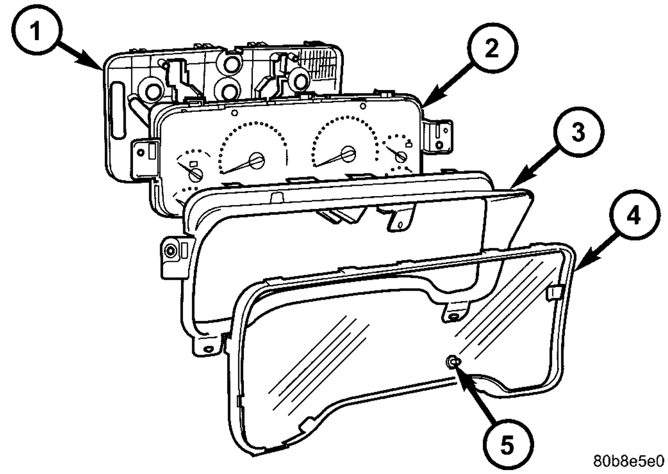

Fig. 2 Instrument Cluster Components

1 - REAR COVER
2 - CLUSTER HOUSING
3 - CLUSTER HOOD & MASK
4 - CLUSTER LENS
5 - SWITCH BUTTON BOOT

The rear of the cluster housing and the EMIC electronic circuitry are protected by a molded plastic rear cover, which is secured to the cluster housing with two screws, eight integral latch formations around its perimeter, and a single latch that is integral to the cluster housing. The rear cover includes clearance holes for service access to each of the five general illumination lighting and the one high beam indicator incandescent bulb and bulb holder units installed on the cluster circuit board, and for the two color-coded cluster connector receptacles. The connector receptacles on the back of the cluster electronic circuit board connect the EMIC to the vehicle electrical system through two take outs with color-coded connectors from the instrument panel wire harness.

Sandwiched between the rear cover and the lens, hood and mask unit is the cluster housing. The molded plastic cluster housing serves as the carrier for the cluster circuit board and circuitry, the cluster connector receptacles, the gauges, a Light Emitting Diode (LED) for each cluster indicator, the VFD unit, an audible tone generator, the cluster overlay, the gauge pointers, the odometer/trip odometer switch and the switch button. The molded plastic EMIC housing has four integral mounting tabs, two on the lower outboard edges of the housing and one on each side. A screw through each of these four mounting tabs secures the EMIC to the instrument panel structural support.

The cluster overlay is a laminated plastic unit. The dark, visible, outer surface of the overlay is marked with all of the gauge dial faces and graduations, but

INSTRUMENT CLUSTER (Continued)

this layer is also translucent. The darkness of this outer layer prevents the cluster from appearing cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the overlay is opaque and allows light from the LED or incandescent lamp for each of the various indicators and the incandescent illumination lamps behind it to be visible through the outer layer of the overlay only through predetermined stencil-like cutouts. A rectangular opening near the base of the overlay between the speedometer and tachometer dial faces has a smoked clear lens through which the illuminated VFD unit can be viewed.

Several versions of the EMIC module are offered on this model. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle will be offered. The microprocessor-based EMIC utilizes integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus network along with several hard wired analog and multiplexed inputs to monitor sensors and switches throughout the vehicle. In response to those inputs, the internal circuitry and programming of the EMIC allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the PCI data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - PCI BUS).

Besides typical instrument cluster gauge and indicator support, the electronic functions and features that the EMIC supports or controls include the following:

- **Audible Warnings** - The EMIC electronic circuit board is equipped with an audible tone generator and programming that allows it to provide various audible chime tone alerts to the vehicle operator. (Refer to 8 - ELECTRICAL/CHIME/BUZZER - DESCRIPTION).
- **Audio System Cabin Equalization** - The EMIC stores the cabin equalization curves for various optional speaker system architectures for use by the radio. The EMIC provides this information when requested by the radio over the PCI data bus. Changing the cabin equalization settings of the EMIC requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.
- **Axle Locker Control** - The EMIC provides the logic that controls the operation of the rear and front axle locker feature found on models equipped with the optional off-road package.
- **Electronic Pinion Factor** - The EMIC stores the tire size, axle ratio, and transfer case type information for use in calibrating the proper vehicle speed and distance values for display by the speedometer and odometer, as well as for use by other electronic modules in the vehicle. The EMIC provides this information when requested by other modules over the PCI data bus. Changing the electronic pinion factor settings of the EMIC requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.
- **Interior Lamp Load Shedding** - The EMIC provides a battery saver feature which will automatically turn off all interior lamps that remain on after a timed interval of about twenty minutes.
- **Interior Lighting Control** - The EMIC monitors inputs from the interior lighting switch and the door ajar switches to provide courtesy lamp control. This includes support for a timed illuminated entry with a theater-style fade-to-off feature.
- **Panel Lamps Dimming Control** - The EMIC provides a hard wired 12-volt Pulse-Width Modulated (PWM) output that synchronizes the dimming level of all panel lamps dimmer controlled lamps with that of the cluster illumination lamps. This includes providing features such as VFD unit illumination when a door is ajar (rental car mode), radio illumination control, a parade mode, and one step dimmable front and rear lock, cruise, four-wheel drive, and upshift indicators.
- **Rear Window Defogger Control** - The EMIC provides control and timer functions for the output to the rear window defogger on vehicles so equipped, which eliminates the need for a separate control and timer module for the rear window defogger system. (Refer to 8 - ELECTRICAL/WINDOW DEFOGGER - DESCRIPTION).
- **Vacuum Fluorescent Display Synchronization** - The EMIC transmits electronic panel lamp dimming level messages which allows all other electronic modules with Vacuum Fluorescent Display (VFD) units on the PCI data bus to coordinate their illumination intensity with that of the EMIC VFD unit.

The EMIC houses six analog gauges and has provisions for up to seventeen indicators (Fig. 3). The EMIC includes the following analog gauges:

- **Coolant Temperature Gauge**
- **Fuel Gauge**
- **Oil Pressure Gauge**
- **Speedometer**
- **Tachometer**
- **Voltage Gauge**

Some of the EMIC indicators are automatically configured when the EMIC is connected to the vehicle electrical system for compatibility with certain

INSTRUMENT CLUSTER (Continued)

optional equipment or equipment required for regulatory purposes in certain markets. While each EMIC may have provisions for indicators to support every available option, the configurable indicators will not be functional in a vehicle that does not have the equipment that an indicator supports. The EMIC includes provisions for the following indicators (Fig. 3):

- **Airbag Indicator (with Airbag System only)**
- **Antilock Brake System (ABS) Indicator (with ABS brakes only)**
- **Brake Indicator**
- **Check Gauges Indicator**
- **Cruise Indicator (with Speed Control only)**
- **Fog Lamp Indicator (with Front or Rear Fog Lamps only)**
- **Four-Wheel Drive (4WD) Indicator**
- **Front Lock Indicator (with Off-Road Package only)**
- **High Beam Indicator**
- **Low Fuel Indicator**
- **Malfunction Indicator Lamp (MIL)**
- **Rear Lock Indicator (with Off-Road Package only)**
- **Seatbelt Indicator**
- **Sentry Key Immobilizer System (SKIS) Indicator (with SKIS only)**
- **Turn Signal (Right and Left) Indicators**
- **Upshift Indicator (with Manual Transmission only)**

The EMIC high beam indicator is illuminated by a dedicated incandescent bulb. Each remaining indicator in the EMIC is illuminated by a dedicated LED that is soldered onto the EMIC electronic circuit board. The LED units are not available for service replacement and, if damaged or faulty, the entire EMIC must be replaced. Cluster illumination is accomplished by dimmable incandescent back lighting, which illuminates the gauges for visibility when the exterior lighting is turned on. Each of the incandescent bulbs is secured by an integral bulb holder to

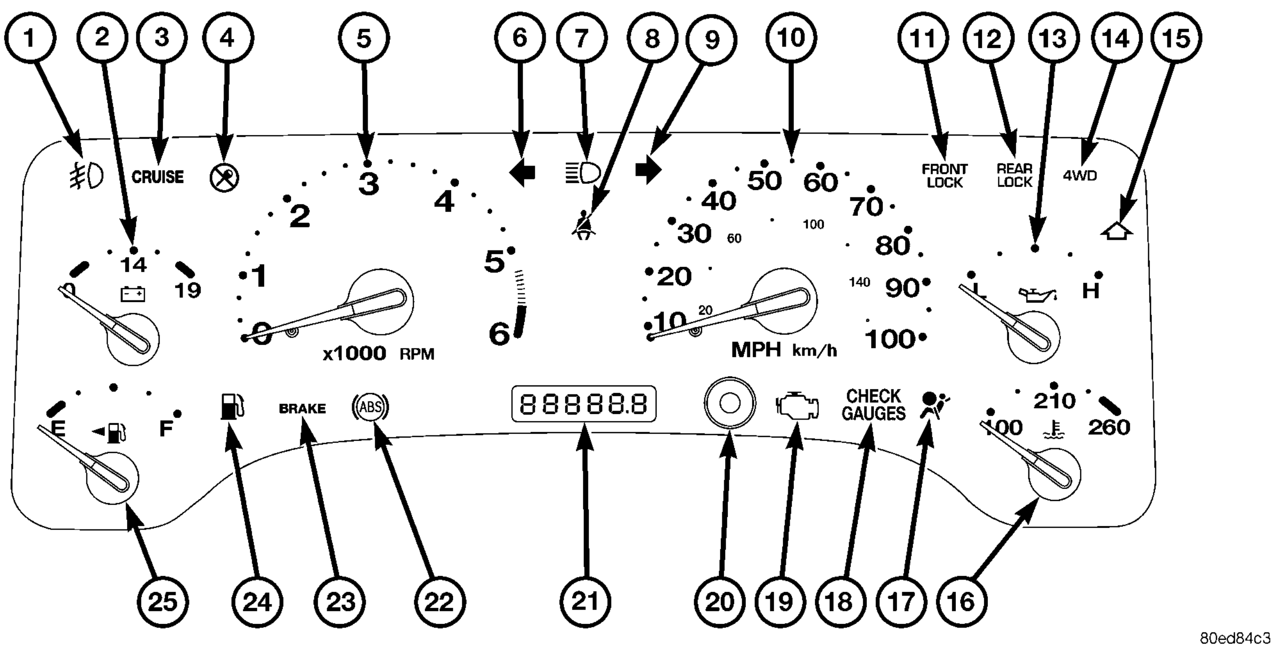

Fig. 3 Gauges & Indicators

1 - FOG LAMP INDICATOR
2 - VOLTAGE GAUGE
3 - CRUISE INDICATOR
4 - SKIS INDICATOR
5 - TACHOMETER
6 - LEFT TURN INDICATOR
7 - HIGH BEAM INDICATOR
8 - SEATBELT INDICATOR
9 - RIGHT TURN INDICATOR
10 - SPEEDOMETER
11 - FRONT LOCK INDICATOR
12 - REAR LOCK INDICATOR
13 - OIL PRESSURE GAUGE
14 - 4WD INDICATOR
15 - UPSHIFT INDICATOR
16 - ENGINE TEMPERATURE GAUGE
17 - AIRBAG INDICATOR
18 - CHECK GAUGES INDICATOR
19 - MALFUNCTION INDICATOR LAMP
20 - ODOMETER/TRIP ODOMETER SWITCH BUTTON
21 - ODOMETER/TRIP ODOMETER DISPLAY
22 - ABS INDICATOR
23 - BRAKE INDICATOR
24 - LOW FUEL INDICATOR
25 - FUEL GAUGE

INSTRUMENT CLUSTER (Continued)

the electronic circuit board from the back of the cluster housing.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC modules for this model are serviced only as complete units. The EMIC module cannot be adjusted or repaired. If a gauge, an LED indicator, a VFD unit, the electronic circuit board, the circuit board hardware, the cluster overlay, or the EMIC housing are damaged or faulty, the entire EMIC module must be replaced. The cluster lens, the cluster hood and mask unit, the cluster housing rear cover, the odometer/trip odometer switch button boot, and the incandescent lamp bulbs with holders are available for individual service replacement.

OPERATION

The ElectroMechanical Instrument Cluster (EMIC) in this model also includes the hardware and software necessary to serve as the electronic body control module. The following information deals primarily with the instrument cluster functions of this unit. Additional details of the electronic body control functions of this unit may be found within the service information for the system or component that the EMIC controls. For example: Additional details of the audible warning functions of the EMIC are found within the Chime/Buzzer service information.

The EMIC is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges and indicators in the EMIC provide valuable information about the various standard and optional powertrains, fuel and emissions systems, cooling systems, lighting systems, safety systems, and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service. The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but most are in the form of electronic messages that are transmitted by other electronic modules over the Programmable Commutations Interface (PCI) data bus network. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable, and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that are consistent with customer expectations. However, when abnormal conditions exist, such as low/high battery voltage, low oil pressure, or high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor can turn on the Check Gauges indicator and/or sound a chime through the on-board tone generator to provide distinct visual and/or audible indications of a problem to the vehicle operator. The instrument cluster circuitry may also produce audible warnings for other electronic modules in the vehicle based upon electronic tone request messages received over the PCI data bus. Each audible warning is intended to provide the vehicle operator with an audible alert to supplement a visual indication.

The EMIC circuitry operates on battery current received through the Ignition-Off Draw (IOD) fuse in the Power Distribution Center (PDC) on a non-switched fused B(+) circuit, and on battery current received through a fuse in the fuse block on a fused ignition switch output (run-start) circuit. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On or Start positions. The EMIC circuitry is grounded through a ground circuit and take out of the instrument panel wire harness with an eyelet terminal connector that is secured under a ground screw to the back of the instrument panel structural support near the lower left corner of the instrument panel, just inboard of the left instrument panel end bracket.

The EMIC also has a self-diagnostic actuator test capability, which will test each of the PCI bus message-controlled functions of the cluster by lighting the appropriate indicators, positioning the gauge needles at several predetermined calibration points across the gauge faces, and illuminating all segments of the odometer/trip odometer Vacuum-Fluorescent Display (VFD) unit. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EMIC.

INSTRUMENT CLUSTER (Continued)

GAUGES

All gauges receive battery current through the EMIC circuitry only when the ignition switch is in the On or Start positions. With the ignition switch in the Off position battery current is not supplied to any gauges, and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions.

All of the EMIC gauges are air core magnetic units. Two fixed electromagnetic coils are located within each gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a pivot shaft, while the gauge needle is attached to the other end of the shaft. One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil is changed by the EMIC circuitry in response to messages received over the PCI data bus. The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

The gauges are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic data bus message inputs to the EMIC that control each gauge require the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

VACUUM-FLUORESCENT DISPLAY

The Vacuum-Fluorescent Display (VFD) unit is soldered to the EMIC electronic circuit board. With the ignition switch in the Off or Accessory positions, the odometer display is activated when either door is opened (Rental Car mode) and is deactivated after both doors are closed. If a door is left open with the ignition switch in any position except On or Start, the VFD will remain illuminated until the interior lights control battery saver (load shedding) timer expires after about twenty minutes. Otherwise, the display unit is active when the ignition switch is in the On or Start positions, and inactive when the ignition switch is in the Off or Accessory positions.

The illumination intensity of the VFD unit is controlled by the EMIC circuitry based upon an input from the headlamp switch circuitry and a dimming level input received from the panel lamp dimmer switch circuitry. The EMIC synchronizes the illumination intensity of other VFD units with that of the unit in the EMIC by sending electronic dimming level messages to other electronic modules in the vehicle over the PCI data bus.

The EMIC VFD unit has several display capabilities including odometer, trip odometer, software version, and can display various diagnostic information when certain fault conditions exist. An odometer/trip odometer switch on the EMIC circuit board is used to control some of the display modes. This switch is actuated manually by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just right of center. Actuating this switch momentarily with the ignition switch in the On position will toggle the VFD between the odometer and trip odometer modes. Depressing the switch button for about two seconds while the VFD is in the trip odometer mode will reset the trip odometer value to zero. Holding this switch depressed while turning the ignition switch from the Off position to the On position will initiate the EMIC self-diagnostic actuator test. Refer to the appropriate diagnostic information for additional details on this VFD function. The EMIC microprocessor remembers which display mode is active when the ignition switch is turned to the Off position, and returns the VFD display to that mode when the ignition switch is turned On again.

The VFD is diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic data bus message inputs to the EMIC that control some of the VFD functions requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific operation details for the odometer and trip odometer functions of the VFD may be found elsewhere in this service information.

INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC electronic circuit board. The antilock brake system indicator, headlamp high beam indicator, fog lamp indicator, and turn signal indicators operate based upon hard wired inputs to the EMIC. The brake indicator is controlled by the EMIC programming and hard wired park brake and brake warning indicator switch inputs to the EMIC. In vehicles without the optional off-road package the four-wheel drive indicator is controlled by a hard wired input from the transfer case switch, while in vehicles equipped with the off-road package this indicator is controlled by PCI data bus messages from the Powertrain Control Module (PCM). The rear and front lock indicators are controlled by the EMIC programming and hard wired

INSTRUMENT CLUSTER (Continued)

inputs from the axle locker switch and the rear/front locker indicator switches. The seatbelt indicator is controlled by the EMIC programming and a hard wired seat belt switch input to the EMIC. The Malfunction Indicator Lamp (MIL) is normally controlled by PCI data bus messages from the PCM; however, if the EMIC loses PCI data bus communications, the EMIC circuitry will automatically turn the MIL on and display the message “no BuS” in the odometer VFD unit until PCI data bus communication is restored. The EMIC uses PCI data bus messages from the PCM, Airbag Control Module (ACM), and the Sentry Key Immobilizer Module (SKIM) to control all of the remaining indicators.

The various EMIC indicators are controlled by different strategies; some receive fused ignition switch output from the EMIC circuitry and have a switched ground, others are grounded through the EMIC circuitry and have a switched battery feed. However, all indicators except those for the antilock brake system, turn signals, and fog lamps are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. The cruise, four-wheel drive, upshift and both axle lock indicators are one-step dimmable based upon an input to the EMIC from the headlamp switch circuitry. When the exterior lamps are off, these indicators are illuminated at a fixed maximum intensity; and, when the exterior lamps are on, these indicators are dimmed by the EMIC to a fixed lower intensity. All remaining indicators are illuminated at a fixed intensity, which is not affected by the status of the exterior lighting or the selected illumination intensity of the EMIC general illumination lamps.

In addition, certain indicators in this instrument cluster are automatically configured or self-configured. This feature allows the configurable indicators to be enabled by the EMIC circuitry for compatibility with certain optional equipment. The airbag indicator, cruise indicator, and the Sentry Key Immobilizer System (SKIS) indicator are automatically configured. The automatically configured or self-configured indicators remain latent in each EMIC at all times and will be active only when the EMIC receives the appropriate PCI message inputs for that optional system or equipment. Once a configurable indicator is enabled by the EMIC, it is learned and stored in cluster memory for the remainder of the cluster life.

The hard wired indicator inputs may be diagnosed using conventional diagnostic methods. However, the EMIC circuitry and PCI bus message controlled indicators are diagnosed using the EMIC self-diagnostic actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). Proper testing of the PCI data bus and the electronic message inputs to the EMIC that control an indicator requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

CLUSTER ILLUMINATION

The EMIC has several illumination lamps that are illuminated when the exterior lighting is turned on with the headlamp switch circuitry of the left multi-function switch. The illumination intensity of these lamps is adjusted when the interior lamps control ring on the left multi-function switch control stalk is rotated (downward to dim, upward to brighten). In response to that input, an analog/digital (A/D) converter in the EMIC converts the analog panel lamps dimmer resistor multiplexed input from the left multi-function switch into a digital dimming level message and a 12-volt Pulse-Width Modulated (PWM) output. The EMIC uses the PWM output to power the cluster illumination lamps and the VFD unit on the EMIC circuit board, then provides a synchronized PWM output on the hard wired fused panel lamp feed output circuit to control and synchronize the illumination intensity of other incandescent illumination lamps in the vehicle. The cluster illumination lamps are grounded at all times.

The EMIC also sends electronic dimming level messages over the PCI data bus to other electronic modules in the vehicle to control and synchronize the illumination intensity of their VFD units with that of the EMIC VFD unit. In addition, the interior lamps control ring on the left multi-function switch control stalk has a Parade Mode position to provide a parade mode. The EMIC monitors the request for this mode from the left multi-function switch, then sends an electronic dimming level message over the PCI data bus to illuminate all VFD units in the vehicle at full (daytime) intensity for easier visibility when driving in daylight with the exterior lighting turned on.

The hard wired left multi-function switch cluster illumination inputs and the EMIC fused panel lamp feed output may be diagnosed using conventional diagnostic methods. However, proper testing of the PWM control of the EMIC and the electronic dimming level messages sent by the EMIC over the PCI data bus requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

AUDIO SYSTEM CABIN EQUALIZATION

Each time the EMIC receives an electronic cabin equalization request message from the radio over the PCI data bus, it provides an electronic response to the radio containing the appropriate equalization curve information. Because there are numerous optional radios which are common to many platforms and available with various speaker architectures,

INSTRUMENT CLUSTER (Continued)

each radio contains a Digital Signal Processing (DSP) microprocessor chip. This DSP chip uses the equalization curve information to optimize the radio's sound output characteristics for the unique cabin and speaker architecture found within the particular vehicle into which the radio has been installed.

Proper testing of the PCI data bus and the electronic data bus message inputs to and outputs from the EMIC that control audio system cabin equalization requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

AXLE LOCKER CONTROL

The EMIC contains a logic circuit and programming to perform the axle locker control functions for models equipped with the optional off-road package. The EMIC monitors hard wired inputs from the ignition switch on the fused ignition switch output (run-start) circuit and the key-in ignition switch on the key-in ignition switch sense circuit. The EMIC also monitors vehicle speed and transfer case shift position switch electronic message inputs received from the Powertrain Control Module (PCM) over the PCI data bus. The internal programming of the EMIC then determines whether to activate or deactivate the axle locker function by enabling or disabling the axle lock switch located in the instrument panel accessory switch bezel.

The EMIC programming controls the axle lock switch through two separate axle lock switch enable circuits, enable 1 and enable 2. In all cases, the EMIC will not activate either enable circuit if there are any transfer case shift position switch or vehicle speed sensor faults present. Whenever the ignition switch is in the On or Start positions, the key is in the ignition lock cylinder, the transfer case is in 4 X 4 Low range, and the vehicle speed is less than about 72 kilometers per hour (45 miles per hour) the first enable (enable 1) circuit is activated. The second enable (enable 2) circuit is activated only if the vehicle speed is less than about 16 kilometers per hour (10 miles per hour). When both enable circuits are activated, the axle lock switch becomes functional.

Once activated, the enable 1 circuit is automatically deactivated whenever the transfer case is moved out of the 4 X 4 Low range, or if the vehicle speed is greater than about 72 kilometers per hour (45 miles per hour). If the enable 1 circuit is deactivated after the rear or the front and rear axle lockers are engaged, all outputs from the axle lock switch are dropped causing both axles to unlock. The enable 2 circuit is automatically deactivated whenever the vehicle speed is greater than about 16 kilometers per hour (10 miles per hour). If the enable 2 circuit is deactivated after the rear or the front and rear axle lockers are engaged, the outputs from the axle lock switch are unaffected and the locked axles remain locked. However, an unlocked axle cannot be locked until the vehicle speed is reduced and the enable 2 circuit is again activated.

In addition, once activated, both enable circuits will remain active regardless of the status of the ignition switch input. Therefore, any locked axle will remain locked and the various components of the axle locker system will remain functional after the ignition switch is turned to the Off position. However, while the currently selected axle locker mode remains active with the ignition switch turned Off, if the key is removed from the ignition lock cylinder, Off is the only other axle locker mode that can be selected with the axle lock switch. For as long as the key is removed from the ignition lock cylinder, the cluster logic will interpret any revision to the input status of either request circuit from the axle lock switch as a cancellation request and will deactivate the enable 1 circuit and all outputs from the axle lock switch are dropped, causing both axles to unlock. Otherwise, once locked, any locked axle will remain locked until the axle lock switch is deactivated (enable 1 circuit is deactivated), or until the Off mode is manually selected by moving the axle lock switch rocker to the Off position. The EMIC also provides the vehicle operator with distinct visual and/or audible indications as to the current status of the axle locker system through chime warnings and illumination of the rear/front lock indicators in the cluster as outlined elsewhere in this service information.

The hard wired input and output circuits of the EMIC axle locker control may be diagnosed using conventional diagnostic methods. However, proper testing of the EMIC programming and the electronic vehicle speed and transfer case shift position switch messages received by the EMIC over the PCI data bus requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

CHIME SERVICE

The EMIC is equipped with hardware and software to provide chime service for all available features in the chime warning system. Upon receiving the proper chime inputs, the EMIC activates an integral on-board audible tone generator to provide audible chime tones to the vehicle operator. The chime tone generator in the EMIC is capable of producing single chime tones or repeated chime tones at two different rates: a slow rate of about fifty chime tones per minute, and a fast rate of about 180 chime tones per minute. The internal programming of the EMIC determines the priority of each chime tone request input that is received, as well as the rate and duration of each chime tone that is to be generated.

INSTRUMENT CLUSTER (Continued)

The EMIC relies upon hard wired inputs from the door ajar switches, the left multi-function switch, the ignition switch, and the park brake/brake warning indicator switches to provide chime service for the driver/passenger door ajar warning, the head/park lights-on reminder, and the key-in ignition reminder. For the remaining chime warning functions, the EMIC uses a combination of hard wired inputs, electronic message inputs received from other modules over the PCI data bus, and internal programming. (Refer to 8 - ELECTRICAL/CHIME/BUZZER - OPERATION).

The hard wired chime inputs to the EMIC may be diagnosed using conventional diagnostic methods. However, proper testing of the EMIC programming and the electronic chime request messages received by the EMIC over the PCI data bus requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

ELECTRONIC PINION FACTOR

Each time the EMIC receives an electronic pinion factor request message from the Powertrain Control Module (PCM) over the PCI data bus, it provides a response to the PCM containing the appropriate electronic pinion factor information. Because there are numerous optional combinations of tire size, axle ratio, and transfer case type which are available for this vehicle, the electronic pinion factor needs to be considered for accurate processing of the vehicle speed and distance information. The instrument cluster stores the electronic pinion factor information and broadcasts it over the PCI data bus upon request by the PCM. Using this factor and the Vehicle Speed Sensor (VSS) input, the PCM then calculates the proper vehicle speed and distance information, and transmits the appropriate electronic vehicle speed messages over the PCI data bus for use by other electronic modules in the vehicle.

Proper testing of the PCI data bus and the electronic data bus message inputs to and outputs from the EMIC that control the electronic pinion factor function requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

INTERIOR LIGHTING CONTROL

The EMIC contains an integral timer and logic circuit to perform both timer and control functions for the interior courtesy lamps. The EMIC uses hard wired inputs from the ignition switch, both door ajar switches on separate driver and passenger door ajar switch sense circuits, from the resistor multiplexed panel lamps dimmer circuitry of the left multi-function switch on the panel lamps dimmer signal circuit and its control logic to provide a battery current output to the courtesy lamps on a courtesy lamp feed circuit. The EMIC control provides a theater-type fade-to-off feature that will slowly dim the courtesy lamps about five seconds after both doors are closed.

The EMIC interior lighting control programming provides an illuminated entry/exit feature by monitoring the door ajar and ignition switch inputs. When a door is opened with the ignition switch in the Off position, the EMIC turns on the courtesy lamps. When the ignition switch is turned to the On or Start positions, the EMIC turns the courtesy lamps off immediately with no theater dimming. When the ignition switch is turned from the On position to the Off position, the EMIC turns on the interior lights for about ten seconds or until the ignition switch is again turned to the On or Start positions, whichever occurs first.

The EMIC interior lighting control programming also provides a battery saver feature (load shedding) for the interior lighting. Unless the engine is running, the EMIC will automatically turn off the interior lights if they are left on for more than about twenty minutes, regardless of the status of the ignition switch, door ajar switch, or left multi-function switch inputs to the cluster.

The hard wired inputs and output of the EMIC interior lighting control may be diagnosed using conventional diagnostic methods; however, there are no other diagnostic tools available for the EMIC timer and logic circuitry. If the input and output components and circuits of the interior lighting system test OK, but the system fails to operate as designed, the EMIC must be replaced.

REAR WINDOW DEFOGGER CONTROL

The EMIC contains an integral timer and logic circuit to perform the rear window defogger timer and control functions for the optional rear window defogger system. The EMIC uses a hard wired input from the rear window defogger switch on the rear window defogger switch sense circuit and its control logic to determine the correct output to the rear window defogger relay. The EMIC controls the ground path of the rear window defogger relay control coil through an output on the rear window defogger relay control circuit.

The EMIC is programmed to interpret each momentary ground signal it receives on the rear window defogger switch sense circuit as a request to change the current state of the output on the rear window defogger relay control circuit. Therefore, with the ignition switch in the On position, the first ground input on the rear window defogger switch sense circuit turns the system On, the second ground input turns the system Off, and so forth. Once the rear window defogger system has been turned On, it can be turned off manually by depressing the rear

INSTRUMENT CLUSTER (Continued)

window defogger switch a second time or by turning the ignition switch to the Off position.

The timer function of the EMIC will also automatically turn the rear window defogger system Off. The timer turns the system Off after about ten minutes of operation; however, after the first timed interval has expired, each time the system is turned On again during that same ignition cycle, the timer will automatically turn it Off after about five minutes of operation.

The hard wired input and output of the EMIC rear window defogger control may be diagnosed using conventional diagnostic methods; however, there are no other diagnostic tools available for the EMIC rear window defogger timer and logic circuitry. If the input and output components and circuits of the rear window defogger system test OK, but the system fails to operate as designed, the EMIC must be replaced.

INPUT AND OUTPUT CIRCUITS

HARD WIRED INPUTS

The hard wired inputs to the EMIC include the following:

- **ABS Warning Indicator Driver**
- **Brake Warning Indicator Sense**
- **Driver Door Ajar Switch Sense**
- **Fog Lamp Feed**
- **Front Axle Lock Request (w/Off-Road Package Only)**
- **Front Lock Indicator Switch Sense (w/Off-Road Package Only)**
- **Fused B(+) - Ignition-Off Draw**
- **Fused Ignition Switch Output (Run-Start)**
- **Headlamp Switch Output**
- **High Beam Indicator Driver**
- **Key-In Ignition Switch Sense**
- **Left Turn Signal**
- **Panel Lamps Dimmer Signal**
- **Passenger Door Ajar Switch Sense**
- **Rear Axle Lock Request (w/Off-Road Package Only)**
- **Rear Lock Indicator Switch Sense (w/Off-Road Package Only)**
- **Rear Window Defogger Switch Sense**
- **Right Turn Signal**
- **Seat Belt Switch Sense**
- **4WD Switch Sense (w/o Off-Road Package only)**

Refer to the appropriate wiring information for additional details.

HARD WIRED OUTPUTS

The hard wired outputs of the EMIC include the following:

- **Courtesy Lamp Feed**
- **Axle Lock Switch Enable 1 (w/Off-Road Package Only)**
- **Axle Lock Switch Enable 2 (w/Off-Road Package Only)**
- **Panel Lamp Feed**
- **Rear Window Defogger Relay Control**

Refer to the appropriate wiring information for additional details.

GROUNDS

The EMIC receives a ground path through the following hard wired circuit:

- **Ground - G201**

Refer to the appropriate wiring information for additional details.

COMMUNICATION

The EMIC has the following data bus communication circuit:

- **PCI Data Bus**

Refer to the appropriate wiring information for additional details.

DIAGNOSIS AND TESTING - INSTRUMENT CLUSTER

If all of the instrument cluster gauges and/or indicators are inoperative, refer to PRELIMINARY DIAGNOSIS. If an individual gauge or Programmable Communications Interface (PCI) data bus message-controlled indicator is inoperative, refer to ACTUATOR TEST. If an individual hard wired indicator is inoperative, refer to the diagnosis and testing information for that specific indicator. If the instrument cluster interior lighting control function is inoperative, refer to INTERIOR LIGHTING CONTROL DIAGNOSIS. If the axle locker control is inoperative, refer to AXLE LOCKER CONTROL DIAGNOSIS. If the instrument cluster rear window defogger control function is inoperative, refer to REAR WINDOW DEFOGGER CONTROL DIAGNOSIS.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

INSTRUMENT CLUSTER (Continued)

CAUTION: Instrument clusters used in this model automatically configure themselves for compatibility with the features and optional equipment in the vehicle in which they are initially installed. The instrument cluster is programmed to do this by embedding the Vehicle Identification Number (VIN) and other information critical to proper cluster operation into electronic memory. This embedded information is learned through electronic messages received from other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus, and through certain hard wired inputs received when the cluster is connected to the vehicle electrically. Once configured, the instrument cluster memory may be irreparably damaged and certain irreversible configuration errors may occur if the cluster is connected electrically to another vehicle; or, if an electronic module from another vehicle is connected that provides data to the instrument cluster (including odometer values) that conflicts with that which was previously learned and stored. Therefore, the practice of exchanging (swapping) instrument clusters and other electronic modules in this vehicle with those removed from another vehicle must always be avoided. Failure to observe this caution may result in instrument cluster damage, which is not reimbursable under the terms of the product warranty. Service replacement instrument clusters are provided with the correct VIN, and the certified odometer value embedded into cluster memory, but will otherwise be automatically configured for compatibility with the features and optional equipment in the vehicle in which they are initially installed.

NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated for deactivated for compatibility with certain optional equipment. If the problem being diagnosed involves improper illumination of the airbag indicator, the cruise indicator, or the SKIM indicator when the vehicle does not have this equipment, the instrument cluster must be replaced with a new unit.

PRELIMINARY DIAGNOSIS

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Check the fused B(+) fuse (Fuse 24 - 10 ampere) in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse (Fuse 24 - 10 ampere) in the PDC. If OK, go to Step 3. If not OK, repair the open B(+) circuit between the PDC and the battery as required.

(3) Disconnect and isolate the battery negative cable. Remove the instrument cluster. Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector (Connector C1) for the instrument cluster. If OK, refer to ACTUATOR TEST. If not OK, repair the open fused B(+) circuit between the instrument cluster and the PDC as required.

(4) Check the fused ignition switch output (run-start) fuse (Fuse 10 - 10 ampere) in the fuse block. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(5) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) fuse (Fuse 10 - 10 ampere) in the fuse block. If OK, go to Step 6. If not OK, repair the open fused ignition switch output (run-start) circuit between the fuse block and the ignition switch as required.

(6) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) circuit cavity of the instrument panel wire harness connector (Connector C1) for the instrument cluster. If OK, refer to ACTUATOR TEST. If not OK, repair the open fused ignition switch output (run-start) circuit between the instrument cluster and the fuse block as required.

(7) Check for continuity between the ground circuit cavity of the instrument panel wire harness connector (Connector C1) for the instrument cluster and a good ground. There should be continuity. If OK, refer to ACTUATOR TEST. If not OK, repair the open ground circuit to ground (G201) as required.

INSTRUMENT CLUSTER (Continued)

ACTUATOR TEST

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

The instrument cluster actuator test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges, the PCI data bus message controlled indicators, and the chime tone generator are capable of operating as designed. During the actuator test the instrument cluster circuitry will sound the chime tone generator, position each of the gauge needles at various calibration points, illuminate all of the segments in the Vacuum-Fluorescent Display (VFD) unit, turn all of the PCI data bus message-controlled indicators on and off again, and display messages in the VFD for certain faults that have been set. It is suggested that a note pad and pencil be used to write down any fault information that is displayed during the test for reference.

Successful completion of the actuator test will confirm that the instrument cluster is operational. However, there may still be a problem with the PCI data bus, the Powertrain Control Module (PCM), the Airbag Control Module (ACM), the Sentry Key Immobilizer Module (SKIM), or the inputs to one of these electronic control modules. Use a DRBIII® scan tool to diagnose these components. Refer to the appropriate diagnostic information.

If an individual gauge does not respond properly, or does not respond at all during the actuator test, the instrument cluster should be removed. However, check that the four screws securing the inoperative gauge to the instrument cluster electronic circuit board are properly tightened before considering instrument cluster replacement. If the gauge mounting screws check OK, replace the faulty instrument cluster.

(1) Begin the test with the ignition switch in the Off position.

(2) Depress the odometer/trip odometer switch button.

(3) While still holding the odometer/trip odometer switch button depressed, turn the ignition switch to the On position, but do not start the engine.

(4) Release the odometer/trip odometer switch button.

(5) The instrument cluster will automatically begin the actuator test sequence, as follows:

(a) The cluster will generate a single chime tone to confirm the functionality of the chime tone generator and the chime control circuitry.

(b) The cluster will scroll the number “8” across the odometer/trip odometer VFD to confirm the functionality of all VFD segments and their control circuitry.

(c) The cluster will illuminate the decimal point in the odometer/trip odometer VFD to confirm the functionality of this VFD segment and its control circuitry.

(d) The cluster will display the EMIC software level in the odometer/trip odometer VFD (example: “SOF 8.9”).

(e) The cluster will display the last six digits (sequence number) of the Vehicle Identification Number (VIN) in the odometer/trip odometer VFD.

(f) If any faults have been set by the cluster, the cluster will display the fault information in the odometer/trip odometer VFD INSTRUMENT CLUSTER FAILURE MESSAGE. If no faults have been set, the cluster will scroll “no FAULtS” across the odometer/trip odometer VFD.

(g) The cluster will turn on, then off again each of the following indicators, one at a time, in sequence to confirm the functionality of the indicator and the cluster control circuitry:

- High Beam
- Brake
- Seatbelt
- MIL
- Check Gauges
- Low Fuel
- 4WD
- SKIS
- Cruise
- Upshift

(h) The cluster will sweep the needles for each of the following gauges, one at a time, to several calibration points in sequence to confirm the functionality of the gauge and the cluster control circuitry:

- Speedometer
- Fuel
- Temperature
- Tachometer
- Voltage
- Oil Pressure

INSTRUMENT CLUSTER (Continued)

INSTRUMENT CLUSTER FAILURE MESSAGE

VFD Message	Description	Correction
″buS b0″	PCM - MIL Message	The cluster is not receiving a MIL lamp message from the PCM. A DRBIII® scan tool is required for further diagnosis. Refer to the appropriate diagnostic information.
″buS b1″	SKIM - SKIM Message	The cluster is not receiving a SKIS lamp message from the SKIM. A DRBIII® scan tool is required for further diagnosis. Refer to the appropriate diagnostic information.
″buS b8″	ACM - Airbag Message	The cluster is not receiving an Airbag lamp message from the ACM. A DRBIII® scan tool is required for further diagnosis. Refer to the appropriate diagnostic information.
″PanEL OPEn″	Panel Sense - Open Circuit	The cluster is not receiving an input from the the panel lamps dimmer circuitry of the left multi-function switch on the panel lamps dimmer signal circuit. Repair the open circuit or replace the faulty switch as required.
″Airbag″	Telltale Open/Shorted	The EMIC airbag indicator is open or shorted. Replace the faulty cluster.

(6) The actuator test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test, if the ignition switch is turned to the Off position during the test, or if a vehicle speed message indicating that the vehicle is moving is received from the PCM over the PCI data bus during the test.

(7) Go back to Step 1 to repeat the test, if necessary.

INTERIOR LIGHTING CONTROL DIAGNOSIS

Before performing this test, complete the testing of each of the hard wired interior lighting switches. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Interior Lighting Control function of the instrument cluster requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

(1) Check the door ajar switch output fuse (Fuse 4 - 10 ampere) in the fuse block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for continuity between the door ajar switch output fuse (Fuse 4 - 10 ampere) in the fuse block and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit between the fuse block and ground (G300) as required.

(3) Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the driver and/or passenger door ajar switch from the switch connector receptacle. Check for continuity between the door ajar switch output circuit cavity of the driver or passenger door ajar switch and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open door ajar switch output

INSTRUMENT CLUSTER (Continued)

circuit between the driver or passenger door ajar switch and the fuse block as required.

(4) Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the cluster connector receptacle. Check for continuity between the driver and/or passenger door ajar switch sense circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted driver and/or passenger door ajar switch sense circuits between the instrument cluster and the driver and/or passenger door ajar switches as required.

(5) Check for continuity between the driver and/or passenger door ajar switch sense circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and the body wire harness connector for the driver and/or passenger door ajar switches. There should be continuity. If OK, use a DRBIII® scan tool to complete the diagnosis of the instrument cluster interior lighting control. Refer to the appropriate diagnostic information. If not OK, repair the open driver and/or passenger door ajar switch sense circuits between the instrument cluster and the driver and/or passenger door ajar switches as required.

AXLE LOCKER CONTROL DIAGNOSIS

If the problem being diagnosed involves a rear or front lock indicator in the instrument cluster that is blinking on and off, be certain to complete inspection of the appropriate front or rear axle locker relays, locker pumps, pneumatic lines, locker indicator switches, and axle locker mechanisms before performing the following tests. If the problem being diagnosed involves a rear or front lock indicator in the instrument cluster that stays on when it should be off, or stays off when it should be on, complete the testing of the axle locker switch before performing the following tests.

These tests will establish the integrity of the hard wired circuits related to the axle locker control function of the instrument cluster. However, proper testing of the instrument cluster programming and the electronic vehicle speed and transfer case shift position messages received by the cluster over the PCI data bus requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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(1) Disconnect and isolate the battery negative cable. Remove the rear and front axle locker relays from their receptacles in the Power Distribution Center (PDC). Remove the axle lock switch from the instrument panel. Disconnect the instrument panel wire harness connector for the axle lock switch from the switch connector receptacle. Remove the instrument cluster from the instrument panel.

(2) Check for continuity between each of the rear and front axle lock request circuit cavities of the appropriate instrument panel wire harness connectors (Connector C1 for rear, Connector C2 for front) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted rear or front axle lock request circuit between the instrument cluster, the axle lock switch, and the rear or front axle locker relay as required.

(3) Check for continuity between each of the rear and/or front axle lock request circuit cavities of the instrument panel wire harness connectors (Connector C1 for rear, Connector C2 for front) for the instrument cluster, the instrument panel wire harness connector for the axle lock switch, and the rear or front axle locker relay receptacle in the PDC. In each case, there should be continuity. If OK, go to Step 4. If not OK, repair the open rear and/or front axle lock request circuit between the instrument cluster, the axle lock switch, and the PDC as required.

(4) Check for continuity between the axle lock switch enable 1 and/or enable 2 circuit cavity of the instrument panel wire harness connector (Connector C1 for enable 1, Connector C2 for enable 2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted axle lock switch enable 1 or enable 2 circuit between the instrument cluster and the axle lock switch as required.

(5) Check for continuity between the axle lock switch enable 1 and/or enable 2 circuit cavities of the instrument panel wire harness connector (Connector

INSTRUMENT CLUSTER (Continued)

C1 for enable 1, Connector C2 for enable 2) for the instrument cluster and the instrument panel wire harness connector for the axle lock switch. There should be continuity. If OK, go to Step 6. If not OK, repair the open axle lock switch enable 1 or enable 2 circuit between the instrument cluster and the axle lock switch as required.

(6) Disconnect the rear and/or front locker indicator switch pigtail harness connector from the rear or front axle jumper harness connector. Check for continuity between the ground circuit cavity of the rear or front axle jumper harness connector and a good ground. There should be continuity. If OK, go to Step 7. If not OK, repair the open ground circuit between the rear or front axle jumper harness connector for the rear or front locker indicator switch and ground (G105) as required.

(7) Check for continuity between the ground circuit and the rear or front locker indicator switch sense circuit cavities of the rear or front locker indicator switch pigtail harness connector. There should be continuity with the axle locker engaged, and no continuity with the axle locker disengaged. If OK, go to Step 8. If not OK, replace the faulty rear or front locker indicator switch.

(8) Check for continuity between the rear or front locker indicator switch sense circuit cavity of the rear or front axle jumper harness connector for the locker indicator switch and a good ground. There should be no continuity. If OK, go to Step 9. If not OK, repair the shorted rear or front locker indicator switch sense circuit between the rear or front axle jumper harness connector for the locker indicator switch and the instrument cluster as required.

(9) Check for continuity between the rear or front locker indicator switch sense circuit cavities of the rear or front axle jumper harness connector for the locker indicator switch and the instrument cluster. There should be continuity. If OK, use a DRBIII® scan tool to perform additional testing of the instrument cluster. Refer to the appropriate diagnostic information. If not OK, repair the open rear or front locker indicator switch sense circuit between the rear or front axle jumper harness connector for the locker indicator switch and the instrument cluster as required.

REAR WINDOW DEFOGGER CONTROL DIAGNOSIS

Before performing this test, complete the testing of the rear window defogger switch and the rear window defogger relay. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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(1) Disconnect and isolate the battery negative cable. Remove the rear window defogger relay from the receptacle in the Power Distribution Center (PDC). Disconnect the instrument panel wire harness connector for the rear window defogger switch from the switch connector receptacle. Remove the instrument cluster from the instrument panel.

(2) Check for continuity between the rear window defogger switch sense circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted rear window defogger switch sense circuit between the instrument cluster and the rear window defogger switch as required.

(3) Check for continuity between the rear window defogger switch sense circuit cavities of the instrument panel wire harness connectors for the instrument cluster (Connector C2) and the rear window defogger switch. There should be continuity. If OK, go to Step 4. If not OK, repair the open rear window defogger switch sense circuit between the instrument cluster and the rear window defogger switch as required.

(4) Check for continuity between the rear window defogger relay control circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted rear window defogger relay control circuit between the instrument cluster and the PDC as required.

(5) Check for continuity between the rear window defogger relay control circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and the rear window defogger relay receptacle in the PDC. There should be continuity. If OK, replace the faulty instrument

cluster. If not OK, repair the open rear window defogger relay control circuit between the instrument cluster and the PDC as required.

CLUSTER ILLUMINATION DIAGNOSIS

The diagnosis found here addresses an inoperative instrument cluster illumination lamp condition. If the problem being diagnosed is a single inoperative illumination lamp, be certain that the bulb and bulb holder unit are properly installed in the instrument cluster electronic circuit board. If no installation problems are found replace the faulty bulb and bulb holder unit. If all of the cluster illumination lamps are inoperative and the problem being diagnosed includes inoperative exterior lighting controlled by the left multi-function switch, that system needs to be repaired first. If the exterior lamps controlled by the left multi-function switch are inoperative, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP - DIAGNOSIS AND TESTING). If no exterior lighting system problems are found, the following procedure will help locate a short or open in the cluster illumination lamp circuit. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

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(1) Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the left multi-function switch from the switch connector receptacle. Check for continuity between the ground circuit cavity of the body wire harness connector for the left multi-function switch and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open ground circuit to ground (G300) as required.

(2) Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the cluster connector receptacle. Check for continuity between the panel lamp dimmer signal circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted panel lamp dimmer signal circuit between the instrument cluster and the left multi-function switch as required.

(3) Check for continuity between the panel lamp dimmer signal circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and the body wire harness connector for the left multi-function switch. There should be continuity. If OK, use a DRBIII® scan tool to complete the diagnosis of the instrument cluster illumination lighting. Refer to the appropriate diagnostic information. If not OK, repair the open panel lamp dimmer signal circuit between the instrument cluster and the left multi-function switch as required.

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) Remove the four screws that secure the instrument cluster to the instrument panel structural support (Fig. 4).

(4) Pull the instrument cluster rearward far enough to access and disconnect the two instrument panel wire harness connectors for the instrument cluster from the connector receptacles on the back of the cluster housing.

(5) Remove the instrument cluster from the instrument panel.

INSTRUMENT CLUSTER (Continued)

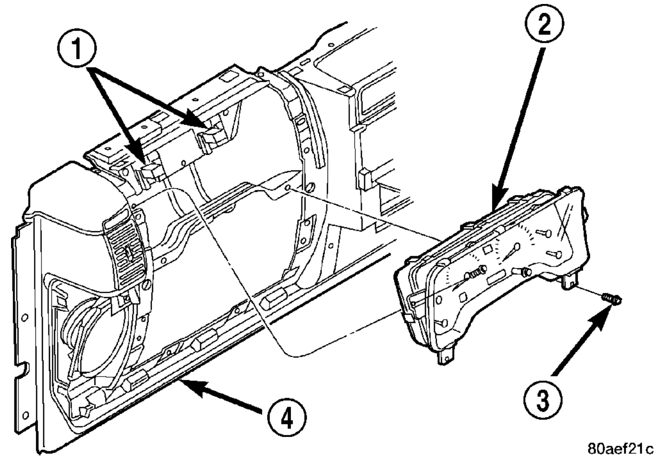

Fig. 4 Instrument Cluster Remove/Install

1 - WIRE HARNESS CONNECTORS
2 - INSTRUMENT CLUSTER
3 - SCREW (4)
4 - INSTRUMENT PANEL

DISASSEMBLY

Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include: the incandescent instrument cluster indicator and illumination lamp bulbs (including the integral bulb holders), the cluster lens, the trip odometer reset button boot, the cluster hood and mask unit, and the cluster housing rear cover. Following are the procedures for disassembling these components from the instrument cluster unit.

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CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator bulb and bulb holder units. However, the illumination lamps and the indicators use different bulb and bulb holder unit sizes. They must never be interchanged.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Turn the bulb holder counterclockwise about sixty degrees on the cluster electronic circuit board (Fig. 5).

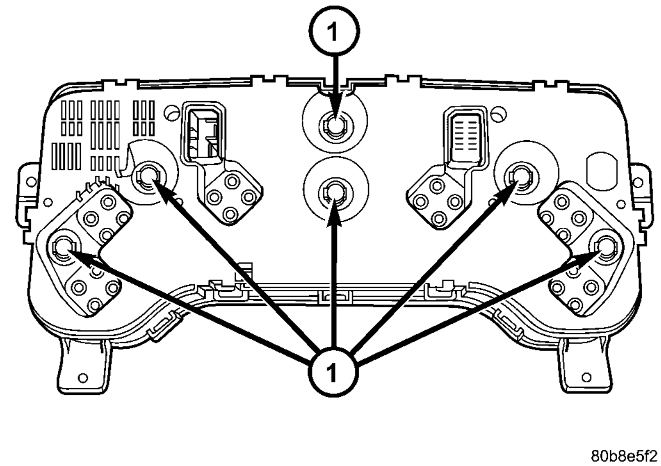

Fig. 5 Cluster Bulb Locations

1 - CLUSTER INCANDESCENT BULBS

(4) Pull the bulb and bulb holder unit straight back to remove it from the bulb mounting hole in the cluster electronic circuit board.

CLUSTER LENS

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Work around the perimeter of the cluster lens and disengage each of the eight latches that secure the lens to the cluster mask and the cluster housing (Fig. 6).

(4) Gently pull the cluster lens away from the face of the instrument cluster.

TRIP ODOMETER RESET BUTTON BOOT

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Remove the cluster lens from the cluster housing. Refer to CLUSTER LENS.

(4) Remove the odometer reset button boot by pulling it straight out of the pocketed hole from the face of the cluster lens (Fig. 6).

INSTRUMENT CLUSTER (Continued)

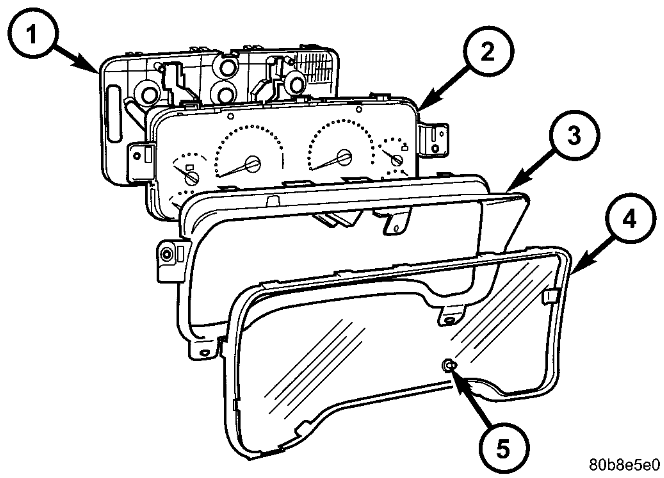

Fig. 6 Instrument Cluster Components

1 - REAR COVER
2 - CLUSTER HOUSING
3 - CLUSTER HOOD & MASK
4 - CLUSTER LENS
5 - SWITCH BUTTON BOOT

CLUSTER HOOD AND MASK

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Remove the cluster lens from the cluster housing. Refer to CLUSTER LENS.

(4) Work around the perimeter of the cluster hood and mask unit and disengage each of the five latches that secure the cluster hood and mask unit to the cluster housing (Fig. 6).

(5) Gently pull the cluster hood and mask unit away from the face of the instrument cluster housing.

CLUSTER HOUSING REAR COVER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Remove the screw adjacent to each of the two cluster connector receptacles that secure the rear cover to the cluster housing.

(4) Work around the perimeter of the cluster housing rear cover and disengage each of the eight latches that secure the cover to the outside of the cluster housing (Fig. 6).

(5) Disengage the one inboard latch located in a receptacle near the lower edge of the rear cover just to the right of center that secures the rear cover to the cluster housing.

(6) Gently pull the cluster housing rear cover away from the back of the cluster housing.

ASSEMBLY

Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include: the incandescent instrument cluster indicator and illumination lamp bulbs (including the integral bulb holders), the cluster lens, the trip odometer reset button boot, the cluster hood and mask unit, and the cluster housing rear cover. Following are the procedures for disassembling these components from the instrument cluster unit.

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CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator bulb and bulb holder units. However, the illumination lamps and the indicators use different bulb and bulb holder unit sizes. They must never be interchanged.

CAUTION: Be certain that any bulb and bulb holder unit removed from the cluster electronic circuit board is reinstalled in the correct position. Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

(1) Insert the bulb and bulb holder unit straight into the correct bulb mounting hole in the cluster electronic circuit board (Fig. 5).

(2) With the bulb holder fully seated against the cluster electronic circuit board, turn the bulb holder clockwise about sixty degrees to lock it into place.

(3) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(4) Reconnect the battery negative cable.

INSTRUMENT CLUSTER (Continued)

CLUSTER LENS

(1) Position the cluster lens over the cluster hood and mask unit on the face of the instrument cluster (Fig. 6). Be certain that the trip odometer reset switch button is aligned with and inserted into the reset button boot in the lens.

(2) Press firmly and evenly on the cluster lens to install it onto the instrument cluster housing.

(3) Work around the perimeter of the cluster lens making certain that each of the eight latches that secure the lens to the cluster mask and the cluster housing is fully engaged.

(4) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(5) Reconnect the battery negative cable.

TRIP ODOMETER RESET BUTTON BOOT

(1) Position the trip odometer reset button boot into the pocketed mounting hole from the back of the cluster lens (Fig. 6).

(2) Gently pull the tip of the trip odometer reset button boot from the face of the cluster lens until it is fully seated in the pocketed mounting hole.

(3) Reinstall the cluster lens onto the cluster housing. Refer to CLUSTER LENS.

(4) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(5) Reconnect the battery negative cable.

CLUSTER HOOD AND MASK

(1) Align the cluster hood and mask unit with the face of the instrument cluster housing (Fig. 6).

(2) Press firmly and evenly on the cluster hood and mask unit to install it onto the cluster housing.

(3) Work around the perimeter of the cluster hood and mask unit making certain that each of the five latches that secure the hood and mask unit to the instrument cluster housing is fully engaged.

(4) Reinstall the cluster lens onto the cluster housing. Refer to CLUSTER LENS.

(5) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(6) Reconnect the battery negative cable.

CLUSTER HOUSING REAR COVER

(1) Position the cluster housing rear cover to the back of the instrument cluster housing.

(2) Press firmly and evenly on the cluster housing rear cover to install it onto the back of the instrument cluster housing.

(3) Work around the perimeter of the cluster housing rear cover making certain that each of the eight latches that secure the rear cover to the instrument cluster housing is fully engaged.

(4) Install and tighten the two screws that secures the rear cover to the instrument cluster housing adjacent to each cluster connector receptacle. Tighten the screws to 2 N·m (20 in. lbs.).

(5) Reinstall the instrument cluster onto the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(6) Reconnect the battery negative cable.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Position the instrument cluster to the instrument panel.

(2) Reconnect the two instrument panel wire harness connectors for the cluster to the connector receptacles on the back of the cluster housing (Fig. 4).

(3) Position the instrument cluster into the instrument panel structural support.

(4) Install and tighten the four screws that secure the instrument cluster to the instrument panel structural support. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(6) Reconnect the battery negative cable.

NOTE: Certain indicators in this instrument cluster are automatically configured. This feature allows those indicators to be activated for deactivated for compatibility with certain optional equipment. If the problem being diagnosed involves improper illumination of the airbag indicator, the cruise indicator, or the SKIM indicator when the vehicle does not have this equipment, the instrument cluster must be replaced with a new unit.

ABS INDICATOR

DESCRIPTION

Fig. 7 ABS Indicator

An Antilock Brake System (ABS) indicator is standard equipment on all instrument clusters (Fig. 7). However, this indicator is only functional on vehicles equipped with the ABS option. The ABS indicator is located near the lower edge of the instrument cluster, to the left of center. The ABS indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Failure of Anti-lock Braking System” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The ABS indicator is serviced as a unit with the instrument cluster.

OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS system is faulty or inoperative. This indicator is hard wired on the instrument cluster electronic circuit board, and is completely controlled by the Controller Antilock Brake (CAB). The ABS indicator Light Emitting Diode (LED) receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions; therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the CAB through the CAB relay in the Power Distribution Center (PDC). The CAB will turn on the ABS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ABS indicator is illuminated by the cluster for about two seconds as a bulb test.
- **ABS Self-Test Fault** - Each time the CAB detects a fault in a monitored ABS circuit, the ABS indicator will be illuminated. The indicator remains illuminated until the fault condition is corrected, or until the ignition switch is turned to the Off position, whichever occurs first.
- **ABS Diagnostic Test** - The ABS indicator is blinked on and off by the CAB during the performance of the ABS diagnostic tests.

The CAB continually monitors the ABS circuits and sensors to decide whether the system is in good operating condition. If the CAB turns the ABS indicator on after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. (Refer to 5 - BRAKES - DESCRIPTION). The ABS indicator can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - ABS INDICATOR

The diagnosis found here addresses an inoperative Antilock Brake System (ABS) indicator condition. If there are problems with several indicators in the instrument cluster, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the ABS indicator stays on with the ignition switch in the On position or comes on and stays on while driving, proceed to the diagnosis for the ABS brake system. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no ABS problem is found, the following procedure will help to locate a short or open in the ABS warning indicator driver circuit. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the connector receptacle on the back of the cluster housing. Reconnect the battery negative cable. Turn the ignition switch to the On

ABS INDICATOR (Continued)

position and within about two seconds check for continuity between the ABS warning indicator driver circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be continuity for about two seconds after ignition On, and then an open circuit. If OK, proceed to the diagnosis for the ABS brake system. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If not OK, go to Step 2.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the Controller Antilock Brake (CAB) relay from the Power Distribution Center (PDC). Check for continuity between the ABS warning indicator driver circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted ABS warning indicator driver circuit between the instrument cluster and the PDC as required.

(3) Check for continuity between the ABS warning indicator driver circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and the CAB relay receptacle in the PDC. There should be continuity. If OK, proceed to the diagnosis for the ABS brake system. (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If not OK, repair the open ABS warning indicator driver circuit between the instrument cluster and the PDC as required.

AIRBAG INDICATOR

DESCRIPTION

Fig. 8 Airbag Indicator

An airbag indicator is standard equipment on all instrument clusters (Fig. 8). However, the instrument cluster can be programmed to disable this indicator on vehicles that are not equipped with the airbag system, which is not available in some markets. The airbag indicator is located near the lower edge of the instrument cluster, to the right of center. The airbag indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Airbag” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The airbag indicator is serviced as a unit with the instrument cluster.

OPERATION

The airbag indicator gives an indication to the vehicle operator when the airbag system is faulty or inoperative. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Airbag Control Module (ACM) over the Programmable Communications Interface (PCI) data bus. The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the airbag indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the airbag indicator is illuminated for about seven seconds. The first two seconds is the cluster bulb test function, and the remainder is the ACM bulb test function.
- **ACM Lamp-On Message** - Each time the cluster receives a lamp-on message from the ACM, the airbag indicator will be illuminated. The indicator remains illuminated for about twelve seconds or until the cluster receives a lamp-off message from the ACM, whichever is longer.
- **Communication Error** - If the cluster receives no airbag messages for five consecutive seconds, the airbag indicator is illuminated. The indicator remains illuminated until the cluster receives a single lamp-off message from the ACM.
- **Actuator Test** - Each time the cluster is put through the actuator test, the airbag indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry. The actuator test illumination of the airbag indicator is a function of the ACM.

The ACM continually monitors the airbag system circuits and sensors to decide whether the system is in good operating condition. The ACM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the ACM sends a lamp-on message after the bulb test, it indicates that the ACM has detected a system malfunction and/or that the airbags may not deploy when required, or may deploy

AIRBAG INDICATOR (Continued)

when not required. The ACM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. Each time the airbag indicator fails to illuminate due to an open or short in the cluster airbag indicator circuit, the cluster sends a message notifying the ACM of the condition and stores a DTC. For proper diagnosis of the airbag system, the ACM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the airbag indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

BRAKE/PARK BRAKE INDICATOR

DESCRIPTION

BRAKE

Fig. 9 Brake Indicator

A brake indicator is standard equipment on all instrument clusters (Fig. 9). The brake indicator is located near the lower edge of the instrument cluster, to the left of center. The brake indicator consists of a stencil-like cutout of the word “BRAKE” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “BRAKE” text to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The brake indicator is serviced as a unit with the instrument cluster.

OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, or when there are certain brake hydraulic system malfunctions. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming, electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus, and hard wired inputs to the instrument cluster from the park brake switch and the brake warning indicator switch. The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The cluster can illuminate the LED solid, or flash it on and off at about one flash per second. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake indicator is illuminated by the instrument cluster for about four seconds as a bulb test.
- **Park Brake Switch Input** - Each time the cluster detects ground on the red brake warning indicator driver circuit (park brake switch closed = park brake applied or not fully released) the brake indicator is illuminated solid. If a vehicle speed message is received by the cluster from the PCM over the PCI data bus indicating the vehicle is moving while the red brake warning indicator driver input is grounded, the brake indicator is flashed on and off repeatedly. Whether illuminated solid or flashing, the indicator remains illuminated until the red brake warning indicator driver input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Brake Hydraulic System Malfunction** - Each time the cluster detects ground on the red brake warning indicator driver circuit (brake warning indicator switch closed = pressures in the two halves of the split brake hydraulic system are unequal) the brake indicator is illuminated solid. The indicator remains illuminated until the red brake warning indicator driver input to the cluster is an open circuit (brake warning indicator switch open = brake hydraulic system pressures are equal), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the instrument cluster is put through the actuator test, the brake indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The park brake switch and the brake warning pressure switch are each connected in parallel between ground and the red brake warning indicator driver input to the instrument cluster so that each of their inputs will illuminate the indicator independently of the other. The park brake switch and brake warning indicator switch inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. (Refer to 5 - BRAKES/PARKING BRAKE - OPERATION). (Refer to 5 - BRAKES/ELECTRICAL/BRAKE PRESSURE SWITCH - OPERATION).

BRAKE/PARK BRAKE INDICATOR (Continued)

For further diagnosis of the brake indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the PCM, the PCI data bus, or the message inputs to the instrument cluster that control the brake indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - BRAKE INDICATOR

The diagnosis found here addresses an inoperative brake indicator condition. If there are problems with several indicators in the instrument cluster, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the brake indicator stays on with the ignition switch in the On position and the park brake released, or comes on while driving, (Refer to 5 - BRAKES - DIAGNOSIS AND TESTING). If no brake system problem is found, the following procedures will help to locate a shorted or open circuit, or a faulty switch input. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

INDICATOR ILLUMINATES DURING BULB TEST, BUT DOES NOT WHEN PARK BRAKE APPLIED

(1) Disconnect and isolate the battery negative cable. Disconnect the floor wire harness connector for the park brake switch from the switch terminal. Apply the parking brake. Check for continuity between the park brake switch terminal and a good ground. There should be continuity. If OK, go to Step 2. If not OK, replace the faulty park brake switch.

(2) Disconnect the headlamp and dash wire harness connector for the brake warning indicator switch from the switch terminals. Check for continuity between the red brake warning indicator driver (G9) circuit cavities of the floor wire harness connector for the park brake switch and the headlamp and dash wire harness connector for the brake warning indicator switch. There should be continuity. If not OK, repair the open red brake warning indicator driver (G9) circuit between the park brake switch and the brake warning indicator switch as required.

INDICATOR REMAINS ILLUMINATED - BRAKE SYSTEM CHECKS OK

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the connector receptacle on the back of the cluster housing. Disconnect the headlamp and dash wire harness connector for the brake warning indicator switch from the switch terminals. Check for continuity between the red brake warning indicator driver circuit (G99) cavity of the headlamp and dash wire harness connector for the brake warning indicator switch and a good ground. There should be no continuity. If OK, go to Step 2. If not OK, repair the shorted red brake warning indicator driver circuit (G99) between the brake warning indicator switch and the instrument cluster as required.

(2) Disconnect the floor wire harness connector for the park brake switch from the switch terminal. Check for continuity between the red brake warning indicator driver circuit (G9) cavity of the headlamp and dash wire harness connector for the brake warning indicator switch and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted red brake warning indicator driver circuit (G9) between the brake warning indicator switch and the park brake switch as required.

(3) Check for continuity between each of the two terminals of the brake warning indicator switch and a good ground. In each case, there should be no continuity. If OK, go to Step 4. If not OK, replace the faulty brake warning indicator switch.

(4) Check for continuity between the terminal of the park brake switch and a good ground. There should be no continuity with the park brake released, and continuity with the park brake applied. If not OK, replace the faulty park brake switch.

CHECK GAUGES INDICATOR

DESCRIPTION

Fig. 10 Check Gauges Indicator

A check gauges indicator is standard equipment on all instrument clusters (Fig. 10). The check gauges indicator is located on the lower edge of the instrument cluster, to the right of center. The check gauges indicator consists of a stencil-like cutout of the words “CHECK GAUGES” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “CHECK GAUGES” text to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The check gauges indicator is serviced as a unit with the instrument cluster.

OPERATION

The check gauges indicator gives an indication to the vehicle operator when certain instrument cluster gauge readings reflect a condition requiring immediate attention. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The check gauges indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the check gauges indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the check gauges indicator is illuminated for about two seconds as a bulb test.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is about 127° C (261° F) or higher, the check gauges indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine temperature is about 124° C (255° F) or lower, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Engine Oil Pressure Low Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure of a 2.4L engine is below about 0.2 kg/cm^2 (3 psi), or of any engine other than a 2.4L is below about 0.4 kg/cm^2 (6 psi), the check gauges indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine oil pressure of a 2.4L engine is above about 0.2 kg/cm^2 (3 psi), or of any engine other than a 2.4L is above about 0.4 kg/cm^2 (6 psi), or until the ignition switch is turned to the Off position, whichever occurs first. The cluster will only turn the indicator on in response to an engine oil pressure low message if the engine speed is 300 rpm or greater for more than about five seconds.
- **System Voltage Low (Charge Fail) Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is about 9.0 volts or lower (charge fail condition), the check gauges indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is greater than about 12.0 volts (but less than 16.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **System Voltage High Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is greater than about 16.0 volts, the check gauges indicator will be illuminated. The indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is less than about 16.0 volts (but higher than 9.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the check gauges indicator will be turned on, then off again during the bulb check portion of the test in order to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine temperature, oil pressure, and electrical system voltage, then sends the proper messages to the instrument cluster. For further diagnosis of the check gauges indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the check gauges indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CRUISE INDICATOR

DESCRIPTION

CRUISE

Fig. 11 Cruise Indicator

A cruise indicator is standard equipment on all instrument clusters (Fig. 11). However, on vehicles not equipped with the optional speed control system, this indicator is electronically disabled. The cruise indicator is located near the upper edge of the instrument cluster, to the left of center. The cruise indicator consists of a stencil-like cutout of the word “CRUISE” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “CRUISE” text to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The illumination intensity of the cruise indicator is one-step dimmable. When the exterior lighting is turned On, the indicator is dimmed; and, when the exterior lighting is turned Off, the indicator is illuminated at full intensity. The cruise indicator is serviced as a unit with the instrument cluster.

OPERATION

The cruise indicator gives an indication to the vehicle operator when the speed control system is turned On, regardless of whether the speed control is engaged. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The cruise indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the cruise indicator for the following reasons:

- **Cruise Lamp-On Message** - Each time the cluster receives a cruise lamp-on message from the PCM indicating the speed control system has been turned On, the cruise indicator is illuminated. The indicator remains illuminated until the cluster receives a cruise lamp-off message from the PCM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the cruise indicator will be turned on, then off again during the bulb check portion of the test in order to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the speed control switches to determine the proper outputs to the speed control servo. The PCM then sends the proper cruise indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the cruise indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the speed control system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the cruise indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE GAUGE

DESCRIPTION

Fig. 12 Engine Coolant Temperature Icon

An engine coolant temperature gauge is standard equipment on all instrument clusters. The engine coolant temperature gauge is located in the lower right quadrant of the instrument cluster, below the oil pressure gauge. The engine coolant temperature gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from 40° C (or 100° F) to 125° C (or 260° F). An International Control and Display Symbol icon for “Engine Coolant Temperature” is located on the cluster overlay, directly above the hub of the gauge needle (Fig. 12). The engine coolant temperature gauge graphics are white and blue against a black field except for a single red graduation at the high end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white, the blue graphics appear blue, and the red graphics appear red. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The engine coolant temperature gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is between about 40° C (100° F) and 124° C (255° F), the gauge needle is moved to the actual relative temperature position on the gauge scale.
- **Engine Temperature Low Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is at or below about 40° C (100° F), the gauge needle is held at the 40° C (100° F) graduation at the far left end of the gauge scale. The gauge needle remains at the left end of the gauge scale until the cluster receives a message from the PCM indicating that the engine temperature is above about 40° C (100° F), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Engine Temperature High Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is above about 127° C (261° F), the gauge needle is moved into the red zone at the far right end of the gauge scale, the check gauges indicator is illuminated, and a single chime tone is sounded. The gauge needle remains in the red zone and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine temperature is below about 124° C (255° F), or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will occur only once per ignition cycle.
- **Engine Temperature Critical Message** - Each time the cluster receives a message from the PCM indicating the engine coolant temperature is above about 129° C (264° F), the gauge needle is moved to the far right end of the red zone on the gauge scale. The gauge needle remains at the far right end of the red zone until the cluster receives a message from the PCM indicating that the engine temperature is below about 127° C (261° F), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive an engine temperature message, it will hold the gauge needle at the last indication about twelve seconds or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, the cluster will move the gauge needle to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The PCM then sends the proper engine coolant temperature messages to the instrument cluster. For further diagnosis of the engine coolant temperature gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the check gauges indicator due to a high or critical engine temperature gauge reading, it may indicate that the engine or the engine cooling system requires service. For proper diagnosis of the engine coolant temperature sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the engine coolant temperature gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

FOG LAMP INDICATOR

DESCRIPTION

Fig. 13 Fog Lamp Indicator

A fog lamp indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional front and/or rear fog lamps (Fig. 13). The fog lamp indicator is located near the upper edge of the instrument cluster, to the left of center. The fog lamp indicator consists of a

FOG LAMP INDICATOR (Continued)

stencil-like cutout of the International Control and Display Symbol icon for “Fog Lamps” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A green Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The fog lamp indicator is serviced as a unit with the instrument cluster.

OPERATION

The fog lamp indicator gives an indication to the vehicle operator whenever the optional front and/or rear fog lamps are illuminated. The availability of the front fog lamps, or rear fog lamps options varies by the market for which the vehicle is manufactured. This indicator is controlled by a hard wired input to the cluster from the fog lamp switch circuitry of the left multi-function switch. The fog lamp indicator Light Emitting Diode (LED) is grounded on the instrument cluster electronic circuit board at all times. Therefore, the LED will be on any time the front or rear fog lamps are illuminated, regardless of the ignition switch position. The LED only illuminates when it is provided battery current by the fog lamp switch circuitry of the left multi-function switch.

The fog lamp switch circuitry of the left multi-function switch is connected in series between a fused B(+) fuse in the Power Distribution Center (PDC) and the front or rear fog lamp feed input to the instrument cluster through the fog lamp relay, which is also in the PDC. The fog lamp switch input to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the fog lamp switch and circuits, (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ LEFT MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING).

DIAGNOSIS AND TESTING - FRONT/REAR FOG LAMP INDICATOR

The diagnosis found here addresses an inoperative front/rear fog lamp indicator condition. Before beginning this test, confirm the functionality of the front or rear fog lamp system. If no fog lamp system problem is found, the following procedure will help to locate an open in the front or rear fog lamp feed circuit between the fog lamp relay and the instrument cluster. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C1) for the instrument cluster from the connector receptacle on the back of the cluster housing.

(2) Reconnect the battery negative cable. Turn the fog lamps on by pulling out the control knob on the end of the left-multi-function switch control stalk. Check for battery voltage at the front/rear fog lamp feed circuit cavity of the instrument panel wire harness connector (Connector C1) for the instrument cluster. If OK, replace the faulty instrument cluster. If not OK, repair the open front/rear fog lamp feed circuit between the fog lamp relay and the instrument cluster as required.

FRONT LOCK INDICATOR

DESCRIPTION

**FRONT
LOCK**

Fig. 14 Front Lock Indicator

A front lock indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional off-road package (Fig. 14). The front lock indicator is located near the upper edge of the instrument cluster, to the right of center. The front lock indicator consists of a stencil-like cutout of the words “FRONT LOCK” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A amber

FRONT LOCK INDICATOR (Continued)

Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “FRONT LOCK” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The illumination intensity of the front lock indicator is one-step dimmable. When the exterior lighting is turned On, the indicator is dimmed; and, when the exterior lighting is turned Off, the indicator is illuminated at full intensity. The front lock indicator is serviced as a unit with the instrument cluster.

OPERATION

The front lock indicator gives an indication to the vehicle operator of the status of the locker mechanism in the front axle of vehicles equipped with the optional off-road package. The front lock indicator can also give an indication when certain faults are detected in the axle locker system. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming, and hard wired inputs to the cluster from the key-in ignition switch, the axle lock switch, and the front locker indicator switch. The front lock indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The cluster can illuminate the LED solid, or flash it on and off at two different rates, slow or fast. The slow rate is about one flash per second, while the fast rate is about two flashes per second. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the front lock indicator for the following reasons:

- **Front Axle Lock Request Input** - Each time the cluster detects ground on the front axle lock request circuit from the axle lock switch (front axle lock request circuit ground = front axle lock request active) while the key is in the ignition lock cylinder, the front lock indicator flashes on and off at a slow rate. The indicator continues to flash until the front axle lock request input to the cluster is an open circuit (front axle lock request circuit open = front axle lock request inactive), or until the cluster detects a change in the inputs from the front locker indicator switch or the key-in ignition switch, whichever occurs first.
- **Front Locker Indicator Switch Input** - Each time the cluster detects ground on the front locker indicator switch sense circuit (front locker indicator switch closed = front axle locker engaged) while the front axle lock request is active and the key is in the ignition lock cylinder, the front lock indicator is illuminated solid. The indicator remains illuminated solid until the front locker indicator switch input to the cluster is an open circuit (front locker indicator switch open = front axle locker disengaged), or until the cluster detects a change in the inputs from the axle lock switch or the key-in ignition switch, whichever occurs first.
- **Front Lock Request/Feedback Mismatch** - Each time the cluster detects that the inputs from the axle lock switch (request) on the front axle lock request circuit and from the front locker indicator switch (feedback) on the front locker indicator switch sense circuit are mismatched, the front lock indicator flashes on and off at a slow rate. This condition occurs when the lock request is active but the axle locker remains disengaged, or when the lock request is inactive but the axle locker remains engaged. The indicator continues to flash until the request and the feedback are matching.
- **Key-In Ignition Switch Input** - Each time the cluster detects that the key has been removed from the ignition lock cylinder (key-in ignition switch open = key is not in ignition switch) while the front axle lock request is still active, the front lock indicator flashes at a fast rate and three chime tones are sounded. The indicator will continue to flash at this rate until the key is replaced in the ignition lock cylinder (key-in ignition switch closed = key is in ignition switch) while the front axle lock request is still active, or until the front axle lock request input is deactivated, whichever occurs first.

The axle lock switch in the accessory switch bezel on the instrument panel provides a hard wired ground input to the instrument cluster circuitry through the front axle lock request circuit whenever the switch is enabled and the rear and front axle lock position of the switch is selected by the vehicle operator. The front locker indicator switch on the front axle housing provides a hard wired ground input to the instrument cluster whenever the front axle locker mechanism is engaged. The key-in ignition switch integral to the ignition switch provides a hard wired ground input to the instrument cluster whenever a key is present in the ignition lock cylinder. Each of these inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For further diagnosis of the instrument cluster circuitry that controls the front lock indicator LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

FUEL GAUGE

DESCRIPTION

Fig. 15 Fuel Gauge Icon

A fuel gauge is standard equipment on all instrument clusters. The fuel gauge is located in the lower left quadrant of the instrument cluster, below the voltage gauge. The fuel gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from “E” (or Empty) to “F” (or Full). An International Control and Display Symbol icon for “Fuel” is located on the cluster overlay, in the center of the gauge directly above the hub of the gauge needle (Fig. 15). An arrowhead pointed toward the left side of the vehicle is imprinted on the cluster overlay next to the “Fuel” icon in the fuel gauge to provide the driver with a reminder as to the location of the fuel filler access. The fuel gauge graphics are white and blue against a black field except for a single red graduation at the low end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white, the blue graphics appear blue, and the red graphics appear red. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The fuel gauge is serviced as a unit with the instrument cluster.

OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The fuel gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating the percent tank full, the cluster programming applies an algorithm to calculate the proper gauge needle position, then moves the gauge needle to the proper relative position on the gauge scale. The algorithm is used to dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate inputs from the fuel tank sending unit to the PCM.
- **Less Than 12.5 Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating that the percent tank full is less than about 12.5 (one-eighth), the gauge needle is moved to the proper position on the gauge scale, the low fuel indicator is illuminated, and a single chime tone is sounded. The low fuel indicator remains illuminated until the cluster receives messages from the PCM for a continuous twenty seconds indicating that the percent tank full has increased by more than 0.625 gallons or until the ignition switch is turned to the Off position, whichever occurs first. The chime tone feature will occur only once per ignition cycle.
- **Less Than Empty Percent Tank Full Message -** Each time the cluster receives a message from the PCM indicating that the percent tank full is less than empty, the gauge needle is moved to the far left end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the gauge needle is moved to the far left end of the gauge scale and the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is an open circuit.
- **Communication Error -** If the cluster fails to receive a percent tank full message, it will hold the gauge needle at the last indication about twelve seconds or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, the cluster will move the gauge needle to the left end of the gauge scale and the low fuel indicator is illuminated immediately.
- **Actuator Test -** Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the fuel tank sending unit to determine the level of the fuel in the fuel

FUEL GAUGE (Continued)

tank. The PCM then sends the proper fuel level messages to the instrument cluster. For further diagnosis of the fuel gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the fuel tank sending unit, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the fuel gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

HIGH BEAM INDICATOR

DESCRIPTION

Fig. 16 High Beam Indicator

A high beam indicator is standard equipment on all instrument clusters (Fig. 16). The high beam indicator is located near the upper edge of the instrument cluster, between the tachometer and the speedometer. The high beam indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “High Beam” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A blue lens behind the cutout in the opaque layer of the overlay causes the icon to appear in blue through the translucent outer layer of the overlay when the indicator is illuminated from behind by a replaceable incandescent bulb and bulb holder unit, which is located on the instrument cluster electronic circuit board. The high beam indicator is serviced as a unit with the instrument cluster.

OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated, or when the exterior lamps are inadvertently left On. This indicator is controlled by a hard wired input to the cluster from the headlamp beam select switch circuitry of the left multi-function switch, and by the instrument cluster circuit board based upon cluster programming based upon hard wired inputs from the head/park/fog lamp switch circuitry of the left multi-function switch, from the driver door ajar switch, and from the ignition switch. The high beam indicator bulb is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the bulb can be illuminated regardless of the ignition switch position. The bulb only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the high beam indicator for the following reasons:

- **Beam Select Switch Input** - Each time the cluster detects battery current on the beam select switch sense circuit (beam select switch closed = high beams selected or optical horn feature activated) the high beam indicator will be illuminated solid. This input can occur when the headlamp high beams are selected or when the optical horn feature is activated. The indicator remains illuminated until the beam select switch sense input to the cluster is an open circuit (beam select switch open = high beams not selected and optical horn feature not activated), or until the exterior lighting is turned off, whichever occurs first.
- **Exterior Lamps-On Optical Warning** - Each time the cluster detects battery current on the headlamp switch output circuit (park or head lamp switch closed = exterior lighting is On), ground on the driver door ajar switch sense circuit (driver door ajar switch closed = driver door is open), and the fused ignition switch output (run-start) input is an open circuit (ignition switch is in a position other than On or Start), the high beam indicator will be flashed on and off repeatedly. The indicator will continue to flash until the exterior lighting is turned Off, until the driver door is closed, or until the ignition switch is turned to the On or Start positions, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the high beam indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the bulb and the cluster control circuitry.

The instrument cluster continually monitors the headlamp beam select switch and circuitry integral to the left multi-function switch, the driver door ajar switch, and the ignition switch and turns the high beam indicator on or off accordingly. For further diagnosis of the high beam indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). The left multi-function switch, driver door ajar switch, and ignition switch inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - HIGH BEAM INDICATOR

The diagnosis found here addresses an inoperative high beam indicator condition. Before beginning this test, confirm the functionality of the high beam indi-

HIGH BEAM INDICATOR (Continued)

cator bulb and the cluster control circuitry by performing the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the high beam indicator fails to illuminate during the actuator test, replace the indicator bulb and bulb holder with a known good unit and repeat the test. If the indicator still fails to illuminate, replace the faulty instrument cluster. If the problem being diagnosed is related to inoperative headlamp high beams, be certain to repair the headlamp system circuits and switches before attempting to diagnose or repair the high beam indicator. If no headlamp system problems are found and the high beam indicator illuminates during the instrument cluster actuator test, the following procedure will help locate an open in the high beam indicator driver circuit. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C1) for the instrument cluster from the connector receptacle on the back of the cluster housing.

(2) Reconnect the battery negative cable. Turn the headlamps On and select the headlamp high beams with the left multi-function switch control stalk. Check for battery voltage at the high beam indicator driver circuit cavity of the instrument panel wire harness connector (Connector C1) for the instrument cluster. If OK, replace the faulty instrument cluster. If not OK, repair the open high beam indicator driver circuit between the instrument cluster and the left multi-function switch as required.

LOW FUEL INDICATOR

DESCRIPTION

Fig. 17 Low Fuel Indicator

A low fuel indicator is standard equipment on all instrument clusters (Fig. 17). The low fuel indicator is located near the lower edge of the instrument cluster, to the left of center. The low fuel indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Fuel” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The low fuel indicator is serviced as a unit with the instrument cluster.

OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The low fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the indicator is illuminated for about two seconds as a bulb test.
- **Less Than 12.5 Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating that the percent tank full is less than 12.5 (one-eighth), the low fuel indicator is illuminated and a single chime tone is sounded. The low fuel indicator remains illuminated until the cluster receives messages from the PCM for a continuous twenty seconds indicating that the percent tank full

LOW FUEL INDICATOR (Continued)

has increased by more than 0.625 gallons or until the ignition switch is turned to the Off position, whichever occurs first. This strategy is intended to reduce the effect that fuel sloshing within the fuel tank can have on reliable indications. The chime tone feature will occur only once per ignition cycle.

- **Less Than Empty Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is less than empty, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is a short circuit.
- **More Than Full Percent Tank Full Message** - Each time the cluster receives a message from the PCM indicating the percent tank full is more than full, the low fuel indicator is illuminated immediately. This message would indicate that the fuel tank sender input to the PCM is an open circuit.
- **Actuator Test** - Each time the cluster is put through the actuator test, the low fuel indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the fuel tank sending unit to determine the level of fuel in the fuel tank. The PCM then sends the proper fuel level messages to the instrument cluster. For further diagnosis of the low fuel indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the fuel tank sending unit, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the low fuel indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

Fig. 18 Malfunction Indicator Lamp (MIL)

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters (Fig. 18). The MIL is located near the lower edge of the instrument cluster, to the right of center. The MIL consists of a stencil-like cutout of the International Control and Display Symbol icon for “Engine” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The MIL is serviced as a unit with the instrument cluster.

OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Powertrain Control Module (PCM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. The MIL is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the PCM over the Programmable Communications Interface (PCI) data bus. The MIL Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the indicator is illuminated for about seven seconds as a bulb test. The entire two seven second bulb test is a function of the PCM.
- **MIL Lamp-On Message** - Each time the cluster receives a MIL lamp-on message from the PCM, the indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the PCM message. For some DTC’s, if a problem does not recur, the PCM will send a lamp-off message automatically. Other DTC’s may require that a fault be repaired and the PCM be reset before a lamp-off message will be sent. For more information on the PCM and the DTC set and reset parameters, (Refer to 25 - EMISSIONS CONTROL - OPERATION).
- **Communication Error** - If the cluster receives no lamp-on or lamp-off message from the PCM for twenty seconds, the MIL is illuminated by the instrument cluster and a “no BuS” message will appear in the odometer/trip odometer Vacuum Fluorescent Display (VFD) unit to indicate a loss of bus communication. The indicator remains controlled and illuminated by the cluster until a valid lamp-on or lamp-off message is received from the PCM.

MALFUNCTION INDICATOR LAMP (MIL) (Continued)

• **Actuator Test** - Each time the cluster is put through the actuator test, the MIL will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The PCM then sends the proper lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the MIL or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the MIL after the bulb test, it may indicate that a malfunction has occurred and that the fuel and emissions system may require service. For proper diagnosis of the fuel and emissions systems, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the MIL, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

ODOMETER

DESCRIPTION

Fig. 19 Odometer Display

An odometer and trip odometer are standard equipment in all instrument clusters (Fig. 19). The odometer and trip odometer information are displayed in a common electronic, blue-green Vacuum Fluorescent Display (VFD). The VFD is soldered onto the cluster electronic circuit board and is visible through a window with a smoked clear lens located near the lower edge of the cluster overlay between the tachometer and speedometer. The dark lens over the VFD prevents it from being clearly visible when it is not illuminated. However, the odometer, and trip odometer information are not displayed simultaneously. The trip odometer reset switch on the instrument cluster circuit board toggles the display between odometer and trip odometer modes by depressing the odometer/trip odometer switch button that extends through the lower edge of the cluster lens, just right of the odometer VFD.

The odometer and trip odometer information is stored in the instrument cluster memory. This information can be increased when the proper inputs are provided to the instrument cluster, but the information cannot be decreased. The odometer can display values up to 999,999 kilometers (999,999 miles). The odometer latches at these values, and will not roll over to zero. The trip odometer can display values up to 9,999.9 kilometers (9,999.9 miles) before it rolls over to zero. The odometer display does not have a decimal point and will not show values less than a full unit (kilometer or mile), while the trip odometer display does have a decimal point and will show tenths of a unit (kilometer or mile). The unit of measure (kilometers or miles) for the odometer and trip odometer display is not shown in the VFD. The unit of measure for the instrument cluster odometer/trip odometer is selected at the time that it is manufactured, and cannot be changed. If the instrument cluster has a speedometer with a primary scale in kilometers-per-hour, the letters "KM" are printed on the cluster mask next to the VFD window to indicate the odometer unit of measure.

The odometer has a "Rental Car" mode, which will illuminate the odometer information in the VFD whenever the driver side front door is opened with the ignition switch in the Off or Accessory positions. During daylight hours (exterior lamps are Off) the VFD is illuminated at full brightness for clear visibility. At night (exterior lamps are On) the VFD lighting level is adjusted with the other cluster illumination lamps using the panel lamps dimmer control ring on the control stalk of the left multi-function switch. However, a "Parade" mode position of the panel lamps dimmer control ring allows the VFD to be illuminated at full brightness if the exterior lamps are turned On during daylight hours.

The VFD, the trip odometer switch, and the trip odometer switch button are serviced as a unit with the instrument cluster. The rubber trip odometer reset knob boot that seals the hole in the cluster lens through which the reset knob protrudes is available for individual service replacement.

OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. This indicator is controlled by the instrument cluster circuitry based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The odometer and trip odometer information is displayed by the instrument cluster Vacuum Fluorescent Display (VFD). The VFD will display the odometer information whenever the driver door is opened with the ignition switch in the Off or Accessory positions, and will display the last previously selected odometer or trip odometer information when the ignition switch is turned to the On or Start positions. The instrument cluster circuitry controls the VFD and provides the following features:

ODOMETER (Continued)

• **Odometer/Trip Odometer Display Toggling** - Actuating the trip odometer reset switch button momentarily with the VFD illuminated will toggle the display between the odometer and trip odometer information. Each time the VFD is illuminated with the ignition switch in the On or Start positions, the display will automatically return to the last mode previously selected (odometer or trip odometer).

• **Trip Odometer Reset** - When the trip odometer reset switch button is pressed and held for longer than about two seconds with the ignition switch in the On or Start positions, trip odometer will be reset to 0.0 kilometers (miles). The VFD must be displaying the trip odometer information in order for the trip odometer information to be reset.

• **Communication Error** - If the cluster fails to receive a distance message during normal operation, it will hold and display the last data received until the ignition switch is turned to the Off position. If the cluster does not receive a distance message within one second after the ignition switch is turned to the On position, it will display the last distance message stored in the cluster memory. If the cluster is unable to display distance information due to an error internal to the cluster, either “888888”will be displayed in the VFD or the VFD will be blank.

• **Actuator Test** - Each time the cluster is put through the actuator test, the number “8” will be scrolled across the VFD from right-to-left, then the trip odometer decimal point “.” will be illuminated in order to confirm the functionality of each of the VFD segments and the cluster control circuitry.

The PCM continually monitors the vehicle speed pulse information received from the vehicle speed sensor, then sends the proper distance messages to the instrument cluster. For further diagnosis of the odometer/trip odometer or the instrument cluster circuitry that controls these functions, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the vehicle speed sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the odometer/trip odometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

OIL PRESSURE GAUGE

DESCRIPTION

Fig. 20 Engine Oil Icon

An oil pressure gauge is standard equipment on all instrument clusters. The oil pressure gauge is located in the upper right quadrant of the instrument cluster, above the engine coolant temperature gauge. The oil pressure gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from “L” (or Low) to “H” (or High). An International Control and Display Symbol icon for “Engine Oil” is located on the cluster overlay, in the center of the gauge directly above the hub of the gauge needle (Fig. 20). The oil pressure gauge graphics are white and blue against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white, and the blue graphics appear blue. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The oil pressure gauge is serviced as a unit with the instrument cluster.

OPERATION

The oil pressure gauge gives an indication to the vehicle operator of the engine oil pressure. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The oil pressure gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

• **Engine Oil Pressure Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure of a 2.4L engine is above about 0.2 kg/cm^2 (3 psi), or of any engine other than a 2.4L is above about 0.4 kg/cm^2 (6 psi), the cluster moves the gauge needle to the middle of the normal range on the gauge scale to represent the engine oil pressure. The gauge needle will continue to be positioned at the middle of normal range on the gauge scale until the cluster receives a message from the PCM that indicates the engine oil pressure is low, or until the ignition switch is turned to the Off position, whichever occurs first.

• **Engine Oil Pressure Low Message** - Each time the cluster receives a message from the PCM indicating the engine oil pressure of a 2.4L engine is

OIL PRESSURE GAUGE (Continued)

below about 0.2 kg/cm^2 (3 psi), or of any engine other than a 2.4L is below about 0.4 kg/cm^2 (6 psi), the gauge needle is moved to the graduation at the far left (low) end of the gauge scale, the check gauges indicator is illuminated, and a single chime tone is generated. The gauge needle remains at the left end of the gauge scale and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating that the engine oil pressure of a 2.4L engine is above about 0.2 kg/cm^2 (3 psi), or of any engine other than a 2.4L is above about 0.4 kg/cm^2 (6 psi), or until the ignition switch is turned to the Off position, whichever occurs first. The cluster will only turn the check gauges indicator on in response to an engine oil pressure low message if the engine speed message is 300 rpm or greater for more than about five seconds.

- **Communication Error -** If the cluster fails to receive an engine oil pressure message, it will hold the gauge needle at the last indication about twelve seconds or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, the cluster will move the gauge needle to the left end of the gauge scale.
- **Actuator Test -** Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the engine oil pressure sensor to determine the engine oil pressure. The PCM then sends the proper engine oil pressure messages to the instrument cluster. For further diagnosis of the oil pressure gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the check gauges indicator due to a low oil pressure gauge reading, it may indicate that the engine or the engine oiling system requires service. For proper diagnosis of the engine oil pressure sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the oil pressure gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

REAR LOCK INDICATOR

DESCRIPTION

REAR
LOCK

Fig. 21 Rear Lock Indicator

A rear lock indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional off-road package (Fig. 21). The rear lock indicator is located near the upper edge of the instrument cluster, to the right of center. The rear lock indicator consists of a stencil-like cutout of the words “REAR LOCK” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “REAR LOCK” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The illumination intensity of the rear lock indicator is one-step dimmable. When the exterior lighting is turned On, the indicator is dimmed; and, when the exterior lighting is turned Off, the indicator is illuminated at full intensity. The rear lock indicator is serviced as a unit with the instrument cluster.

OPERATION

The rear lock indicator gives an indication to the vehicle operator of the status of the locker mechanism in the rear axle of vehicles equipped with the optional off-road package. The rear lock indicator can also give an indication when certain faults are detected in the axle locker system. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming, and hard wired inputs to the cluster from the key-in ignition switch, the axle lock switch, and the rear locker indicator switch. The rear lock indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The cluster can illuminate the LED solid, or flash it on and off at two different rates, slow or fast. The slow rate is about one flash per second, while the fast rate is about two flashes per second. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument

REAR LOCK INDICATOR (Continued)

cluster will turn on the rear lock indicator for the following reasons:

- **Rear Axle Lock Request Input** - Each time the cluster detects ground on the rear axle lock request circuit from the axle lock switch (rear axle lock request circuit ground = rear axle lock request active) while the key is in the ignition lock cylinder, the rear lock indicator flashes on and off at a slow rate. The indicator continues to flash until the rear axle lock request input to the cluster is an open circuit (rear axle lock request circuit open = rear axle lock request inactive), or until the cluster detects a change in the inputs from the rear locker indicator switch or the key-in ignition switch, whichever occurs first.
- **Rear Locker Indicator Switch Input** - Each time the cluster detects ground on the rear locker indicator switch sense circuit (rear locker indicator switch closed = rear axle locker engaged) while the rear axle lock request is active and the key is in the ignition lock cylinder, the rear lock indicator is illuminated solid. The indicator remains illuminated solid until the rear locker indicator switch input to the cluster is an open circuit (rear locker indicator switch open = rear axle locker disengaged), or until the cluster detects a change in the inputs from the axle lock switch or the key-in ignition switch, whichever occurs first.
- **Rear Lock Request/Feedback Mismatch** - Each time the cluster detects that the inputs from the axle lock switch (request) on the rear axle lock request circuit and from the rear locker indicator switch (feedback) on the rear locker indicator switch sense circuit are mismatched, the rear lock indicator flashes on and off at a slow rate. This condition occurs when the lock request is active but the axle locker remains disengaged, or when the lock request is inactive but the axle locker remains engaged. The indicator continues to flash until the request and the feedback are matching.
- **Key-In Ignition Switch Input** - Each time the cluster detects that the key has been removed from the ignition lock cylinder (key-in ignition switch open = key is not in ignition switch) while the rear axle lock request is still active, the rear lock indicator flashes at a fast rate and three chime tones are sounded. The indicator will continue to flash at this rate until the key is replaced in the ignition switch lock cylinder (key-in ignition switch closed = key is in ignition switch) while the rear axle lock request is still active, or until the rear axle lock request input is deactivated, whichever occurs first.

The axle lock switch in the accessory switch bezel on the instrument panel provides a hard wired ground input to the instrument cluster circuitry through the rear axle lock request circuit whenever the switch is enabled and the rear or the rear and front axle lock position of the switch is selected by the vehicle operator. The rear locker indicator switch on the rear axle housing provides a hard wired ground input to the instrument cluster whenever the rear axle locker mechanism is engaged. The key-in ignition switch integral to the ignition switch provides a hard wired ground input to the instrument cluster whenever a key is present in the ignition lock cylinder. Each of these inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For further diagnosis of the instrument cluster circuitry that controls the rear lock indicator LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

SEATBELT INDICATOR

DESCRIPTION

Fig. 22 Seatbelt Indicator

A seatbelt indicator is standard equipment on all instrument clusters (Fig. 22). The seatbelt indicator is located near the center of the instrument cluster, between the tachometer and the speedometer. The seatbelt indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Seat Belt” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The seatbelt indicator is serviced as a unit with the instrument cluster.

OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver side front seatbelt. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the seatbelt switch in the driver side front seatbelt buckle through the seat belt indicator driver circuit. The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a bat-

SEATBELT INDICATOR (Continued)

tery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster receives a battery current input on the fused ignition switch output (run-start) circuit, the indicator will be illuminated as a seatbelt reminder for about seven seconds, or until the ignition switch is turned to the Off position, whichever occurs first. This reminder function will occur regardless of the status of the seatbelt switch input to the cluster.
- **Driver Side Front Seatbelt Not Buckled** - Following the seatbelt reminder function, each time the cluster detects a ground on the seat belt switch sense circuit (seatbelt switch closed = seatbelt unbuckled) with the ignition switch in the Start or On positions, the indicator will be illuminated. The seatbelt indicator remains illuminated until the seat belt switch sense input to the cluster is an open circuit (seatbelt switch open = seatbelt buckled), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the seatbelt indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The seatbelt switch is connected in series between ground and the seat belt switch sense input to the instrument cluster. The seatbelt switch input to the instrument cluster circuitry can be diagnosed using conventional diagnostic tools and methods. For further diagnosis of the seatbelt indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

SHIFT INDICATOR (TRANSFER CASE)

DESCRIPTION

Fig. 23 4WD Indicator

A four-wheel drive indicator is standard equipment on all instrument clusters (Fig. 23). The four-wheel drive indicator is located near the upper edge of the instrument cluster, to the right of center. The four-wheel drive indicator consists of a stencil-like cutout of the text “4WD” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “4WD” text to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The illumination intensity of the four-wheel drive indicator is one-step dimmable. When the exterior lighting is turned On, the indicator is dimmed; and, when the exterior lighting is turned Off, the indicator is illuminated at full intensity. The four-wheel drive indicator is serviced as a unit with the instrument cluster.

OPERATION

The four-wheel drive indicator gives an indication to the vehicle operator that a four-wheel drive operating mode of the four-wheel drive transfer case is selected. The four-wheel drive indicator lights when the transfer case is engaged in the 4H or 4L positions. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming. On models not equipped with the optional Off-Road Package the cluster also uses a hard wired transfer case switch input. Models that are equipped with the Off-Road Package do not have a hard wired transfer case switch input, so the cluster uses electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus to determine the transfer case operating mode. The four-wheel drive indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the four-wheel drive indicator for the following reasons:

- **Transfer Case Switch Input** - Each time the cluster detects a ground on the 4WD switch sense circuit (transfer case switch closed = 4WD mode selected) the part time indicator is illuminated. The indicator remains illuminated until the 4WD switch sense input to the cluster is an open circuit (transfer case switch open = 4WD mode not selected), or until

SHIFT INDICATOR (TRANSFER CASE) (Continued)

the ignition switch is turned to the Off position, whichever occurs first.

- **4WD Transfer Case Status Message** - Each time the cluster receives a message from the PCM indicating that the transfer case is operating in a four-wheel drive mode, the 4WD indicator is illuminated. The 4WD indicator remains illuminated until the cluster receives messages from the PCM indicating that the transfer case is not in a four-wheel drive mode or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the 4WD indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

On models without the Off-Road Package, the transfer case shift position switch is connected in series between ground and the 4WD switch sense input to the instrument cluster. The transfer case switch input to the instrument cluster circuitry can be diagnosed using conventional diagnostic tools and methods. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - DESCRIPTION) for more information on the transfer case switch. For further diagnosis of the 4WD indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING).

On models equipped with the Off-Road Package, the PCM continually monitors the transfer case shift position switch to determine the operating mode of the transfer case. The PCM then sends the proper transfer case shift position status messages to the instrument cluster. For further diagnosis of the 4WD indicator or the instrument cluster circuitry that controls the LED, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the transfer case shift position switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the 4WD indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - 4WD INDICATOR

The diagnosis found here addresses an inoperative four-wheel drive indicator condition only on models that are not equipped with the optional Off-Road Package. If the vehicle is equipped with the Off-Road Package, for proper diagnosis of the transfer case switch, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the 4WD indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information. Before beginning this test, confirm the functionality of the four-wheel drive indicator Light Emitting Diode (LED) and the cluster control circuitry by performing the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the four-wheel drive indicator fails to illuminate during the actuator test, replace the faulty instrument cluster. If the problem being diagnosed is related to indicator accuracy, be certain to confirm that the problem is with the indicator or transfer case switch and not a mechanical malfunction of the transfer case or transfer case shift linkage. (Refer to 21 - TRANSMISSION/TRANSAXLE/TRANSFER CASE - DIAGNOSIS AND TESTING). If no transfer case problem is found, the following procedure will help to locate a short or open in the 4WD switch sense circuit. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

INDICATOR DOES NOT ILLUMINATE WITH 4WD MODE SELECTED

(1) Disconnect and isolate the battery negative cable. Disconnect the engine wire harness connector for the transfer case switch from the transfer case switch connector receptacle. Check for continuity between the ground circuit cavity of the engine wire harness connector for the transfer case switch and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open ground circuit to ground (G105) as required.

(2) Reconnect the battery negative cable. Turn the ignition switch to the On position. Install a jumper wire between the 4WD switch sense circuit cavity of the engine wire harness connector for the transfer case switch and a good ground. The 4WD indicator

SHIFT INDICATOR (TRANSFER CASE) (Continued)

should light. If OK, replace the faulty transfer case switch. If not OK, go to Step 3.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the connector receptacle on the back of the cluster housing. Check for continuity between the 4WD switch sense circuit cavities of the instrument panel wire harness connector (Connector C2) for the instrument cluster and the engine wire harness connector for the transfer case switch. There should be continuity. If OK, replace the faulty instrument cluster. If not OK, repair the open 4WD switch sense circuit between the instrument cluster and the transfer case switch as required.

INDICATOR STAYS ILLUMINATED WITH 4WD MODE NOT SELECTED

(1) Disconnect and isolate the battery negative cable. Disconnect the engine wire harness connector for the transfer case switch from the transfer case switch connector receptacle. Check for continuity between the ground circuit and the 4WD switch sense circuit terminals in the transfer case switch connector receptacle. There should be no continuity. If OK, go to Step 2. If not OK, replace the faulty transfer case switch.

(2) Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector (Connector C2) for the instrument cluster from the connector receptacle on the back of the cluster housing. Check for continuity between the 4WD switch sense circuit cavity of the instrument panel wire harness connector (Connector C2) for the instrument cluster and a good ground. There should be no continuity. If OK, replace the faulty instrument cluster. If not OK, repair the shorted 4WD switch sense circuit between the transfer case switch and the instrument cluster as required.

SKIS INDICATOR

DESCRIPTION

Fig. 24 SKIS Indicator

A Sentry Key Immobilizer System (SKIS) indicator is standard equipment on all instrument clusters, but is only functional on vehicles equipped with the optional SKIS (Fig. 24). The SKIS indicator is located near the upper edge of the instrument cluster overlay, to the left of center. The SKIS indicator consists of a stencil-like cutout of a graphical representation or icon of a key that is circled and crossed-out in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The SKIS indicator is serviced as a unit with the instrument cluster.

OPERATION

The Sentry Key Immobilizer System (SKIS) indicator gives an indication to the vehicle operator of the status of the SKIS. This indicator is controlled by the instrument cluster circuit board based upon electronic messages received by the cluster from the Sentry Key Immobilizer Module (SKIM) over the Programmable Communications Interface (PCI) data bus. The SKIS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the LED will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the SKIS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position, the SKIM sends a message to the cluster to illuminate the SKIS indicator for about three seconds as a bulb test.
- **SKIM Lamp-On Message** - Each time the cluster receives a lamp-on message from the SKIM, the SKIS indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the SKIM message. For more information on the SKIS and the SKIS indicator control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - OPERATION). The indicator remains illuminated until the cluster receives a lamp-off message from the SKIM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the SKIS indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The SKIM performs a self-test each time the ignition switch is turned to the On position to decide

SKIS INDICATOR (Continued)

whether the system is in good operating condition. The SKIM then sends the proper SKIS lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the SKIS indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the SKIS indicator after the bulb test, either solid or flashing, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative. For proper diagnosis of the SKIS, the PCI data bus, or the electronic message inputs to the instrument cluster that control the SKIS indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SPEEDOMETER

DESCRIPTION

MPH km/h

Fig. 25 Speedometer Text

A speedometer is standard equipment on all instrument clusters. The speedometer is located next to the tachometer, just to the right of center in the instrument cluster. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 210 degree primary scale on the cluster overlay that reads left-to-right either from “0” to “100” mph, from “0” to “110” mph, or from “0” to “180” km/h, depending upon the requirements of the market for which the vehicle is manufactured. Each version also has a secondary inner scale on the cluster overlay that provides the equivalent opposite units from the primary scale. Text appearing on the cluster overlay just below the hub of the speedometer needle abbreviates the unit of measure for the primary scale (i.e.: MPH or km/h), followed by the unit of measure for the secondary scale (Fig. 25). The speedometer graphics are white (primary scale) and blue (secondary scale) against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white and the blue graphics appear blue. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The speedometer is serviced as a unit with the instrument cluster.

OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The speedometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Vehicle Speed Message** - Each time the cluster receives a vehicle speed message from the PCM it will calculate the correct vehicle speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new vehicle speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continue to be positioned at the actual vehicle speed position on the gauge scale until the ignition switch is turned to the Off position.
- **Communication Error** - If the cluster fails to receive a speedometer message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After six seconds, the gauge needle will return to the left end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the vehicle speed sensor to determine the vehicle road speed, then sends the proper vehicle speed messages to the instrument cluster. For further diagnosis of the speedometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the vehicle speed sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the speedometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TACHOMETER

DESCRIPTION

Fig. 26 Tachometer Text

A tachometer is standard equipment on all instrument clusters. The tachometer is located to the left of the speedometer, just to the left of center in the instrument cluster. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 210 degree scale on the cluster overlay that reads left-to-right from 0 to 6. The text “X1000 RPM” imprinted on the cluster overlay directly below the hub of the tachometer needle identifies that each number on the tachometer scale is to be multiplied by 1000 rpm (Fig. 26). Red graduations at the right (high) end of the gauge scale designate the engine overspeed area of the gauge. The tachometer graphics are white against a black field, except for the red graduations, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white and the red graphics appear red. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The tachometer is serviced as a unit with the instrument cluster.

OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The tachometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster electronic circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message** - Each time the cluster receives an engine speed message from the PCM it will calculate the correct engine speed reading and position the gauge needle at that relative speed position on the gauge scale. The cluster will receive a new engine speed message and reposition the gauge pointer accordingly about every 86 milliseconds. The gauge needle will continually be repositioned on the gauge scale until the engine stops running, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive an engine speed message, it will hold the gauge needle at the last indication for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After six seconds, the gauge needle will return to the left (low) end of the gauge scale.
- **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale in a prescribed sequence to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the crankshaft position sensor to determine the engine speed. The PCM then sends the proper engine speed messages to the instrument cluster. For further diagnosis of the tachometer or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the crankshaft position sensor, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the tachometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TURN SIGNAL INDICATOR

DESCRIPTION

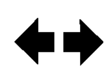

Fig. 27 Turn Signal Indicators

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters (Fig. 27). The turn signal indicators are located near the upper edge of the instrument cluster, between the speedometer and the tachometer. Each turn signal indicator consists of a stencil-like cutout of the International Control and Display Symbol icon for “Turn Warning” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. A green Light Emitting Diode (LED) behind each turn signal indicator cutout in the opaque layer of the cluster over-

TURN SIGNAL INDICATOR (Continued)

lay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind the LED, which is soldered onto the instrument cluster electronic circuit board. The turn signal indicators are serviced as a unit with the instrument cluster.

OPERATION

The turn signal indicators give an indication to the vehicle operator that the turn signals (left or right indicator flashing) or hazard warning (both left and right indicators flashing) have been selected and are operating. These indicators are controlled by two individual hard wired inputs received by the cluster from the turn signal switch circuitry and hazard warning switch circuitry within the left multi-function switch. Each turn signal indicator Light Emitting Diode (LED) is grounded on the instrument cluster electronic circuit board at all times. Therefore, these indicators remain functional regardless of the ignition switch position. Each LED will only illuminate when it is provided battery current by the circuitry of the left multi-function switch.

The turn signal indicators are connected in series between the output of the combination flasher on the left multi-function switch and the left or right turn signal inputs to the instrument cluster, but in parallel with the other turn signal circuits. This arrangement allows the turn signal indicators to remain functional, regardless of the condition of the other circuits in the turn signal and hazard warning systems. The turn signal switch and hazard warning switch inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - OPERATION) for more information on the turn signal switch and the hazard warning switch.

UPSHIFT INDICATOR

DESCRIPTION

Fig. 28 Upshift Indicator

An upshift indicator is standard equipment on all instrument clusters (Fig. 28). However, on vehicles not built for North American markets and those not equipped with a manual transmission, this indicator is electronically disabled. The upshift indicator is located near the upper edge of the instrument cluster, to the right of center. The upshift indicator consists of a stencil-like cutout of an upward pointed arrow icon in the opaque layer of the instrument cluster overlay. The dark outer layer of the cluster overlay prevents the icon from being clearly visible when the indicator is not illuminated. A amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the cluster overlay causes the icon to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The illumination intensity of the upshift indicator is one-step dimmable. When the exterior lighting is turned On, the indicator is dimmed; and, when the exterior lighting is turned Off, the indicator is illuminated at full intensity. The upshift indicator is serviced as a unit with the instrument cluster.

OPERATION

The upshift indicator gives an indication to the vehicle operator when the manual transmission should be shifted to the next highest gear in order to achieve the best fuel economy. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The upshift indicator function of the instrument cluster is electronically enabled or disabled by a PCI data bus message received by the cluster from the PCM. The upshift indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster receives a battery current input on the fused ignition switch output (run-start) circuit. Therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the upshift indicator for the following reasons:

- **Upshift Lamp-On Message** - Each time the cluster receives an upshift lamp-on message from the PCM indicating the engine speed and load conditions are right for a transmission upshift to occur, the upshift indicator is illuminated. The indicator remains illuminated until the cluster receives an upshift lamp-off message from the PCM, or until the ignition switch is turned to the Off position, whichever occurs first. The PCM will normally send an upshift lamp-off message three to five seconds after a lamp-on message, if an upshift is not performed. The indicator will then remain off until the vehicle stops accelerating and is brought back into the range of indicator operation, or until the transmission is shifted into another gear.

UPSHIFT INDICATOR (Continued)

• **Actuator Test** - Each time the cluster is put through the actuator test, the upshift indicator will be turned on, then off again during the bulb check portion of the test to confirm the functionality of the LED and the cluster control circuitry.

The PCM continually monitors the engine speed and load conditions to determine the proper fuel and ignition requirements. The PCM then sends the proper upshift indicator lamp-on and lamp-off messages to the instrument cluster. For further diagnosis of the upshift indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). For proper diagnosis of the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the upshift indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

VOLTAGE GAUGE

DESCRIPTION

Fig. 29 Battery Charging Condition Icon

A voltage gauge is standard equipment on all instrument clusters. The voltage gauge is located in the upper left quadrant of the instrument cluster, above the fuel gauge. The voltage gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 90 degree scale on the cluster overlay that reads left-to-right from 9 volts to 19 volts. An International Control and Display Symbol icon for “Battery Charging Condition” is located on the cluster overlay, directly above the hub of the gauge needle (Fig. 29). The voltage gauge graphics are white and blue against a black field except for a single red graduation at each end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear white, the blue graphics appear blue, and the red graphics appear red. The orange gauge needle is internally illuminated. Gauge illumination is provided by replaceable incandescent bulb and bulb holder units located on the instrument cluster electronic circuit board. The voltage gauge is serviced as a unit with the instrument cluster.

OPERATION

The voltage gauge gives an indication to the vehicle operator of the electrical system voltage. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus. The voltage gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions. The cluster is programmed to move the gauge needle back to the left end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

• **System Voltage Message** - Each time the cluster receives a system voltage message from the PCM indicating the system voltage is between about 9.5 volts and about 18.5 volts, the gauge needle is moved to the relative voltage position on the gauge scale.

• **System Voltage Low (Charge Fail) Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is less than about 9.0 volts (charge fail condition), the gauge needle is moved to the 9 volt graduation on the far left end of the gauge scale and the check gauges indicator is illuminated. The gauge needle remains on the 9 volt graduation and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is greater than about 12.0 volts (but less than about 16.0 volts), or until the ignition switch is turned to the Off position, whichever occurs first.

• **System Voltage High Message** - Each time the cluster receives a message from the PCM indicating the electrical system voltage is greater than about 19.0 volts, the gauge needle is moved to the 19 volt graduation on the far right end of the gauge scale and the check gauges indicator is illuminated. The gauge needle remains on the right end of the gauge scale and the check gauges indicator remains illuminated until the cluster receives a message from the PCM indicating the electrical system voltage is less than about 16.0 (but greater than about 9.5 volts), or until the ignition switch is turned to the Off position, whichever occurs first.

• **Communication Error** - If the cluster fails to receive a system voltage message, it will hold the gauge needle at the last indication about twelve seconds or until the ignition switch is turned to the Off position, whichever occurs first. After twelve seconds, it will move the gauge needle to the far left end of the gauge scale.

• **Actuator Test** - Each time the cluster is put through the actuator test, the gauge needle will be swept to several calibration points on the gauge scale

VOLTAGE GAUGE (Continued)

in a prescribed sequence in order to confirm the functionality of the gauge and the cluster control circuitry.

The PCM continually monitors the system voltage to control the generator output. The PCM then sends the proper system voltage messages to the instrument cluster. For further diagnosis of the voltage gauge or the instrument cluster circuitry that controls the gauge, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the check gauges indicator due to a charge fail or voltage high condition, it may indicate that the charging system requires service. For proper diagnosis of the charging system, the PCM, the PCI data bus, or the electronic message inputs to the instrument cluster that control the voltage gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LAMPS

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LAMPS/LIGHTING - EXTERIOR

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LAMPS/LIGHTING - EXTERIOR

DESCRIPTION - TURN SIGNAL & HAZARD WARNING SYSTEM

A turn signal and hazard warning system is standard factory-installed safety equipment. The turn signal and hazard warning system includes the following major components, which are described in further detail elsewhere in this service information:

- **Combination Flasher** - The electronic combination flasher is located on the back of the left multi-function switch, beneath the upper steering column shroud on the top of the steering column.
- **Front Side Marker Lamps** - The front side marker lamps are located on the outboard ends of the two front fender flares.
- **Turn Signal Repeater Lamps** - The turn signal repeater lamps are located on the outboard ends of the two front fender flares.
- **Hazard Warning Switch** - The hazard warning switch is integral to the left multi-function switch. The hazard warning switch button protrudes from an opening in the shroud on the top of the steering column.
- **Turn Signal Cancel Cam** - The turn signal cancel cam is integral to the steering column clockspring, which is located beneath the shrouds on the top of the steering column.
- **Turn Signal Indicators** - The two turn signal indicators are integral to the ElectroMechanical Instrument Cluster (EMIC) located in the instrument panel.
- **Turn Signal Lamps** - The front turn signal lamps are integral to the front park/turn signal lamps located beside each headlamp on the front fender. The rear turn signal lamps are integral to the back-up/brake/rear turn signal/tail lamps located on either side of the rear of the quarter panels.
- **Turn Signal Switch** - The turn signal switch is integral to the left multi-function switch. The left multi-function switch control stalk actuates the turn signal switch in the steering column.

The turn signal system in this vehicle includes a turn signal-on warning chime feature. The EMIC electronic circuitry monitors the turn signal indicators as well as electronic vehicle speed and distance messages received from the PCM over the PCI data bus network to provide this feature. If an indicator remains illuminated continuously with the vehicle speed above about 25 kilometers per hour (15 miles per hour) for a distance of greater than about 1.6 kilometers (1 mile), the EMIC generates a chime through an integral chime tone generator (The distance is greater for export vehicles).

Hard wired circuitry connects the turn signal and hazard warning system components to each other through the electrical system of the vehicle. Refer to the appropriate wiring information.

OPERATION - TURN SIGNAL & HAZARD WARNING SYSTEM

The turn signal system operates on battery voltage received on a ignition switch output (run) circuit so that the turn signals will only operate with the ignition switch in the On position. The hazard warning system operates on non-switched battery voltage so that the hazard warning remains operational regardless of the ignition switch position. When the turn signal switch control stalk is moved up or down, the turn signal system is activated. When the turn signal system is activated, the circuitry of the turn signal switch and the combination flasher will cause the selected turn signal indicator, front park/turn signal lamp, front side marker lamp, repeater lamps, and rear tail/stop/turn signal lamp to flash on and off. When the hazard warning system is activated, the circuitry of the hazard warning switch and the combination flasher will cause both the right side and the left side turn signal indicators, front park/turn signal lamps, front side marker lamps, repeater lamps and rear tail/stop/turn signal lamps to flash on and off.

In order to provide the turn signal-on warning, the ElectroMechanical Instrument Cluster (EMIC) monitors vehicle speed and distance messages received from the PCM over the PCI data bus and the hard wired turn signal switch input to the cluster electronic circuit board. If a turn signal remains indicated for a distance of greater than about 1.6 kilometers (1 mile) and the vehicle speed remains greater than about 24 kilometers-per-hour (15 miles-per-hour), the EMIC generates a repetitive chime at a slow rate to provide an audible reminder that a turn signal has been left on (distance is slightly longer with export vehicles). Once the warning chime begins to sound, it will continue until the turn signal is cancelled, until the vehicle speed falls below about 24 kilometers-per-hour (15 miles-per-hour), or until the ignition switch is turned to the Off position, whichever occurs first. This feature is not activated by a hazard warning input to the instrument cluster.

During both the turn signal and the hazard warning operation, if the exterior lamps are turned Off, the front park/turn signal lamps, repeater lamps and the front side marker lamps will flash in unison. If the exterior lamps are turned On, the front park/turn signal lamps, repeater lamps and the front side marker lamps will flash alternately.

WARNING

WARNING:: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

CAUTION: Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp and/or Daytime Running Lamp Module can result.

CAUTION: Do not use fuses, circuit breakers, or relays having greater amperage values than indicated on the fuse panel or in the Owner's Manual.

NOTE: When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - TURN SIGNAL & HAZARD WARNING SYSTEM

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to the appropriate wiring information.

When diagnosing the turn signal or hazard warning circuits, remember that high generator output can burn out bulbs rapidly and repeatedly. If this is a problem on the vehicle being diagnosed (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING). If the problem being diagnosed is related to a failure of the turn signals to automatically cancel following completion of a turn, inspect the multi-function switch for a faulty or damaged cancel actuator and inspect the turn signal cancel cam lobes on the clockspring mechanism for damage or improper installation. For complete circuit diagrams, refer to the appropriate wiring information.

LAMPS/LIGHTING - EXTERIOR (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE TURN SIGNAL LAMP DOES NOT ILLUMINATE	1. Faulty or missing bulb	1. Test and replace turn signal bulb as required.
	2. Faulty ground circuit.	2. Test and repair open ground circuit
	3. Faulty signal circuit.	3. Test and repair open right or left turn signal circuit.
ALL RIGHT SIDE AND/OR LEFT SIDE TURN SIGNAL LAMPS DO NOT FLASH	1. Faulty multifunction switch.	1. Test and replace the multifunction switch as required.
	2. Faulty flasher.	2. Replace the hazard switch/combination flasher.
ALL RIGHT SIDE OR LEFT SIDE TURN SIGNALS FLASH RAPIDLY	1. Faulty or missing bulb.	1. Test and replace faulty bulb as required.
	2. Faulty ground circuit.	2. Test and repair open ground circuit as required.
	3. Faulty signal circuit.	3. Test and repair high resistance or open signal circuit as required.
	4. Faulty flasher.	4. Replace flasher.
HAZARD WARNING LAMPS DO NOT FLASH	1. Faulty or missing fuse.	2. Test and replace fuse as required.
	2. Faulty ground circuit.	2. Test and repair high resistance or open ground circuit.
	3. Open battery positive voltage circuit to hazard warning switch.	3. Test and repair open battery voltage circuit to hazard warning switch.
	4. Faulty flasher	4. Replace flasher
	5. Faulty multifunction switch.	5. Test and replace the multifunction switch as required.

DIAGNOSIS AND TESTING - HEADLAMP SYSTEM

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Conventional and halogen headlamps are interchangeable. It is recommended that they not be intermixed.

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
	4. Battery has insufficient charge.	4. Test battery state-of -charge. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY - DIAGNOSIS AND TESTING)
	5. Battery is sulfated or shorted.	5. Load test battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY - DIAGNOSIS AND TESTING)
	6. Poor lighting circuit ground.	6. Test for voltage drop across ground locations.
	7. Both headlamp bulbs faulty.	7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
	2. Loose or corroded terminals or splices in headlamp circuit.	2. Inspect and repair all connectors and splices.
HEADLAMPS ARE DIM WITH ENGINE RUNNING	1. Charging system output too low.	1. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
ABOVE IDLE*	2. Poor lighting circuit ground.	2. Test for voltage drop across ground locations.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
	4. Both headlamp bulbs faulty.	4. Replace both headlamp bulbs.

LAMPS/LIGHTING - EXTERIOR (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit ground.	1. Test for voltage drop across ground locations.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit. Should not exceed 30 amps.
	3. Faulty headlamps switch circuit breaker.	3. Replace headlamp switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP SWITCH - REMOVAL)
	4. Short in headlamp circuit	Test headlamp circuit, repair as necessary.
	4. Loose or corroded terminals or splices in headlamp circuit.	4. Inspect and repair all connectors and splices.
HEADLAMPS DO NOT ILLUMINATE LOW OR HIGH BEAM	1. No voltage to headlamps.	1. Repair open headlamp circuit.
	2. No ground at headlamps.	2. Repair circuit ground.
	3. Faulty headlamp switch.	3. Replace headlamp switch. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP SWITCH - REMOVAL)
	4. Faulty headlamp dimmer (multi-function) switch.	4. Replace multi-function switch.
	5. Broken connector terminal or wire splice in headlamp circuit.	5. Repair connector terminal or wire splice.
	6. Both headlamp bulbs faulty.	6. Replace both headlamp bulbs.
*Canada vehicles must have lamps ON.		

ADJUSTMENTS

HEADLAMP ALIGNMENT PREPARATION

NOTE: If the vehicle is equipped with a headlamp leveling system, be certain the headlamp leveling switch is in the "0" position.

(1) Verify headlamps are operational in all modes and illuminated in the low beam setting.
(2) Correct defective components that could hinder proper headlamp alignment.
(3) Verify proper tire inflation.
(4) Clean headlamp lenses.
(5) Verify that luggage area is not heavily loaded.
(6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft.), export vehicles use 10 meters (32.8 ft.), away from front of headlamp lens (Fig. 1).
(2) If necessary, tape a line on the floor 7.62 meters (25 ft.), export vehicles use 10 meters (32.8 ft.), away from and parallel to the wall.
(3) Measure from the floor up 1.27 meters (5 ft.) and tape a vertical line on the wall at the centerline of the vehicle. Sight along the centerline of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.
(4) Rock vehicle side-to-side three times to allow suspension to stabilize.
(5) Jounce front suspension three times by pushing downward on front bumper and releasing.
(6) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this horizontal line for up/down adjustment reference.
(7) Place a tape line 130 mm (5.12 in.) below parallel to center of headlamp line.
(8) Measure distance from the centerline of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle centerline. Use these lines for left/right adjustment reference.

LAMPS/LIGHTING - EXTERIOR (Continued)

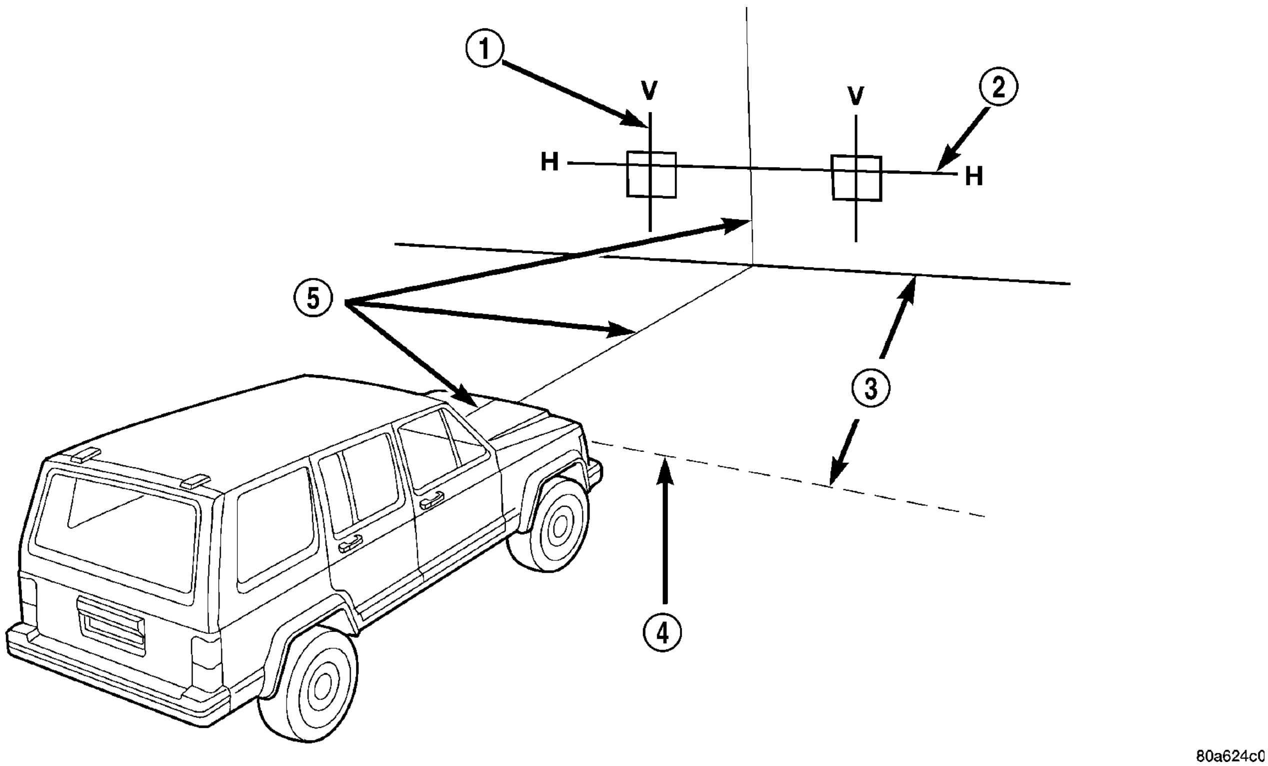


Fig. 1 Headlamp Alignment Screen -Typical

1 - CENTER OF VEHICLE TO CENTER OF HEADLAMP LENS
2 - FLOOR TO CENTER OF HEADLAMP LENS
3 - 7.62 METERS (25 FEET)
4 - FRONT OF HEADLAMP
5 - VEHICLE CENTERLINE

HEADLAMP ADJUSTMENT

(1) Place headlamps on LOW beam.

(2) Cover front of the headlamp that is not being adjusted.

(3) Turn the upper, outboard (up/down) adjustment screw (Fig. 2)until the headlamp beam pattern on screen/wall is similar to the pattern depicted in (Fig. 1)

NOTE: When using a headlamp aiming screen:

- Adjust the headlamps so that the beam horizontal position is at 0.
- Adjust the beam vertical position is 25 mm (1 in) downward from the lamp horizontal centerline.

(4) Rotate the lower, inboard (left/right) adjustment screw (Fig. 2) until the headlamp beam pattern on the aiming screen/wall similar to the pattern in (Fig. 1).

(5) Cover front of the headlamp that has been adjusted and adjust the other headlamp beam as instructed above.

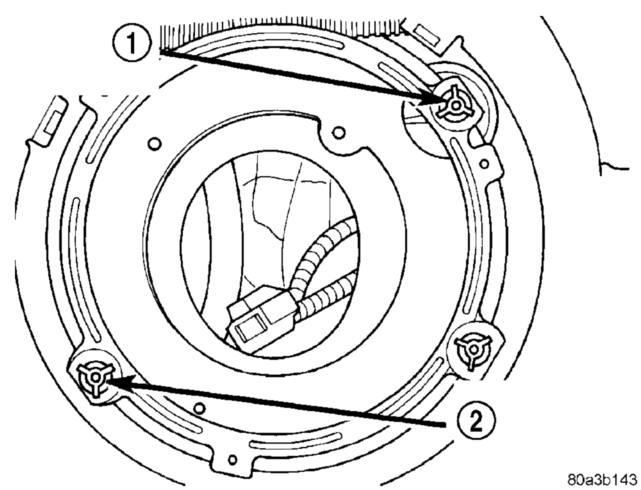


Fig. 2 Headlamp Adjustment Screws

1 - UP/DOWN ADJUSTMENT SCREW
2 - LEFT/RIGHT ADJUSTMENT SCREW

LAMPS/LIGHTING - EXTERIOR (Continued)

SPECIFICATIONS

EXTERIOR LAMPS

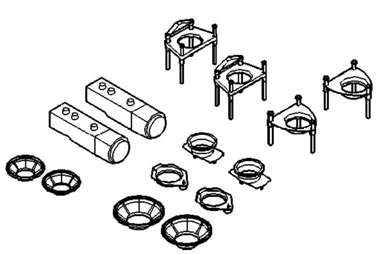
CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

The following Bulb Application Table lists the lamp title on the left side of the column and trade number or part number on the right for domestic and export vehicles.

LAMP	BULB
Back-up lamp	1156 or P21W
Center High Mounted Stoplamp	921 or W16W
Front Fog lamp	H3
Front Position lamp	T4W
Front Side Marker	168 or W3W
Headlamp/Sealed Beam	H6024 or H4
License Plate lamp	W5W Export Only
Park/Turn Signal	3157 or P27/7W
Rear Fog lamp	P21W
Side Repeater lamp	W3W
Tail/Stop	1157 or P21/5W
Underhood lamp	W5W
Underhood Retractable Lamp	105

SPECIAL TOOLS

HEADLAMP ALIGNMENT



Headlamp Aiming Kit C-4466–A

BRAKE LAMP SWITCH

DESCRIPTION

The brake lamp switch consists of multiple switch contacts either normally open or closed. The switch contacts provide brake pedal status to the various controllers. The primary function of the switch is to illuminate the brake lamps. The brake lamp switch is adjustable and mounted on the brake pedal mounting bracket under the instrument panel.

OPERATION

Vehicles equipped with the speed control option use a multiple function brake lamp switch. The PCM monitors the state of the brake lamp switch. Refer to the Brake section for more information on brake lamp switch service and adjustment procedures.

The primary function of the brake switch is to turn on the brake lamps during braking. The switch is also used to send signals to components that must know when the brakes are applied, such as the Powertrain Control Module (PCM), which uses the signal to cancel speed control. The Controller Antilock Brake (CAB) uses the brake switch signal to monitor brake pedal application. When the normally closed switch contacts open, the CAB receives the brake applied signal. The CAB then monitors the ABS system to anticipate the need for a ABS stop.

DIAGNOSIS AND TESTING - BRAKE LAMP SWITCH

The brake lamp switch operation can be tested with an ohmmeter. The ohmmeter is used to check continuity between the pin terminals (Fig. 3).

SWITCH CIRCUIT IDENTIFICATION

- Terminals 1 and 2: brake sensor circuit
- Terminals 3 and 4: speed control circuit if equipped
- Terminals 5 and 6: brake lamp circuit

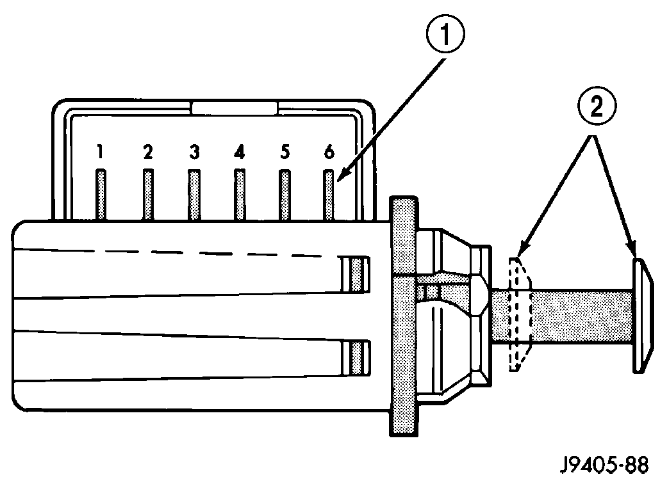


Fig. 3 Brake Lamp Switch Terminal Identification

1 - TERMINAL PINS
2 - PLUNGER TEST POSITIONS

BRAKE LAMP SWITCH (Continued)

SWITCH CONTINUITY TEST

NOTE: Disconnect switch harness before testing switch continuity.

With the switch plunger retracted, attach test leads to terminal pins 1 and 2. Replace switch if meter indicates no continuity.

With the switch plunger retracted, attach test leads to terminal pins 3 and 4. Replace switch if meter indicates no continuity.

With the switch plunger extended, attach test leads to terminal pins 5 and 6. Replace switch if meter indicates no continuity.

REMOVAL

(1) Remove the steering column cover and the lower trim panel.

(2) Press the brake pedal downward to fully applied position.

(3) Rotate the switch approximately 30° in counterclockwise direction. Then pull the switch rearward and out of bracket.

(4) Disconnect the switch harness and remove the switch (Fig. 4).

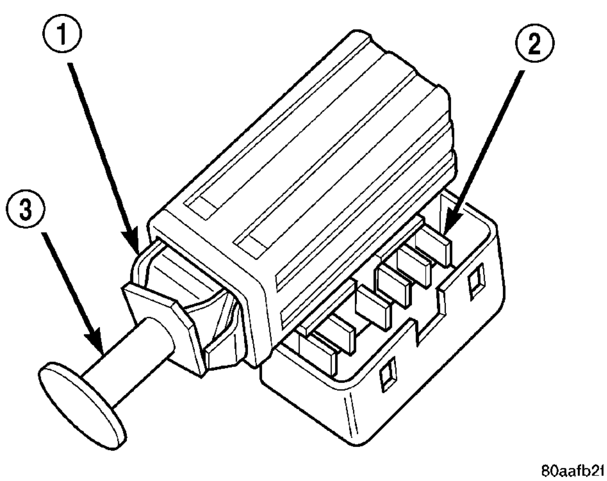


Fig. 4 Brake Lamp Switch

1 - RETAINER
2 - TERMINALS
3 - SWITCH PLUNGER

INSTALLATION

(1) Pull the switch plunger all of the way out, to fully extended position.

(2) Connect the harness connector to the switch.

(3) Press and hold the brake pedal in the applied position.

(4) Align the tab on the switch with the notch in the switch bracket. Then insert the switch in the bracket and turn it clockwise about 30° to lock it in place.

(5) Release the brake pedal, then pull the pedal fully rearward. Pedal will set the plunger to the correct position as the pedal pushes the plunger into the switch body. The switch will make ratcheting sound as it self adjusts.

ADJUSTMENTS

ADJUSTMENT

(1) Press and hold brake pedal in applied position.

(2) Pull switch plunger all the way out to fully extended position.

(3) Release brake pedal. Then pull pedal lightly rearward. Pedal will set plunger to correct position as pedal pushes plunger into switch body. Switch will make ratcheting sound as it self adjusts.

CAUTION: Booster damage may occur if the pedal pull exceeds 20 lbs.

CENTER HIGH MOUNTED STOP LAMP UNIT

REMOVAL

NOTE: To remove to the CHMSL, it will be necessary to remove spare tire from the spare tire carrier bracket.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from CHMSL button contact plate (Fig. 5).

(3) Disconnect the CHMSL wire harness from the CHMSL button contact terminals.

(4) Disengage the CHMSL wire harness from the retaining clips.

(5) Disengage the wire harness grommet and route the CHMSL wire harness through the tailgate.

(6) Remove the bolts attaching CHMSL to the spare tire carrier bracket.

(7) Remove the CHMSL from the vehicle.

INSTALLATION

(1) Position the CHMSL to the vehicle.

(2) Install the bolts that secure the CHMSL to the spare tire carrier bracket.

(3) Route the CHMSL wire harness through the tailgate and seat the wire harness grommet.

(4) Connect the CHMSL wire harness to the CHMSL button contact terminals.

(5) Position the CHMSL wire harness into the retaining clips and engage the clips.

(6) Install the CHMSL button contact plate cover.

CENTER HIGH MOUNTED STOP LAMP UNIT (Continued)

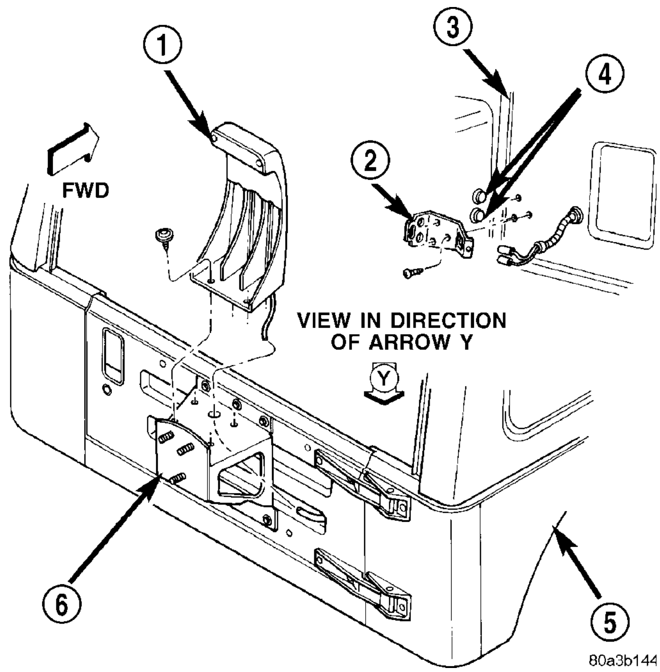


Fig. 5 CHMSL and Contact Buttons

1 - CHMSL
2 - CHMSL BUTTON CONTACT PLATE
3 - TAILGATE
4 - CHMSL CONTACT BUTTONS
5 - BODY
6 - SPARE TIRE CARRIER BRACKET

(7) Reconnect the battery negative cable.

CENTER HIGH MOUNTED STOP LAMP

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screws that secure the CHMSL lens to the CHMSL housing (Fig. 6).

(3) Remove the CHMSL lens from the CHMSL housing.

(4) Rotate the lamp socket one-third turn counter-clockwise and separate the lamp socket from the CHMSL lens.

(5) Pull the lamp straight out of the socket.

INSTALLATION

(1) Install the lamp into the socket by pushing it straight into the socket.

(2) Install the lamp socket into the CHMSL lens by turning the socket one-third turn clockwise.

(3) Position the CHMSL lens onto the CHMSL housing.

(4) Install the screws that secure the CHMSL lens to the CHMSL housing.

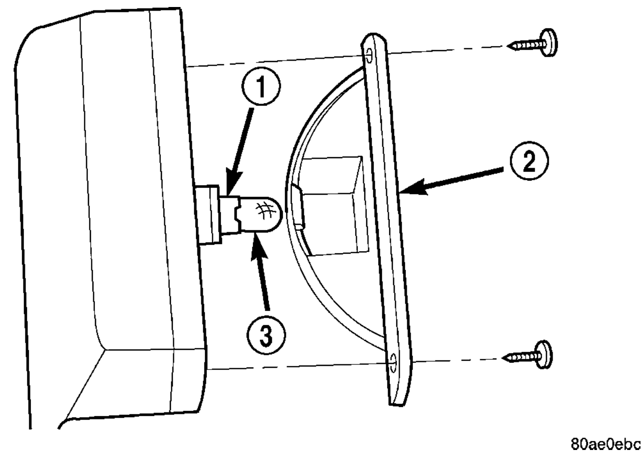


Fig. 6 CHMSL Lamp

1 - SOCKET
2 - CHMSL LENS
3 - LAMP

(5) Reconnect the battery negative cable.

COMBINATION FLASHER

DESCRIPTION

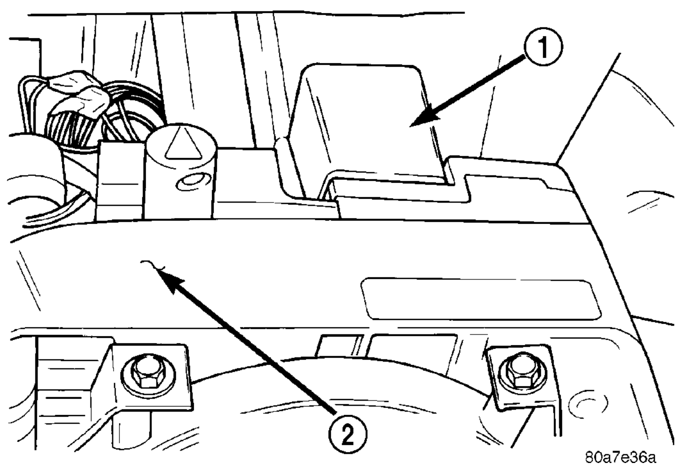


Fig. 7 Combination Flasher

1 - COMBINATION FLASHER
2 - LEFT MULTI-FUNCTION SWITCH

The combination flasher is located to the back of the left multi-function switch housing on the top of the steering column, where it is concealed beneath the upper steering column shroud (Fig. 7). The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher is designed to handle the current flow requirements of the factory-installed lighting. If supplemental lighting is added to the turn signal lamp circuits, such as when towing a trailer with lights, COMBINATION FLASHER (Continued)

the combination flasher will automatically try to compensate to keep the flash rate the same.

The combination flasher cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

Constant battery voltage is supplied to the flasher so that it can perform the hazard warning function, and ignition switched battery voltage is supplied for the turn signal function. The Integrated Circuit (IC) within the combination flasher contains the logic that controls the flasher operation and the flash rate. The IC receives sense ground inputs from the multi-function switch for the hazard flasher, right turn signal, and left turn signal. A special design feature of the combination flasher allows it to ″sense″ that a turn signal circuit or bulb is not operating, and provide the driver an indication of the condition by flashing the remaining bulbs in the affected circuit at a higher rate.

Because of the active elements within the combination flasher, it cannot be tested with conventional automotive electrical test equipment. If the combination flasher is believed to be faulty, test the turn signal and hazard warning system prior to replacement. Refer to (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR - DIAGNOSIS AND TESTING).

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the screws that secure the lower steering column shroud to the upper shroud (Fig. 8).

(4) Move the tilt steering column to the fully lowered position and leave the tilt release lever in the released position.

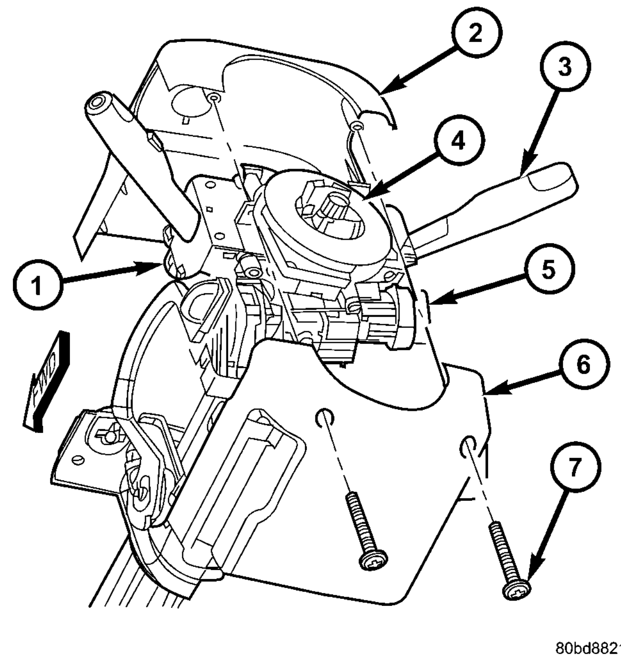


Fig. 8 Steering Column Shrouds Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - UPPER SHROUD
3 - RIGHT MULTI-FUNCTION SWITCH
4 - CLOCKSPRING
5 - IGNITION LOCK CYLINDER HOUSING
6 - LOWER SHROUD
7 - SCREW (2)

(5) Remove the upper shroud from the steering column.

(6) Grasp the combination flasher firmly and pull it toward the dash panel to disengage the flasher terminals. (Fig. 9).

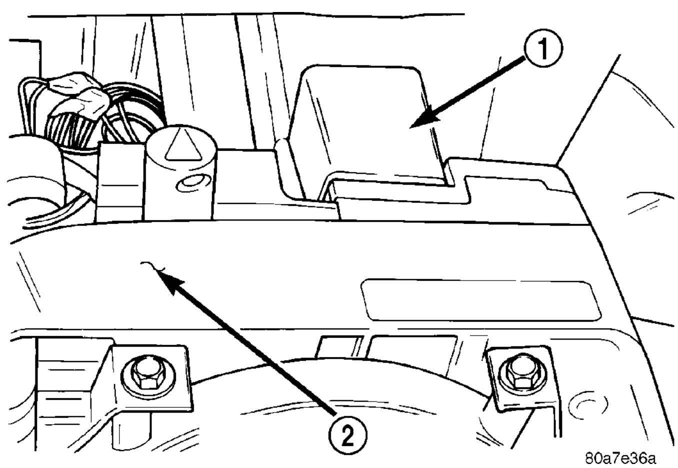


Fig. 9 Combination Flasher

1 - COMBINATION FLASHER
2 - LEFT MULTI-FUNCTION SWITCH

(7) Remove the combination flasher.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Align the combination flasher terminals with the terminals in the connector on the back of the left multi-function switch housing. (Fig. 9).

(2) Push on the combination flasher until the terminals are fully seated in the left multi-function switch connector.

(3) Position the upper shroud onto the steering column (Fig. 27).

(4) Install and tighten the screws that secure the lower steering column shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).

(5) Move the tilt steering column to the fully raised position and secure it in place by moving the tilt release lever back to the locked position.

(6) Reinstall the steering column opening cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(7) Reconnect the battery negative cable.

DAYTIME RUNNING LAMP MODULE

DESCRIPTION

The Daytime Running Lights (Headlamps) System is installed on vehicles manufactured for sale in Canada only. A separate module, mounted on the cowl, controls the DRL.

OPERATION

Battery positive voltage is supplied to the Daytime Running Lamp (DRL) module through a circuit breaker and a fuse in the PDC. Ignition positive voltage is supplied to the DRL module through a fuse in the fuse block. The DRL module also utilizes a VSS input, high and low beam sense circuits and high beam indicator driver. The DRL module is grounded to the chassis. Once the vehicle reaches a speed of 3 kph (2 mph) and travels more than 1 meter (3 feet) with the headlamp switch in the off position, the DRL module will activate the HIGH beams at a reduced intensity (36% of full intensity). When the headlamp switch is placed in the LOW beam position the DRL will turn off. When the headlamp switch is turned to the HIGH beam position, the high beams will operate normally (full intensity) and the DRL module will also illuminate the HIGH BEAM indicator in the instrument cluster.

DIAGNOSIS AND TESTING - DAYTIME RUNNING LAMP SYSTEM

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DAYTIME RUNNING LAMP MODULE (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DAYTIME RUNNING LAMPS (DRL) DO NOT OPERATE	1. Headlamp switch in the on position.	1. Turn the headlamp switch to the off position.
	2. Poor connection at DRL module.	2. Secure connector on DRL module.
	3. Open battery positive voltage circuit to DRL module	3. Test and repair open circuit.
	4. Open ignition positive circuit to DLR module.	4. Test and repair open circuit.
	5. Headlamp circuit shorted to ground.	5. Test and repair headlamp circuit.
	6. Open or high resistance in DLR module ground circuit.	6. Test and repair ground circuit.
	7. Open VSS signal circuit.	7. Test and repair VSS signal circuit.
	8. Defective DRL module.	8. Replace DRL module.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the module.

(3) Remove the screws that attach the module to the cowl (Fig. 10).

(4) Separate the module from the vehicle.

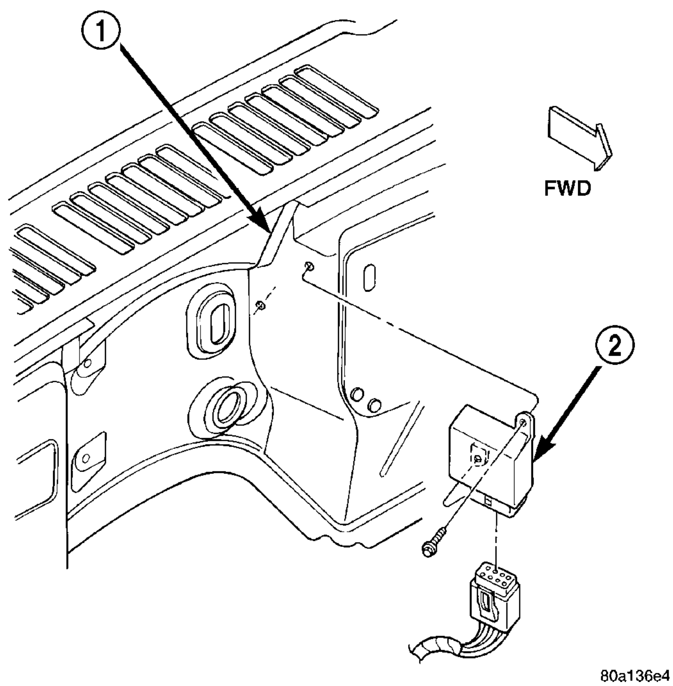


Fig. 10 DRL Module

1 - COWL
2 - DAYTIME RUNNING LAMP MODULE

INSTALLATION

(1) Position the DRL module on the cowl.

(2) Install the screws.

(3) Connect the wire harness connector to the module.

(4) Connect the battery negative cable.

FOG LAMP UNIT

DIAGNOSIS AND TESTING - FRONT FOG LAMP SYSTEM

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FOG LAMP UNIT (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
	4. Battery has insufficient charge.	4. Test battery state-of -charge. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY - DIAGNOSIS AND TESTING)
	5. Battery is sulfated or shorted.	5. Load test battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY - DIAGNOSIS AND TESTING)
	6. Poor lighting circuit ground.	6. Test for voltage drop across ground locations.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system. (Refer to 8 - ELECTRICAL/CHARGING - DIAGNOSIS AND TESTING)
	2. Poor lighting circuit ground.	2. Test for voltage drop across ground locations.
	3. High resistance in fog lamp circuit.	3. Test amperage draw of fog lamp circuit.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit ground.	1. Test for voltage drop across ground locations.
	2. High resistance in fog lamp circuit.	2. Test amperage draw of fog lamp circuit.
	3. Faulty relay	3. Replace relay
	4. Faulty fog lamp switch.	4. Replace multifunction switch.
	5. Loose or corroded terminals or splices in circuit.	5. Inspect and repair all connectors and splices.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp.	1. Replace fuse.
	2. No ground at fog lamps.	2. Repair circuit ground.
	3. High beam headlamps illuminated	3. Switch headlamp beam selector to low beam.
	4. Faulty relay	4. Replace relay
	5. Faulty fog lamp switch.	5. Replace left multifunction switch.
	6. Shorted clockspring.	6. Replace clockspring.
	7. Broken connector terminal or wire splice in fog lamp circuit.	7. Repair connector terminal or wire splice.
	8. Faulty or burned out bulb.	8. Replace bulb.

FOG LAMP UNIT (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the fog lamp wire harness connector.

(3) Remove the nut attaching the fog lamp to the front bumper.

(4) Remove the fog lamp.

INSTALLATION

(1) Position the fog lamp on the bumper.

(2) Install the nut attaching the fog lamp to the front bumper.

(3) Connect the fog lamp wire harness connector.

(4) Connect the battery negative cable.

(5) Readjust fog lamps (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FOG LAMP UNIT - ADJUSTMENTS).

ADJUSTMENTS

Prepare an alignment screen. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp centerline and straight ahead (Fig. 11).

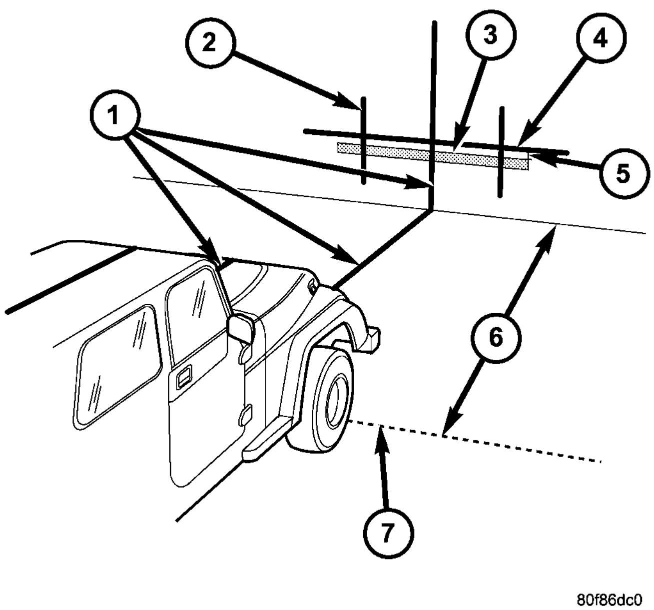


Fig. 11 Fog Lamp Alignment - Typical

1 - VEHICLE CENTERLINE
2 - CENTER OF FOG LAMP LENS
3 - HIGH - INTENSITY AREA
4 - FLOOR TO CENTER OF FOG LAMP LENS
5 - 100mm (4 in.)
6 - 7.62 METERS (25 FEET), EXPORT USE 10 METERS (32.8ft.).
7 - FRONT OF FOG LAMP

(1) For adjustment, loosen the pivot nut and turn the foglamp adjusting screw (rear center of lamp) clockwise for up, counterclockwise for down, then retighten the pivot nut (Fig. 12).

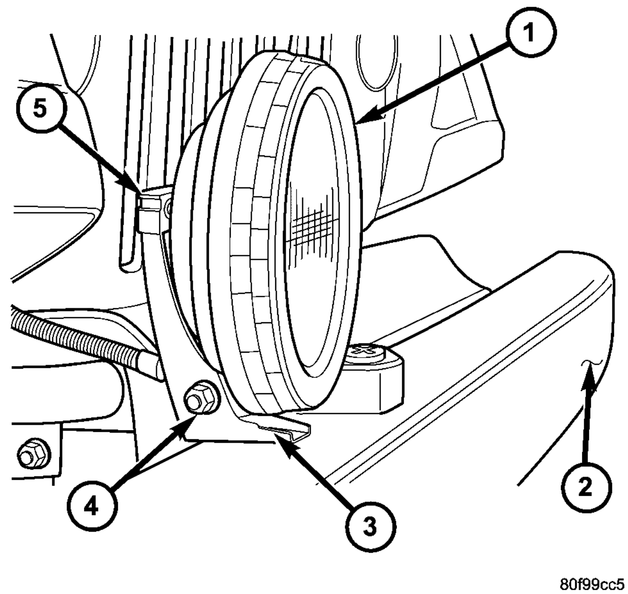


Fig. 12 FOG LAMP ADJUSTER

1 - FOG LAMP
2 - BUMPER
3 - MOUNTING BRACKET
4 - PIVOT NUT
5 - ADJUSTER

FOG LAMP

REMOVAL

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screws that attach the lens and reflector to the lamp housing.

(3) Separate the lens and reflector from the lamp housing.

(4) Disconnect the electrical connector from the bulb.

(5) Squeeze the bulb retainer together to disengage it from the reflector.

(6) Remove the bulb from the reflector (Fig. 13).

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Install the bulb into the reflector.

FOG LAMP (Continued)

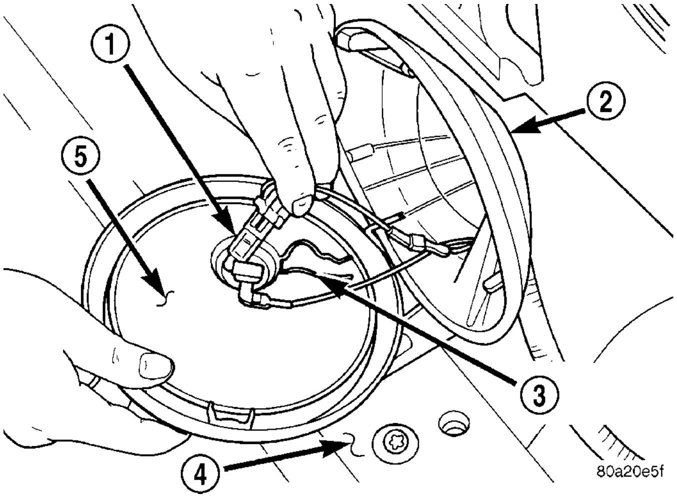


Fig. 13 Fog Lamp Bulb

1 - BULB
2 - FOG LAMP HOUSING
3 - BULB RETAINER
4 - FRONT BUMPER
5 - LENS AND REFLECTOR

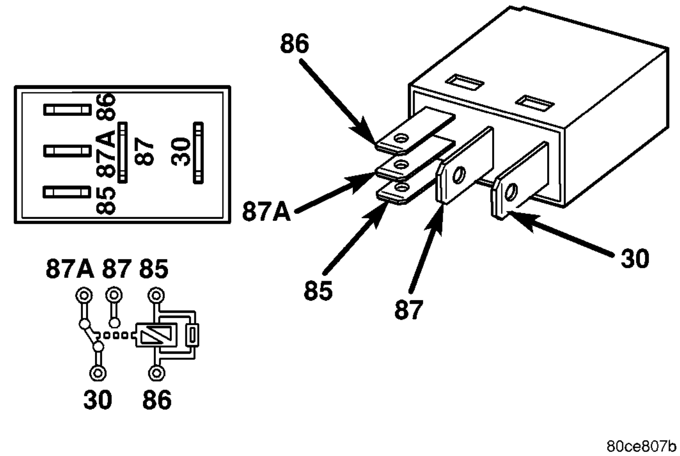


Fig. 14 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

(2) Position and engage the bulb retainer onto the reflector.
(3) Connect the electrical connector to the bulb.
(4) Install the lens and reflector to the lamp housing.
(5) Install the screws that attach the lens and reflector to the lamp housing.
(6) Reconnect the battery negative cable.

FOG LAMP RELAY

DESCRIPTION

The fog lamp relay is located in the Power Distribution Center (PDC) in the engine compartment of the vehicle. The fog lamp relay is a conventional International Standards Organization (ISO) micro relay (Fig. 14). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

The fog lamp relay cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The fog lamp relay is an electromechanical switch that uses a low current input from the multi-function switch to control a high current output to the fog lamps. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The fog lamp relay terminals are connected to the vehicle electrical system through a connector receptacle in the Power Distribution Center (PDC).

The fog lamp relay can be diagnosed using conventional diagnostic tools and methods. Refer to the appropriate wiring information for diagnosis and testing of the fog lamp micro-relay and for complete wiring diagrams.

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove the cover for the Power Distribution Center (PDC).
(3) Remove the fog lamp relay by grasping it firmly and pulling it straight out from the receptacle in the PDC.

INSTALLATION

(1) Position the fog lamp relay to the proper receptacle in the Power Distribution Center (PDC).

FOG LAMP RELAY (Continued)

(2) Align the fog lamp relay terminals with the terminal cavities in the PDC.

(3) Press firmly and evenly on the top of the fog lamp relay until the terminals are fully seated in the PDC.

(4) Reconnect the battery negative cable.

FOG LAMP UNIT - REAR

DESCRIPTION

Some vehicles are equipped with a rear fog lamp. The lamp unit can be found mounted to the rear bumper assembly. The rear fog lamp unit utilizes a red lens with a clear lamp for brightness, and an illuminated indicator in the instrument cluster.

Rear fog lamp(s) are standard equipment in certain parts of the world where excessive fog is experienced on a regular basis.

OPERATION

Battery positive (B+) voltage is supplied to the left multifunction switch. With the headlamp switch in the on position, battery positive voltage is supplied to the rear fog lamp switch contacts within the multifunction switch. Pulling the headlamp switch knob outward and then rotating the knob one detent counterclockwise will activate the rear fog lamp(s) and illuminate the rear fog lamp indicator in the instrument cluster. The rear fog lamp(s) can only be activated when either the Low Beam or High Beam headlamps are on. Refer to Wiring Diagrams for a complete system schematic.

DIAGNOSIS AND TESTING - REAR FOG LAMP

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to the appropriate wiring information.

REAR FOG LAMP CONDITION CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
REAR FOG LAMP IS ON WITH IGNITION KEY ON	1. Shorted multifunction switch. 2. Shorted steering column clock spring. 3. Shorted fog lamp switch output circuit	1. Test and replace multifunction switch 2. Test and replace clock spring. 3. Repair short to voltage in fog lamp switch output circuit.
REAR FOG LAMP BULB BURNS OUT FREQUENTLY	1. Charging system output too high. 2. Loose or corroded terminals or splices in circuit.	1. Test and repair charging system. 2. Inspect and repair all connectors and splices.
REAR FOG LAMP IS DIM WITH ENGINE RUNNING	1. Charging system output too low. 2. Poor lighting circuit ground. 3. High resistance in fog lamp circuit.	1. Test and repair charging system. 2. Test for voltage drop across ground locations. 3. Test amperage draw of fog lamp circuit.
REAR FOG LAMP FLASHES RANDOMLY	1. Poor lighting circuit ground. 2. High resistance in fog lamp circuit. 3. Faulty multifunction switch. 4. Loose or corroded terminals or splices in circuit.	1. Test for voltage drop across ground locations. 2. Test amperage draw of fog lamp circuit. 3. Replace multifunction switch. 4. Inspect and repair all connectors and splices.

FOG LAMP UNIT - REAR (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
REAR FOG LAMP WILL NOT ILLUMINATE	1. Open fuse for fog lamp.	1. Test fog lamp circuitry for short to ground and replace fuse.
	2. Open battery positive voltage circuit to multifunction switch.	2. Test and repair open battery positive voltage circuit.
	3. No ground at fog lamps.	3. Repair circuit ground.
	4. Faulty multifunction switch.	4. Replace multifunction switch.
	5. Broken connector terminal or wire splice in fog lamp circuit.	5. Repair connector terminal or wire splice.
	6. Faulty or burned out bulb.	6. Replace bulb.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the screws that secure the rear fog lamp unit to the rear bumper assembly.

(3) Disconnect the wire harness connector from the rear fog lamp connector (Fig. 15).

(4) Remove the rear fog lamp unit from the vehicle.

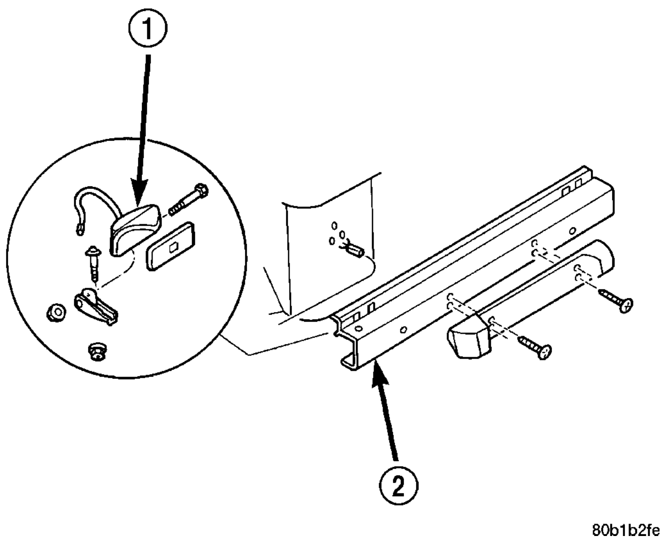


Fig. 15 Rear Fog Lamp Unit

1 - REAR FOG LAMP UNIT
2 - REAR BUMPER ASSEMBLY

INSTALLATION

(1) Position the rear fog lamp unit to the vehicle.

(2) Connect the wire harness connector to the rear fog lamp connector.

(3) Install the screws that secure the rear fog lamp unit to the rear bumper assembly.

(4) Reconnect the negative battery cable.

FOG LAMP - REAR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screws that secure the rear fog lamp lens to the housing (Fig. 16).

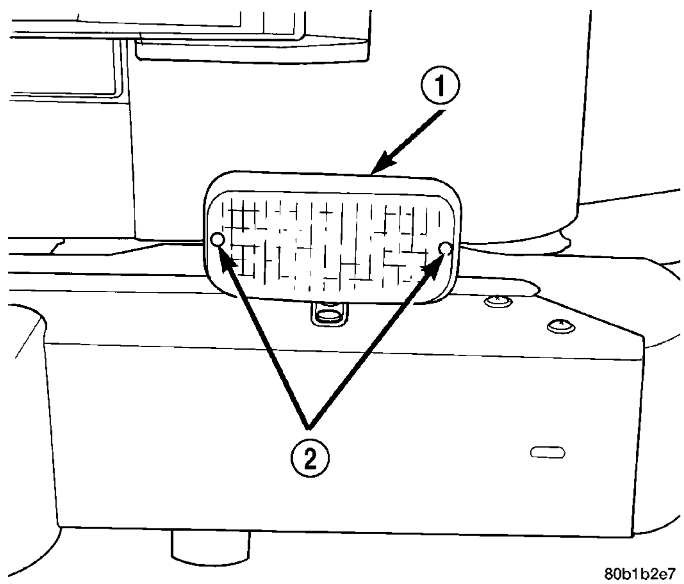


Fig. 16 Rear Fog Lamp Lens

1 - REAR FOG LAMP
2 - FOG LAMP LENS SCREWS

(3) Push and rotate the rear fog lamp one-third turn counterclockwise, then pull the lamp straight out of the socket (Fig. 17).

INSTALLATION

(1) Install the rear fog lamp by pushing the lamp into the rear fog lamp socket and turning it one-third clockwise.

(2) Position the rear fog lamp lens onto the housing.

(3) Install the screws that secure the rear fog lamp lens onto the housing.

FOG LAMP - REAR (Continued)

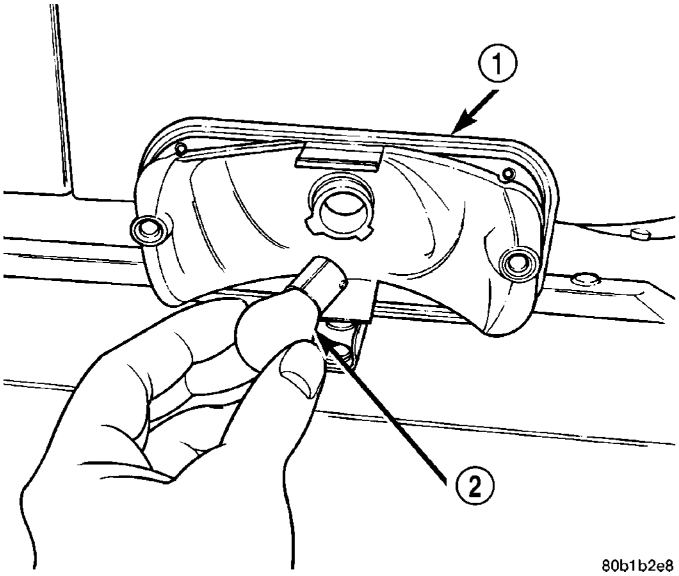


Fig. 17 Rear Fog Lamp

1 - REAR FOG LAMP HOUSING
2 - REAR FOG LAMP

(4) Reconnect the negative battery cable.

FRONT PARK/TURN SIGNAL LAMP UNIT

DESCRIPTION

A front turn signal/parking lamp assembly is mounted to each front fender. Each front turn signal/parking lamp assembly consist of a housing, lens and lamp.

OPERATION

The parking light function is controlled by the headlamp switch located on the instrument panel. The turn signal function is controlled by the multi-function switch located on the steering column. Each front turn signal/parking lamp assembly can be serviced separately.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screws that secure the park/turn signal lamp housing to the front fender (Fig. 18).

(3) Remove the park/turn signal lamp housing from the fender.

(4) Rotate the socket one-third turn counterclockwise and separate the socket and lamp from the housing.

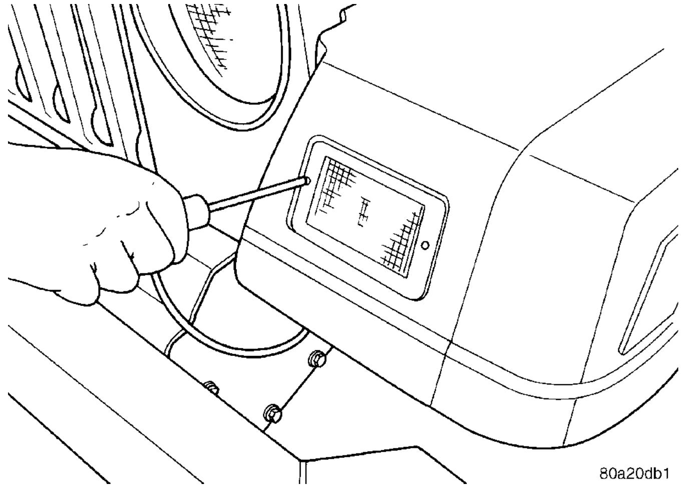


Fig. 18 Park/Turn Signal Lamp Assembly

INSTALLATION

(1) Install the socket and lamp into the housing and rotate the socket one-third turn clockwise.

(2) Position the park/turn signal lamp housing into the fender.

(3) Install the screws that secure the park/turn signal lamp housing to the fender. Tighten the screws securely.

(4) Reconnect the battery negative cable.

FRONT PARK/TURN SIGNAL LAMP

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the park/turn signal lamp housing from the fender (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP UNIT - REMOVAL).

(3) Pull the lamp straight out of the socket.

INSTALLATION

(1) Install the lamp by pushing it into the socket.

(2) Install the lamp housing into the fender (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/PARK/TURN SIGNAL LAMP UNIT - INSTALLATION).

(3) Reconnect the battery negative cable.

HEADLAMP

DESCRIPTION

The headlamps are sealed beam units. Each unit contains a high and low beam filament.

HEADLAMP (Continued)

OPERATION

The headlamps are turned on and off by the headlamp switch. The high and low beam selection is controlled by the multifunction switch. Each headlamp can be serviced individually.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screws that secure the headlamp bezel to the grille (Fig. 19).

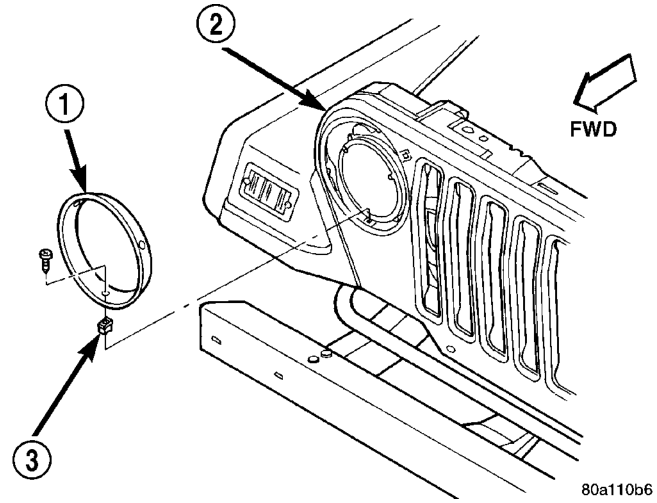


Fig. 19 Headlamp Bezel

1 - HEADLAMP BEZEL
2 - GRILLE
3 - RETAINER

(3) Remove the screws that secure the headlamp retaining ring to the headlamp bucket (Fig. 20).

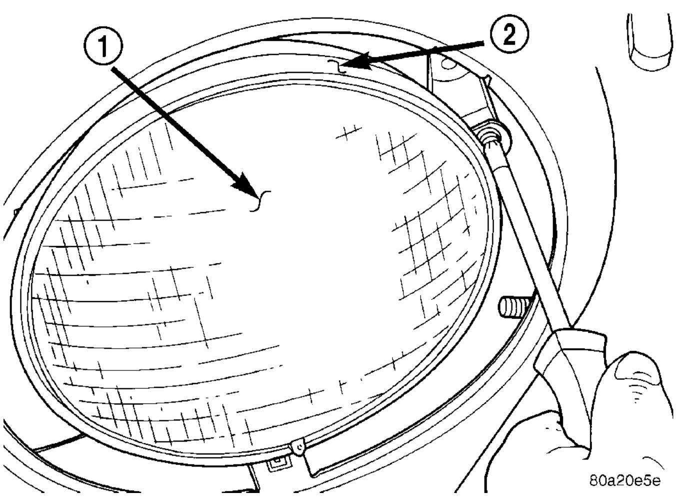


Fig. 20 Headlamp Retaining Ring

1 - HEADLAMP
2 - HEADLAMP RETAINING RING

(4) Remove the headlamp from the bucket and disconnect the wire harness connector from the headlamp (Fig. 21).

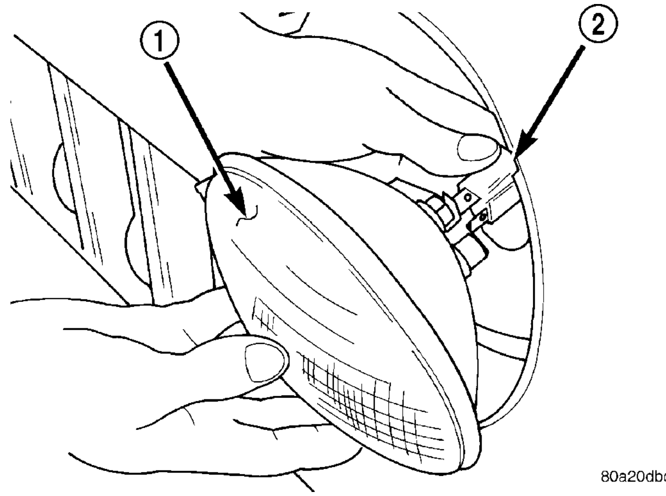


Fig. 21 Headlamp Wire Harness Connector

1 - HEADLAMP
2 - WIRE HARNESS CONNECTOR

INSTALLATION

(1) Connect the wire harness connector to the headlamp and position the headlamp into the bucket.

NOTE: Insure the bosses on the headlamp align with the slots in the bucket.

(2) Align the headlamp bosses with the slots in the bucket and install the retaining ring.

(3) Install the screws that secure the headlamp retaining ring to the headlamp bucket. Tighten the screws securely.

(4) Install the headlamp bezel.

NOTE: Do not overtighten the screws or damage to the headlamp bezel may result.

(5) Install the screws that secure the headlamp bezel. Tighten the screws securely.

(6) Reconnect the battery negative cable.

HEADLAMP LEVELING SWITCH

REMOVAL

HEADLAMP LEVELING SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the negative battery cable.

(2) Using a flat blade screwdriver or similar tool between the headlamp leveling switch and the steering column cover (Fig. 22). Gently pry the headlamp leveling switch out of the steering column cover.

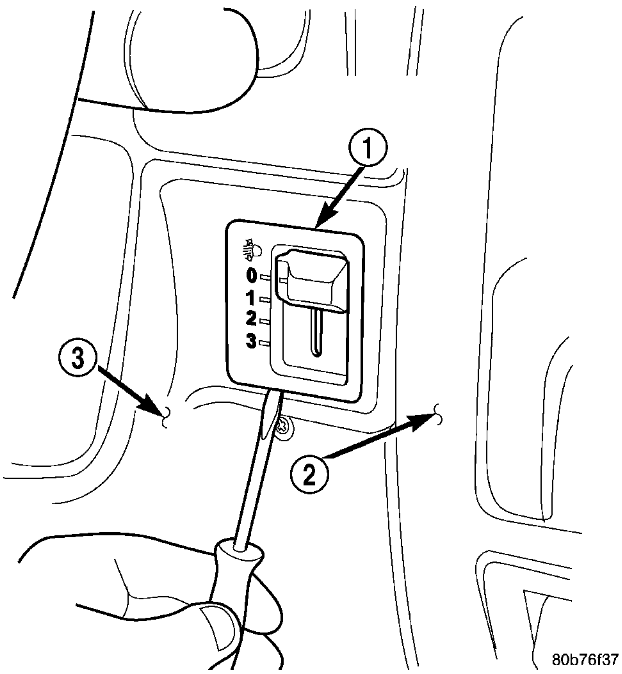


Fig. 22 Headlamp Leveling Switch

1 - HEADLAMP LEVELING SWITCH
2 - I/P CENTER BEZEL
3 - STEERING COLUMN COVER

(3) Disconnect the headlamp leveling switch electrical connector (Fig. 23) and remove the headlamp leveling switch.

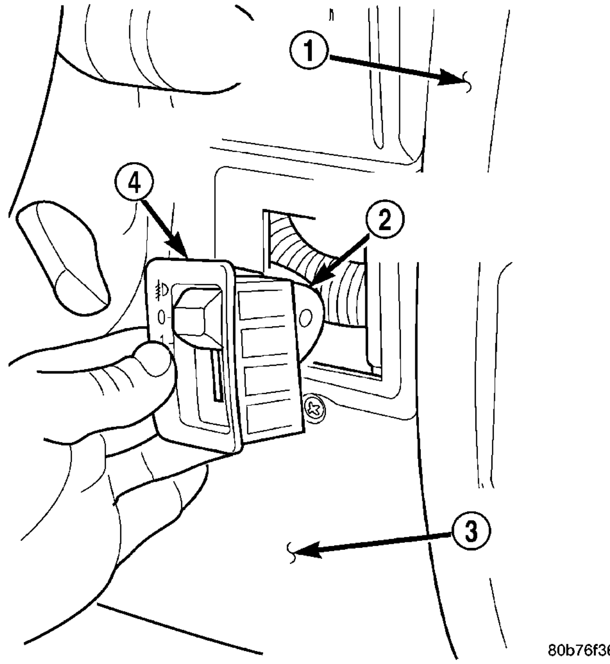


Fig. 23 Headlamp Leveling Switch Electrical Connector

1 - I/P CENTER BEZEL
2 - HEADLAMP LEVELING SWITCH ELECTRICAL CONNECTOR
3 - STEERING COLUMN COVER
4 - HEADLAMP LEVELING SWITCH

INSTALLATION

(1) Position the headlamp leveling switch in front of the steering column cover access hole and connect the switch electrical connector (Fig. 23).

(2) Properly seat the headlamp leveling switch into the steering column cover.

(3) Reconnect negative battery cable.

HEADLAMP LEVELING MOTOR

DIAGNOSIS AND TESTING - HEADLAMP LEVELING SYSTEM

The following test is designed to diagnosis a faulty headlamp leveling system. Refer to Wiring Diagrams for a complete system schematic.

NOTE: Headlamps must be operating properly and the battery must be completely charged (12.4v) prior to testing. It may also be necessary to install battery charger on the vehicles electrical system when performing this test. Refer to the Battery section of the service manual for detailed information.

HEADLAMP LEVELING MOTOR (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ONE MOTOR DOES NOT OPERATE	1. Poor electrical connection at motor.	1. Check for proper electrical harness connection and circuit terminal tension at the motor.
	2. Open or high resistance in the battery positive voltage circuit to the inoperative leveling motor.	2. Repair the open or high resistance in the leveling motor battery positive voltage circuit.
	3. Open, high resistance in the inoperative leveling motor ground circuit.	3. Repair the open, high resistance in the leveling motor ground circuit.
	4. Open, high resistance, short to voltage or short to ground in the inoperative leveling motor sense circuit.	4. Repair the open, high resistance, short to voltage or short to ground in the motor sense circuit.
	5. Inoperative/Damaged motor.	5. Replace leveling motor.
BOTH MOTORS DO NOT OPERATE	1. No battery positive voltage to the headlamp leveling switch.	1. Repair the open circuit or high resistance in the headlamp leveling switch battery positive voltage circuit.
	2. No battery positive voltage to the headlamp leveling motor.	2. Repair the open circuit or high resistance in the headlamp leveling motor battery positive voltage circuit.
	3. Open, high resistance in the headlamp leveling switch ground circuit.	3. Repair the open, high resistance or short to voltage in the headlamp leveling switch ground circuit.
	4. Open, high resistance in the headlamp leveling motor ground circuit.	4. Repair the open, high resistance or short to voltage in the headlamp leveling motor ground circuit.
	5. Open, high resistance, short to voltage or short to ground in the leveling motor sense circuit.	5. Repair the open, high resistance, short to voltage or short to ground in the motor sense circuit.
	6. Inoperative headlamp leveling switch.	6. Replace headlamp leveling switch.
	7. Inoperative headlamp leveling motors.	7. Replace headlamp motors.
MOTORS DO NOT RESPOND TO ONE OR MORE LEVELING POSITION(S)	1. Inoperative headlamp leveling switch.	1. Replace headlamp leveling switch.
	2. Stuck/Binding or Inoperative motor(s).	2. Replace headlamp leveling motor(s).

LEFT MULTI-FUNCTION SWITCH

DESCRIPTION

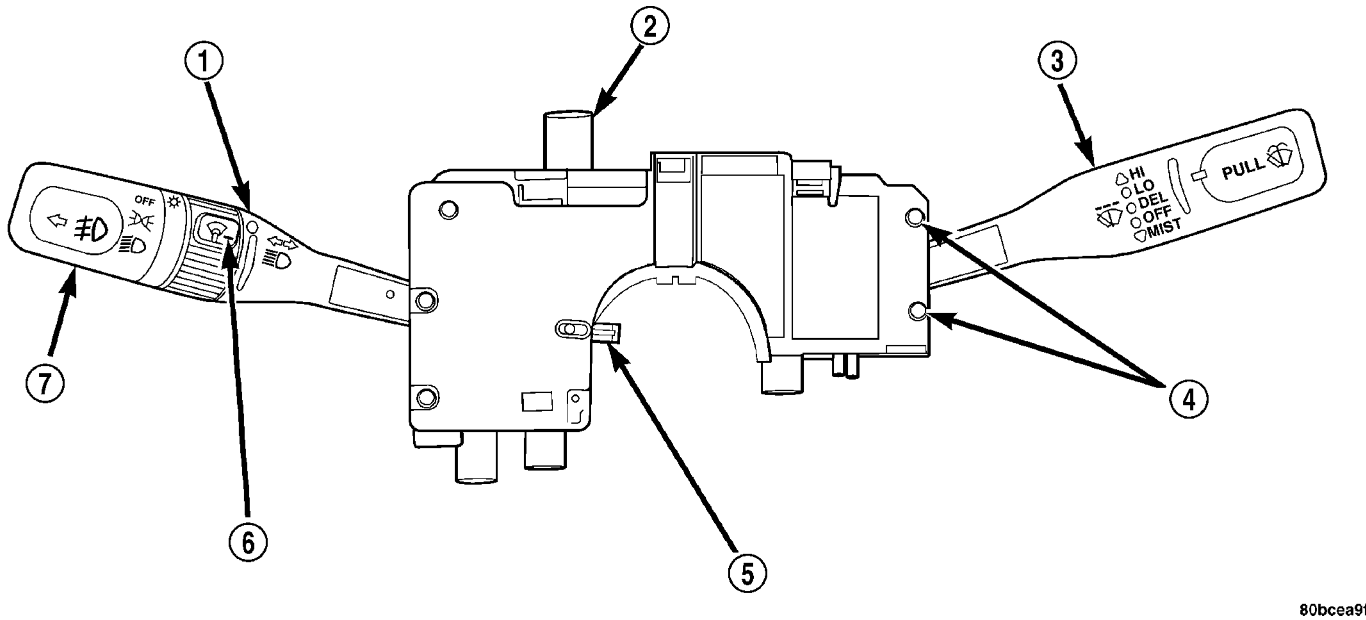


Fig. 24 MULTI-FUNCTION SWITCH

1 - LEFT MULTI-FUNCTION SWITCH CONTROL STALK
2 - HAZARD WARNING SWITCH BUTTON
3 - RIGHT MULTI-FUNCTION SWITCH CONTROL STALK
4 - SCREW (2)
5 - TURN SIGNAL CANCEL ACTUATOR
6 - LEFT MULTI-FUNCTION SWITCH CONTROL RING
7 - LEFT MULTI-FUNCTION SWITCH CONTROL KNOB

The left multi-function switch is secured to the upper steering column housing, below the steering wheel. (Fig. 24). The hazard warning switch push button is located on the top of the multi-function switch housing.

A connector containing eighteen terminal pins is located on the back of the switch housing and connects the switch to the vehicle electrical system. A second connector on the back of the switch housing accepts the combination flasher. The right and left multi-function switchs are mounted together by two screws, and the combined multi-function switch is secured to the upper steering column housing.

The left multi-function switch is the primary control for the interior and exterior lighting systems of the vehicle. The left multi-function switch supports the following functions:

- Hazard Warning Control
- Exterior Lighting Control
- Headlamp Beam Selection
- Headlamp Optical Horn
- Interior Lighting Control
- Turn Signal Control

The left multi-function switch cannot be adjusted or repaired. If any function of the switch is faulty, or if the switch is damaged, the entire switch unit must be replaced. The combination flasher and the right multi-function switch are available for separate service replacement.

OPERATION

The left multi-function switch uses a combination of resistor multiplexed and conventionally switched outputs to control the many functions and features it provides. The switch is grounded to the left cowl side inner panel, beneath the instrument panel. The switch receives battery voltage from a fuse in the Power Distribution Center (PDC), a fused B(+) circuit and, when the ignition switch is in the Accessory or On positions, from a fuse in the fuse block through a fused ignition switch output (run-acc) circuit. Following are descriptions of the how the left multi-function switch operates to control the many functions and features it provides:

- **Front Fog Lamps -** The control knob on the end of the left multi-function switch control stalk is pulled outward to activate the optional front fog lamps. The control knob is keyed so that it cannot be

LEFT MULTI-FUNCTION SWITCH (Continued)

pulled outward unless the knob is first rotated to turn on the exterior lighting. The internal circuitry of the left multi-function switch then provides battery voltage through a fused fog lamp relay output circuit and the fog lamp relay to the fog lamps and to the instrument cluster for control of the fog lamp indicator.

- **Rear Fog Lamp(s)** - The headlamp switch knob must be rolled to the headlamp on position. Pulling the headlamp switch knob outward and then rolling the knob one more detent counterclockwise will activate the rear fog lamp. The headlamp switch is only able to pull outward while in the headlamp position. The internal circuitry of the left multi-function switch then provides battery voltage to the rear fog lamp(s) and to the instrument cluster for control of the fog lamp indicator.
- **Hazard Warning System** - The hazard warning push button is pushed down to unlatch the switch and activate the hazard warning system, and pushed down again to latch the switch and turn the system off. When the hazard warning switch is latched, the push button will be in a lowered position on the top of the steering column shroud; and, when the hazard warning switch is unlatched, the push button will be in a raised position. The left multi-function switch hazard warning simultaneously provides a signal to the hazard warning sense of the combination flasher to activate or deactivate the flasher output, and directs the output of the flasher to the hazard warning lamps.
- **Headlamps** - The control knob on the end of the left multi-function switch control stalk is rotated forward to its second detent from the Off position to activate the headlamps. The internal circuitry of the left multi-function switch then provides battery voltage through the integral beam select switch and the headlamp low beam or high beam circuits to the appropriate headlamp filaments and to the instrument cluster for control of the high beam indicator.
- **Headlamp Beam Selection** - The left multi-function switch control stalk is pulled towards the steering wheel past a detent, then released to actuate the integral beam select switch circuitry. Each time the control stalk is actuated in this manner, the opposite headlamp mode from what is currently selected will be activated.
- **Headlamp Optical Horn** - The left multi-function switch control stalk is pulled towards the steering wheel to just before a detent, to momentarily activate the headlamp high beams. The high beams will remain illuminated until the control stalk is released. The internal beam select switch circuitry directs battery voltage through the headlamp high beam circuit of the left multi-function switch to the headlamp high beams and to the instrument cluster for control of the high beam indicator.
- **Interior Lamps Control** - A control ring on the left multi-function switch control stalk is rotated to a full forward detent to illuminate all interior courtesy lamps. The instrument cluster circuitry monitors the hard wired variable resistor output of the left multi-function switch through the panel lamps dimmer signal circuit then, based upon that input, provides a ground path to activate all interior courtesy lamps through a courtesy lamp feed circuit output.
- **Panel Lamps Dimming** - A control ring on the left multi-function switch control stalk is rotated to one of six intermediate detent positions to select the desired illumination intensity of all adjustable instrument panel and instrument cluster lighting. The control ring is rotated forward to brighten, or rearward to dim the lighting. The instrument cluster monitors the hard wired variable resistor output of the left multi-function switch through the panel lamps dimmer signal circuit then, based upon that input, provides a pulse width modulated output, to control the instrument cluster lighting levels. The instrument cluster also controls the lighting levels of the other adjustable instrument panel lighting based upon this panel lamps dimmer signal through a panel lamps driver circuit output.
- **Parade Mode** - A control ring on the left multi-function switch control stalk is rotated to an intermediate detent that is one detent rearward from the full forward detent to illuminate the Vacuum Fluorescent Display (VFD) in the instrument cluster and the radio at full intensity. The instrument cluster monitors the hard wired variable resistor output of the left multi-function switch through the panel lamps dimmer signal circuit then, based upon that input, adjusts the instrument cluster VFD to its full intensity and provides a battery voltage signal to the radio on a park lamp relay output circuit that signals the radio to light its VFD to full intensity.
- **Park Lamps** - The control knob on the end of the left multi-function switch control stalk is rotated forward to its first detent to activate the parking lamps. The left multi-function switch then provides battery voltage to the parking lamps and to the instrument cluster as a request for cluster illumination and panel lamps output.
- **Turn Signal Control** - The left multi-function switch control stalk actuates the turn signal switch. The multi-function switch turn signal circuitry simultaneously provides a signal to the turn signal sense circuit of the combination flasher to activate the flasher output. The turn signal switch has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate, momentary position in each direction that provides

LEFT MULTI-FUNCTION SWITCH (Continued)

turn signals only until the left multi-function switch control stalk is released. When the control stalk is moved to a turn signal switch detent position, the cancel actuator extends toward the center of the steering column. A turn signal cancel cam that is integral to the clockspring, rotates with the steering wheel and the cam lobes contact the cancel actuator when it is extended from the multi-function switch.If only momentary signaling is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the Off position as soon as the lever is released. When the system is activated, one of two turn indicators in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating.

DIAGNOSIS AND TESTING - LEFT MULTI-FUNCTION SWITCH

Refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the left multi-function switch from the steering column (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LEFT MULTI-FUNCTION SWITCH - REMOVAL).

(3) Remove the combination flasher from the left multi-function switch.

(4) Using an ohmmeter, perform the continuity and resistance tests at the terminals in the left multi-function switch connector receptacles as shown in the Left Multi-Function Switch Test table. Refer to (Fig. 25) and (Fig. 26) for connector terminal and cavity identification.

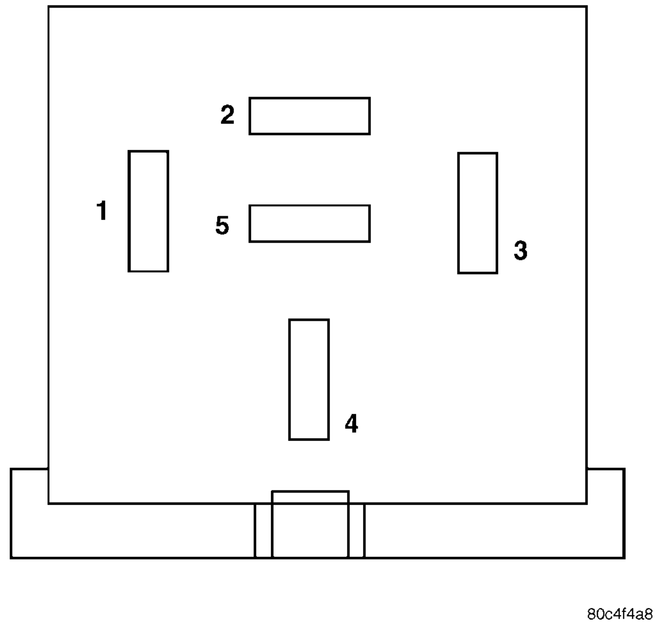


Fig. 25 Combination Flasher Receptacle (Connector A)

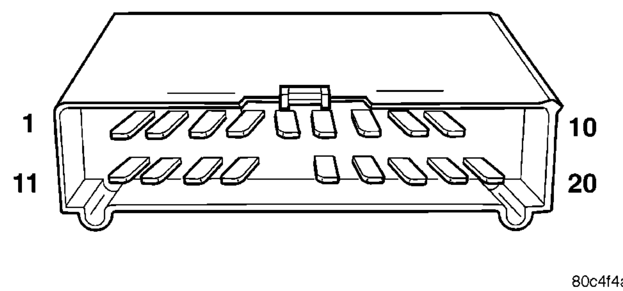


Fig. 26 Left Multi-Function Switch Connector Receptacle (Connector B)

LEFT MULTI-FUNCTION SWITCH (Continued)

LEFT (LIGHTING) MULTI-FUNCTION SWITCH TEST			
TURN SIGNAL AND HAZARD WARNING SWITCH TESTS			
SWITCH POSITION		CONTINUITY BETWEEN	
TURN	HAZARD		
Neutral	Off	B1 & B4, B1 & B5	
Left	Off	A2 & B2, A2 & B4, B1 & B5	
Right	Off	A2 & B5, B1 & B4	
Neutral	On	A2 & B2, A2 & B4, A2 & B5, A2 & B6, A3 & B7, A3 & A5	
EXTERIOR LIGHTING SWITCH TESTS			
SWITCH POSITION		CONTINUITY BETWEEN	
Park Lamps On		B9 & B20	
Headlamp Low Beams On		B16 & B18, B16 & B19	
Headlamp High Beams On		B17 & B18, B17 & B19	
Fog Lamps On		B13 & B14	
Rear Fog Lamps On		B12 & B13	
Optical Horn On		B17 & B18, B17 & B19	
INTERIOR LIGHTING SWITCH TESTS			
SWITCH POSITION		RESISTANCE BETWEEN	RESISTANCE (OHMS)
Panel Lamps Dimming Position 1 (Dimmest)		B7 & B8	5653 ± 10%
Dimming Position 2		B7 & B8	3743 ± 10%
Dimming Position 3		B7 & B8	2593 ± 10%
Dimming Position 4		B7 & B8	1825 ± 10%
Dimming Position 5		B7 & B8	1221 ± 10%
Dimming Position 6 (Brightest)		B7 & B8	768 ± 10%
Parade Mode On		B7 & B8	412 ± 10%
Courtesy Lamps On		B7 & B8	150 ± 10%

(5) If the left multi-function switch fails any of the continuity or resistance tests, replace the faulty switch unit as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the two screws that secure the lower steering column shroud to the upper shroud (Fig. 27).

(4) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.

(5) Remove both the upper and lower shrouds from the steering column.

(6) Disconnect the cross body wire harness connector for the left multi-function switch from the connector receptacle on the back of the switch.

(7) Disconnect the cross body wire harness connector for the right multi-function switch from the connector receptacle on the back of the switch.

LEFT MULTI-FUNCTION SWITCH (Continued)

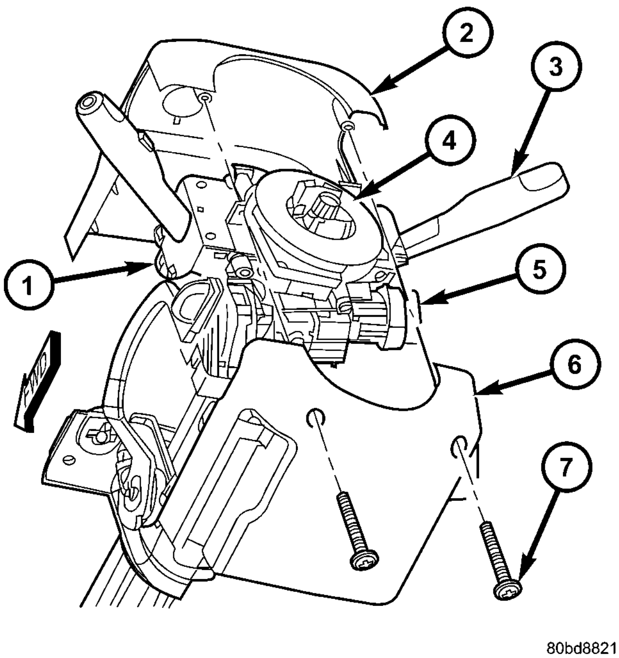


Fig. 27 Steering Column Shrouds Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - UPPER SHROUD
3 - RIGHT MULTI-FUNCTION SWITCH
4 - CLOCKSPRING
5 - IGNITION LOCK CYLINDER HOUSING
6 - LOWER SHROUD
7 - SCREW (2)

(8) Remove the two screws that secure the multi-function switch assembly to the upper steering column housing (Fig. 28).

(9) Remove the multi-function switch assembly from the upper steering column housing.

(10) Remove the two small screws that secure the right multi-function switch to the left multi-function switch mounting housing.

(11) Grasp the right multi-function switch control stalk firmly and pull the switch toward the right far enough to disengage the alignment pins on the top (1) and bottom (2) of the right switch housing from the alignment ramps on the left multi-function switch mounting housing.

(12) Remove the right multi-function switch from the left multi-function switch.

(13) Remove the combination flasher from the connector receptacle on the back of the left multi-function switch.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

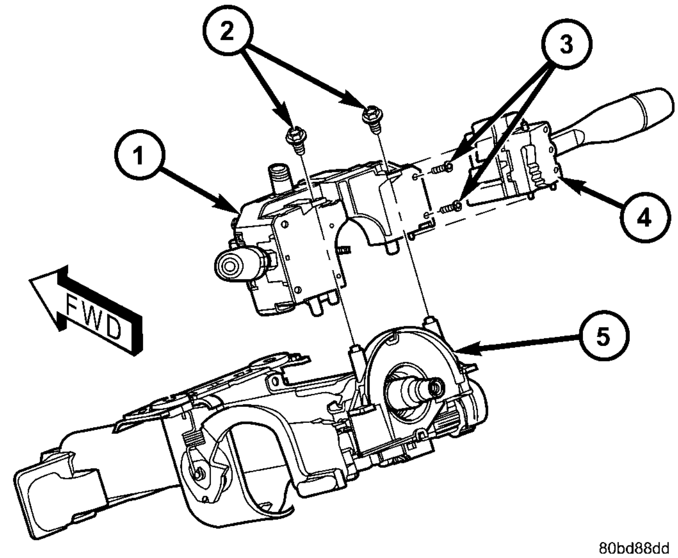


Fig. 28 Multi-Function Switch Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - SCREW (2)
3 - SCREW (2)
4 - RIGHT MULTI-FUNCTION SWITCH
5 - UPPER STEERING COLUMN HOUSING

(1) Install the combination flasher into the connector receptacle on the back of the left multi-function switch.

(2) Position the right multi-function switch to the left multi-function switch.

(3) Grasp the right multi-function switch control stalk firmly and slide the switch toward the left far enough to engage the alignment pins on the top (1) and bottom (2) of the right switch housing into the alignment ramps on the left multi-function switch mounting housing.

(4) Install and tighten the screws that secure the right multi-function switch to the left multi-function switch mounting housing (Fig. 28). Tighten the screws to 2 N·m (17 in. lbs.).

(5) Position the multi-function switch assembly onto the upper steering column housing.

(6) Install and tighten the screws that secure the multi-function switch assembly to the upper steering column housing. Tighten the screws to 2 N·m (17 in. lbs.).

LEFT MULTI-FUNCTION SWITCH (Continued)

(7) Reconnect the cross body wire harness connector for the right multi-function switch to the connector receptacle on the back of the switch.

(8) Reconnect the cross body wire harness connector for the left multi-function switch to the connector on the back of the switch.

(9) Position both the upper and lower shrouds onto the steering column (Fig. 29). Be certain that the locating tabs for the left and right multi-function switch control stalk watershields are properly engaged in the openings of both the upper and lower shrouds.

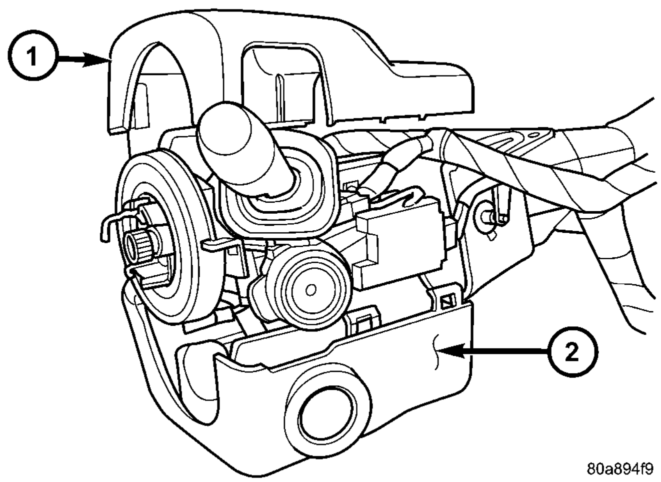


Fig. 29 Shroud Remove/Install

1 - UPPER SHROUD
2 - LOWER SHROUD

(10) Install and tighten the screws that secure the lower steering column shroud to the upper shroud. Tighten the screws to 2 N·m (17 in. lbs.).

(11) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully raised position and secure it in place by moving the tilt release lever back to the locked (up) position.

(12) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(13) Reconnect the battery negative cable.

SIDE MARKER LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) From underside of the fender flare, remove the nut that secures the side marker lamp housing to the front fender flare.

(3) Remove the lamp housing from the fender flare.

(4) Rotate the socket one-third turn counterclockwise and separate the socket and lamp from the housing.

INSTALLATION

(1) Install the socket and lamp into the housing and rotate the socket one-third turn clockwise.

(2) Position the side marker lamp housing into the front fender flare.

(3) Install the nut that secures the side marker lamp housing to the fender flare. Tighten the nut securely.

(4) Reconnect battery negative cable.

SIDE MARKER LAMP

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) From underside of the fender flare, rotate the side marker lamp socket one-third turn counterclockwise and separate it from the side marker lamp housing.

(3) Remove the lamp from the socket by pulling it straight out of the socket.

INSTALLATION

(1) Install the side marker lamp into the socket by pushing it straight into the socket.

(2) Install the socket into the housing and rotate the socket one-third turn clockwise.

(3) Reconnect the battery negative cable.

REPEATER LAMP

DESCRIPTION

Some export models are equipped with side repeater lamps instead of side marker lamps. The side repeater lamp operates with the turn signals and has an amber colored lens and a clear lamp. For Removal and Installation procedures, refer to Side Marker Lamps within this Group.

OPERATION

The side repeater lamps operate in series with the front and rear turn signal lamps and are controlled by the steering column mounted multi-function switch.

DIAGNOSIS AND TESTING - SIDE REPEATER LAMP

The following chart is designed to diagnosis a faulty side repeater lamp with the turn signals operating normally. Refer to Wiring Diagrams for a complete system schematic.

REPEATER LAMP (Continued)

SIDE REPEATER LAMP CONDITION CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TURN SIGNALS OPERATE NORMALLY, ONE REPEATER LAMP DOES NOT ILLUMINATE	1. Inoperative, damaged or burned out lamp.	4. Replace the lamp.
	2. Poor electrical connection at lamp.	2. Check for proper wire harness connection and circuit terminal tension at the lamp.
	3. Open or high resistance in the voltage circuit to the inoperative lamp.	3. Repair the open or high resistance in the repeater lamp voltage circuit.
	4. Open, high resistance in the ground circuit to the inoperative lamp.	4. Repair the open, high resistance in the repeater lamp ground circuit.

TAIL LAMP UNIT

DESCRIPTION

Each tail lamp assembly contains a lens, housing and two lamps. One lamp has two filaments and is used for tail, stop, turn signal, rear side marker and license plate (left side only) lamp functions. The other lamp has a single filament and is used for back-up light illumination.

OPERATION

Each tail lamp assembly can be serviced separately. Each lamp can also be serviced separately. The headlamp switch controls tail lamp operation. The multi-function switch controls turn signal operation. The back-up light switch controls back-up light operation. The brake lamp switch controls stop lamp operation.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) From the underside of the vehicle, remove the push-in fastener that secures the bottom rear edge of the rear wheelhouse splash shield to the body.

(3) Pull the rear of the wheelhouse splash shield away from the body and reach upward to disconnect the wire harness connector from the tail lamp.

(4) Remove the screws that secure the tail lamp lens to the tail lamp housing (Fig. 30).

(5) Remove the tail lamp lens and gasket from the tail lamp housing.

(6) Remove the bolts that secure the tail lamp housing to the body.

(7) Remove the tail lamp housing from the body.

INSTALLATION

(1) Position the tail lamp housing to the body.

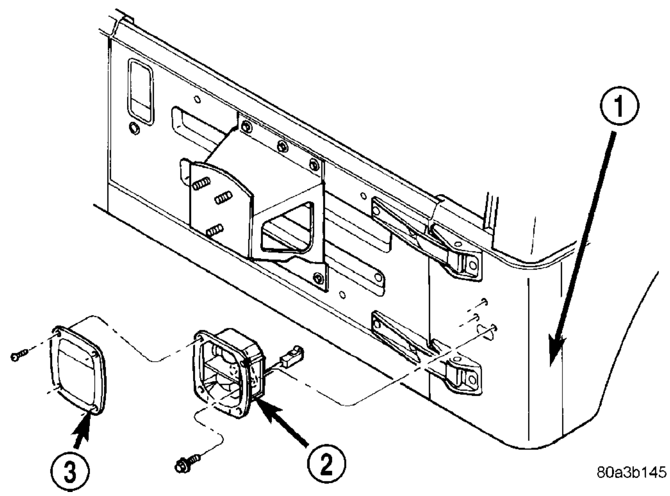


Fig. 30 Tail Lamp Housing

1 - BODY
2 - TAIL LAMP HOUSING
3 - TAIL LAMP LENS

(2) Install the bolts that secure the tail lamp housing to the body. Tighten the bolts securely.

NOTE: Install the tail lamp lens with the clear portion (back-up lens) at the top of the housing. Make sure that the gasket is correctly in place and not twisted or torn.

(3) Install the tail lamp lens and gasket onto the tail lamp housing.

NOTE: Do not overtighten the screws or damage to the tail lamp lens may result.

(4) Install the screws that secure the tail lamp lens to the tail lamp housing. Tighten the screws securely.

(5) Connect the wire harness connector to the tail lamp.

TAIL LAMP UNIT (Continued)

(6) Install the push-in fastener that secures the bottom rear edge of the rear wheelhouse splash shield to the body.

(7) Reconnect the negative battery cable.

TAIL LAMP

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the screws that secure the tail lamp lens to the tail lamp housing (Fig. 31).

(3) Remove the tail lamp lens and gasket from the tail lamp housing.

(4) Push and rotate the lamp(s) one-third turn counterclockwise, then pull the lamp straight out of the socket

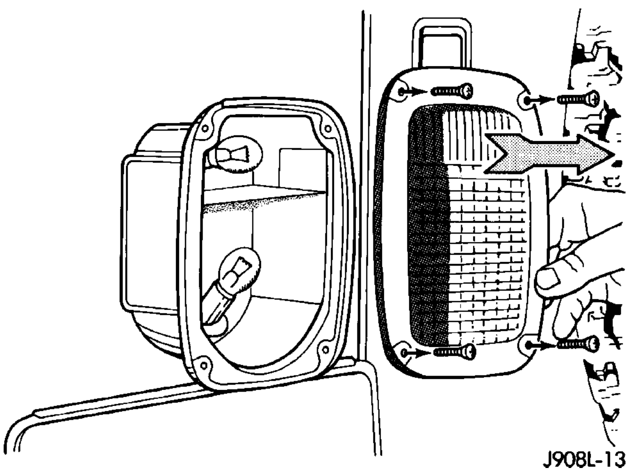


Fig. 31 Tail Lamp Lens

INSTALLATION

(1) Install the lamp(s) by pushing the lamp into the tail lamp socket and turning it one-third clockwise.

NOTE: Install the tail lamp lens with the clear portion (back-up lens) at the top of the housing. Make sure that the gasket is correctly in place and not twisted or torn.

(2) Install the tail lamp lens and gasket onto the tail lamp housing.

NOTE: Do not overtighten the screws or damage to the tail lamp lens may result.

(3) Install the screws that secure the tail lamp lens to the tail lamp housing. Tighten the screws securely.

(4) Reconnect the negative battery cable.

TURN SIGNAL CANCEL CAM

DESCRIPTION

The turn signal cancel cam consists of two lobes that are integral to the lower surface of the clockspring rotor. The clockspring mechanism provides turn signal cancellation as well as a constant electrical connection between the driver airbag, steering wheel accessorys and the cross body wire harness on the steering column. The housing of the clockspring is secured to the steering column and remains stationary. The rotor of the clockspring, including the turn signal cancel cam lobes rotate with the steering wheel.

The turn signal cancel cam is integral to the clockspring and cannot be repaired. If faulty or damaged, the entire clockspring assembly must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

OPERATION

The turn signal cancel cam has two lobes molded into the lower surface of the clockspring rotor. When the turn signals are activated by moving the left multi-function switch control stalk to a detent position, a turn signal cancel actuator is extended from the inside surface of the left multi-function switch housing toward the clockspring rotor. When the steering wheel is rotated during the turn, one of the two turn signal cancel cam lobes will contact the turn signal cancel actuator, but the cancel actuator stays latched. When the steering wheel is rotated back to center as the turn is completed, the cancel actuator is unlatched and releases the left multi-function switch control stalk from its detent, cancelling the turn signal event.

UNDERHOOD LAMP UNIT

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Disconnect the wire harness connector from the underhood lamp (Fig. 32).

(3) Remove the screw that secures the underhood lamp to the inner hood panel.

(4) Remove the underhood lamp from the vehicle.

INSTALLATION

(1) Position the underhood lamp onto the inner hood panel.

(2) Install the screw that secures the underhood lamp to the inner hood panel. Tighten the screw securely.

UNDERHOOD LAMP UNIT (Continued)

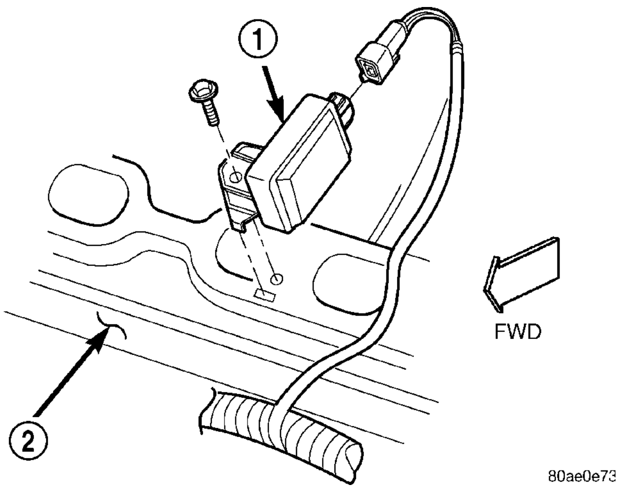


Fig. 32 Underhood Lamp

1 - UNDERHOOD LAMP
2 - HOOD

(3) Connect the wire harness connector to the underhood lamp.

(4) Reconnect the negative battery cable.

UNDERHOOD LAMP

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Insert a small flat blade in the access slot between the lamp housing and lamp lens.

(3) Pry the lamp lens upward and remove the lamp lens.

(4) Press the lamp terminal inward (Fig. 33) to release the lamp.

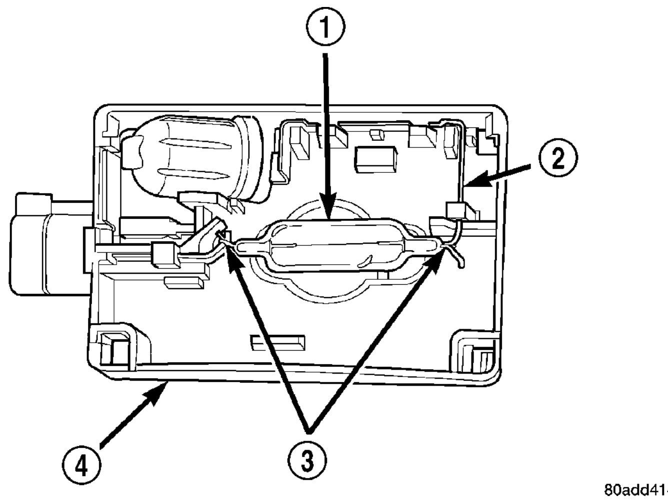


Fig. 33 Underhood Lamp

1 - LAMP
2 - LAMP TERMINAL
3 - LAMP WIRE LOOP
4 - LAMP HOUSING

INSTALLATION

(1) Engage the lamp wire loop to the terminal closest to the lamp housing wire connector.

(2) Press the opposite terminal inward and engage the remaining lamp wire loop onto the terminal.

(3) Position the lamp lens onto the lamp housing and press the lens into place.

(4) Reconnect the negative battery cable.

LAMPS/LIGHTING - INTERIOR

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LAMPS/LIGHTING - INTERIOR

SPECIFICATIONS

INTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp housing and lens can result.

Some components have lamps that can only be serviced by an Authorized Service Center (ASC) after the component is removed from the vehicle.

The following table lists the various lamp trade numbers or part numbers.

LAMP	BULB
Dome (Sound Bar)	912
Under Hood	561
Underpanel Courtesy	906
Instrument Cluster Illumination	103
Instrument Cluster Warning	74
Automatic Transmission Indicator	658

DOME LAMP UNIT

REMOVAL

NOTE: The dome lamp removal procedure is the same for both the right and left side dome lamps.

(1) Disconnect the negative battery cable.

NOTE: The dome lamp lens locating tab is larger than the lens retaining tabs.

(2) Insert a small flat blade between the dome lamp housing and dome lamp lens. Carefully pry the lamp lens from the lamp housing (Fig. 1).

(3) Remove the screws that secure the dome lamp housing to the speaker housing.

(4) Remove the dome lamp housing from the speaker housing and disconnect the wire harness connector from the dome lamp.

INSTALLATION

NOTE: The dome lamp installation procedure is the same for both the right and left side dome lamps.

(1) Connect the wire harness connector to the dome lamp.

NOTE: The dome lamp housing is equipped with a locating tab that must be inserted into the slot in the speaker housing.

(2) Align the locating tab with the slot and position the dome lamp housing into the speaker housing (Fig. 2).

DOME LAMP UNIT (Continued)

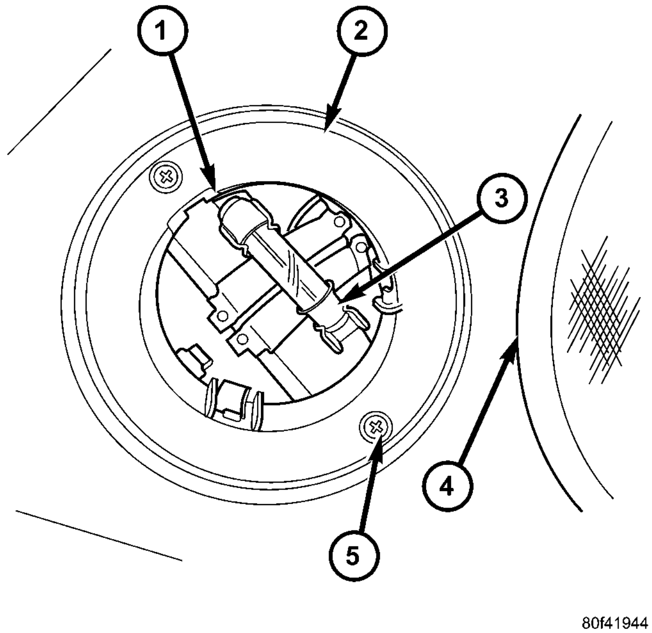

Fig. 1 Dome Lamp - Typical

1 - DOME LENS GUIDE
2 - DOME LAMP HOUSING
3 - DOME LAMP
4 - SPEAKER HOUSING
5 - SCREW (2)

(3) Install the screws that secure the dome lamp housing to the speaker housing.

NOTE: The dome lamp lens is equipped with a locating tab that must be inserted into the slot in the dome lamp housing.

(4) Align the dome lamp lens locating tab with the slot in the dome lamp housing and press the lens into place.

(5) Reconnect the negative battery cable.

DOME LAMP

REMOVAL

(1) Disconnect the negative battery cable.

(2) Insert a small flat blade between the dome lamp housing and dome lamp lens. Carefully pry the lamp lens from the lamp housing

(3) Remove the dome lamp from the lamp terminals by pulling the lamp straight out.

INSTALLATION

(1) Install the dome lamp into the lamp terminals by pushing the lamp straight into the terminals.

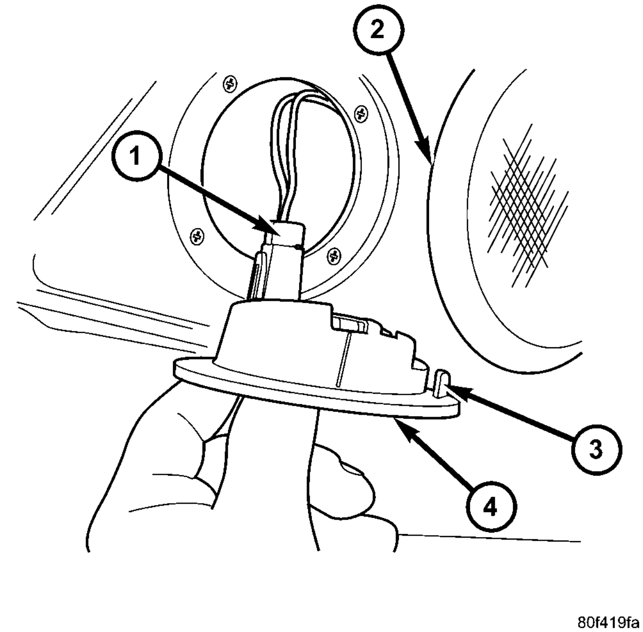

Fig. 2 Dome Lamp Housing

1 - WIRE HARNESS CONNECTOR
2 - SPEAKER
3 - LOCATING TAB
4 - DOME LAMP HOUSING

NOTE: The dome lamp lens is equipped with a locating tab that must be inserted into the slot in the dome lamp housing.

(2) Align the dome lamp lens locating tab with the slot in the dome lamp housing and press the lens into place.

(3) Reconnect the negative battery cable.

DOOR AJAR SWITCH

DESCRIPTION

The door ajar switches, located in each door pillar, are a self-adjusting, spring loaded plunger. The other end of the switch is actuated by the hinge face of the door. The self adjusting feature of the switch plunger is a one-time feature, it can be adjusted inward (compressed), but cannot be readjusted outward (extended) once it has been compressed. This normally open switch only closes when the door is open.

The door ajar switch cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The door ajar switches control a path to ground through separate driver and passenger door ajar switch sense circuit inputs to the instrument cluster chime warning circuitry when a door is opened. The

DOOR AJAR SWITCH (Continued)

door ajar switch inputs to the instrument cluster can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - DOOR AJAR SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the negative battery cable. Remove the door ajar switch from the door hinge pillar. Disconnect the wire harness connector from the door ajar switch. Check for continuity between the door ajar switch output and the driver or passenger door ajar switch sense circuit in the door ajar switch connector. There should be continuity with the switch plunger released, and no continuity with the switch plunger depressed. If OK, go to Step 2. If not OK, replace the faulty door ajar switch.

(2) Check for continuity between the door ajar switch output circuit of the wire harness connector for the driver or passenger door ajar switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open door ajar switch output circuit to ground as required.

(3) Remove the instrument cluster from the instrument panel. Disconnect the instrument panel wire harness connector from the instrument cluster. Check for continuity between the driver or passenger door ajar switch sense circuit of the wire harness connector for the driver or passenger door ajar switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted driver or passenger door ajar switch sense circuit between the door ajar switch and the instrument cluster as required.

(4) Check for continuity between the driver or passenger door ajar switch sense circuit of the wire harness connector for the driver or passenger door ajar switch and the wire harness connector for the instrument cluster. There should be continuity. If not OK, repair the open driver or passenger door ajar switch sense circuit between the door ajar switch and the instrument cluster as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the negative battery cable

(2) Unlatch and open the door fully.

(3) Using a small screwdriver, pry carefully between the hinge pillar and the outer circumference of the door ajar switch housing to release the switch snap features from the mounting hole in the pillar.

(4) Pull the door ajar switch out through the mounting hole in the hinge pillar far enough to access and disconnect the wire harness connector from the door ajar switch.

(5) Remove the door ajar switch from the door hinge pillar.

INSTALLATION

(1) Position the door ajar switch to the door hinge pillar.

(2) Connect the wire harness connector to the door ajar switch.

(3) Guide the wire harness for the door ajar switch and the receptacle end of the switch into the mounting hole in the door hinge pillar.

(4) Using hand pressure, press the door ajar switch housing into the mounting hole in the door hinge pillar until the snap features of the switch are fully engage in the mounting hole.

(5) Slowly close the door and allow the door ajar switch plunger self-adjuster mechanism to ratchet to the proper position.

(6) Reconnect the negative battery cable.

(7) Open and close the door to verify proper door ajar switch operation.

REAR WIPER/WASHER SWITCH ILLUMINATION LAMP

REMOVAL

The rear wiper and washer switch in the accessory switch bezel of the instrument panel includes a single serviceable incandescent lamp and lamp holder unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the negative battery cable.

(2) Remove the rear wiper and washer switch from the accessory switch bezel (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER/WASHER SWITCH - REMOVAL).

(3) From the bottom of the switch housing, use a small thin-bladed screwdriver to rotate the lamp holder counterclockwise about 30 degrees in the mounting hole (Fig. 3).

(4) Pull the rear wiper and washer switch lamp holder and lamp assembly straight out of the mounting hole.

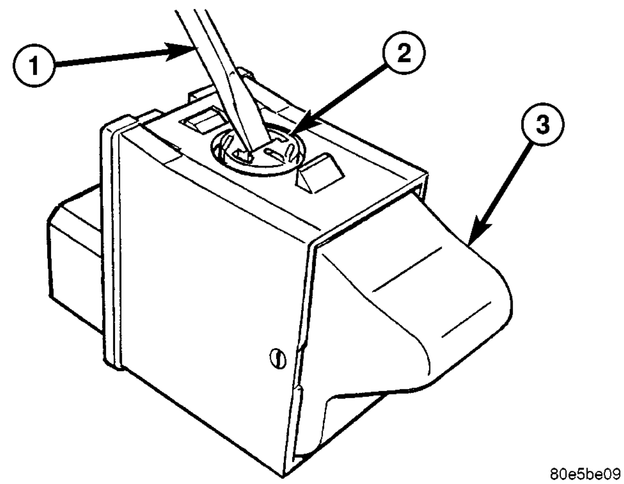

Fig. 3 Rear Wiper/Washer Switch Lamp

1 - SCREW DRIVER
2 - LAMP HOLDER
3 - REAR WIPER/WASHER SWITCH

INSTALLATION

CAUTION: Always use the correct lamp size and type for replacement. An incorrect lamp size or type may overheat and cause damage to the rear wiper and washer switch.

(1) Align the rear wiper and washer switch lamp holder and lamp assembly with the mounting hole in the bottom of the switch.

(2) Insert the rear wiper and washer switch lamp holder and lamp assembly straight into the mounting hole until it is firmly seated.

(3) Using a small thin-bladed screwdriver, rotate the lamp holder clockwise about 30 degrees in the mounting hole.

(4) Install the rear wiper and washer switch into the accessory switch bezel (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER/WASHER SWITCH - INSTALLATION).

(5) Reconnect the negative battery cable.

POWER SYSTEMS

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AUTOMATIC DAY / NIGHT MIRROR

DESCRIPTION

The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system will automatically change the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and will only operate when the ignition switch is in the On position.

Contained within the mirror is a compass/temperature display as well as two LED reading lamps.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is inoperative or damaged, the entire automatic day/night inside rear view mirror unit must be replaced.

OPERATION

The automatic day/night mirror is equipped with three buttons: the left switch for the left LED lamp, the right switch for the right side LED lamp and the center switch for the compass/temperature function. Pressing the left and right switch simultaneously will turn the auto dim function on or off. A green light next to the right button will indicate when the dimming feature is activated. The mirror also senses the backup lamp circuit, and will automatically disable its self-dimming feature whenever the transmission gear selector is in the Reverse position.

The compass/temperature display provides the outside temperature and one of eight compass headings. Press and release the center button once within 3 seconds to display compass/temperature (Fahrenheit). Press and release the center button twice within 3 seconds to display compass/temperature (Celsius). Press and release the center button three times within 3 seconds to deactivate the feature.

A thin layer of electrochromatic material between two pieces of conductive glass make up the face of the mirror. Two photocell sensors are used to monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward, to detect the outside light levels. The headlamp sensor is located on the mirror housing just to the left of the switch and facing rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

AUTOMATIC DAY / NIGHT MIRROR (Continued)

DIAGNOSIS AND TESTING - AUTOMATIC DAY/NIGHT MIRROR

For complete circuit diagrams, refer to the appropriate wiring information.

(1) Check for a blown fuse. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fuse. If OK, go to Step 3. If not OK, repair the open circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the automatic day/night mirror. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the automatic day/night mirror wire harness connector and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the circuit to ground as required.

(5) Connect the battery negative cable. Turn the ignition switch to the On position. Set the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to Step 6. If not OK, repair the open circuit as required.

(6) Turn the ignition switch to the Off position. Disconnect the battery negative cable. Plug in the automatic day/night mirror wire harness connector. Connect the battery negative cable. Turn the ignition switch to the On position. Place the transmission gear selector lever in the Neutral position. Place the mirror switch in the On (the LED in the mirror switch is lighted) position. Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

(7) Shine a light into the rearward facing headlamp photocell sensor. The mirror glass should darken. If OK, go to Step 8. If not OK, replace the faulty automatic day/night mirror unit.

(8) With the mirror glass darkened, place the transmission gear selector lever in the Reverse position. The mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

STANDARD PROCEDURE

STANDARD PROCEDURE - COMPASS CALIBRATION

AUTOMATIC CALIBRATION

The compass is self calibrating which eliminates the need to manually set the compass. When the vehicle is new, the compass may appear erratic and CAL will be displayed. After completing one 360° turn with the vehicle traveling less than 8 km/h (5 mph) in an area free from large metal or metallic objects, CAL will turn off and the compass will function normally.

MANUAL CALIBRATION

If the compass appears erratic and CAL does not appear, you must manually put the compass into the calibration mode. To ensure proper compass calibration, make sure the compass variance is properly set before manually calibrating the compass.

To put the compass into calibration mode: Turn the ignition to the ON position. Press and hold the center button for 6 seconds to change the display between VAR (compass variance) and CAL (compass calibration) modes. To recalibrate the compass, CAL should display for a complete 1 1/2 360° turns in a area free from large metal objects or power lines. When the compass has been calibrated, the CAL symbol will turn off and the compass will function normally.

AUTOMATIC DAY / NIGHT MIRROR (Continued)

STANDARD PROCEDURE - COMPASS VARIATION ADJUSTMENT

Compass variance is the difference between magnetic north and geographic north. In some areas of the country, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this occurs, the compass variance must be set according to the compass variance map (Fig. 1).

To set the variance: Turn the ignition to the ON position. Press and hold the center button for 3 to 6 seconds. The last variance zone number will be displayed. Each press of the center button will select a new variance zone. When the proper zone is selected, wait 5 seconds to resume normal operation.

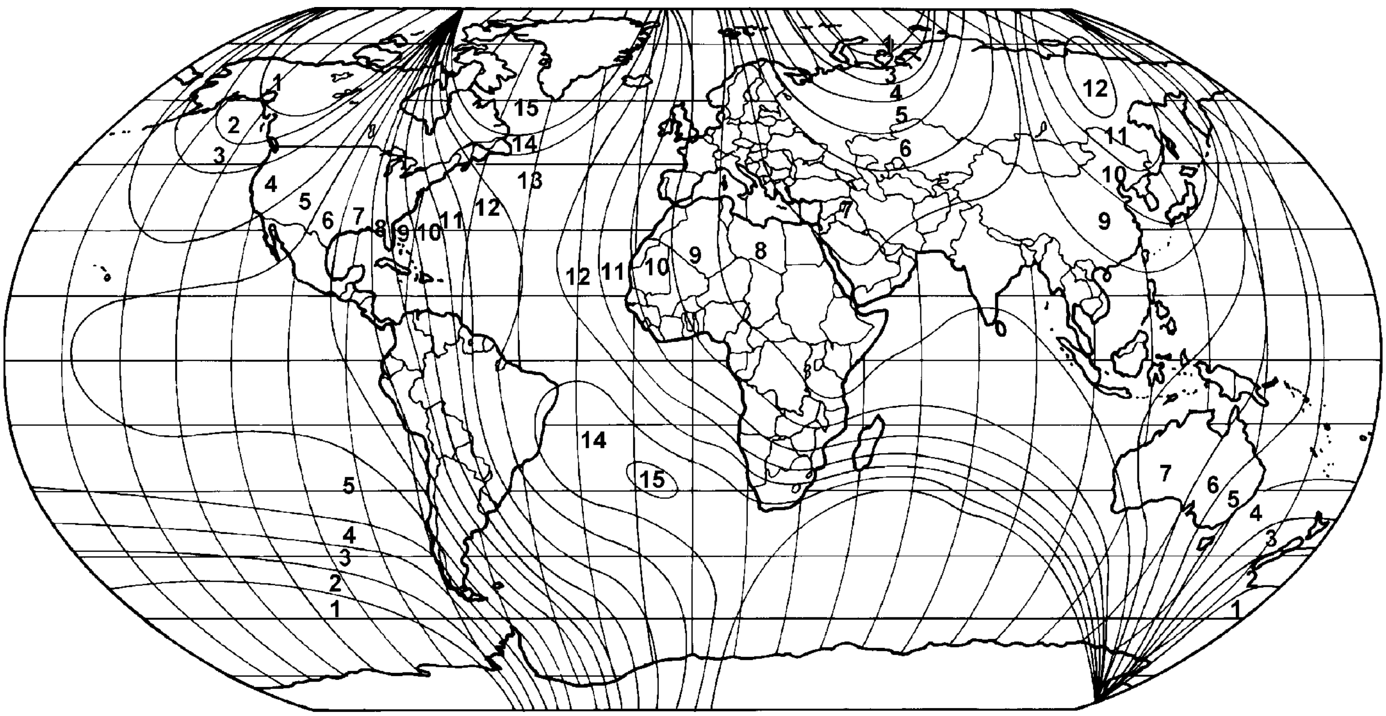

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Fig. 1 Variance Settings

RESTRAINTS

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RESTRAINTS

DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this model. Available occupant restraints for this model include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed (Fig. 1).

ACTIVE RESTRAINTS

The active restraints for this model include:

- **Front Seat Belts -** Both front seating positions are equipped with three-point seat belt systems employing a lower sport bar mounted inertia latch-type retractor, height-adjustable upper sport bar mounted turning loops, a fixed lower seat belt anchor secured with the retractor to the lower end of the

RESTRAINTS (Continued)

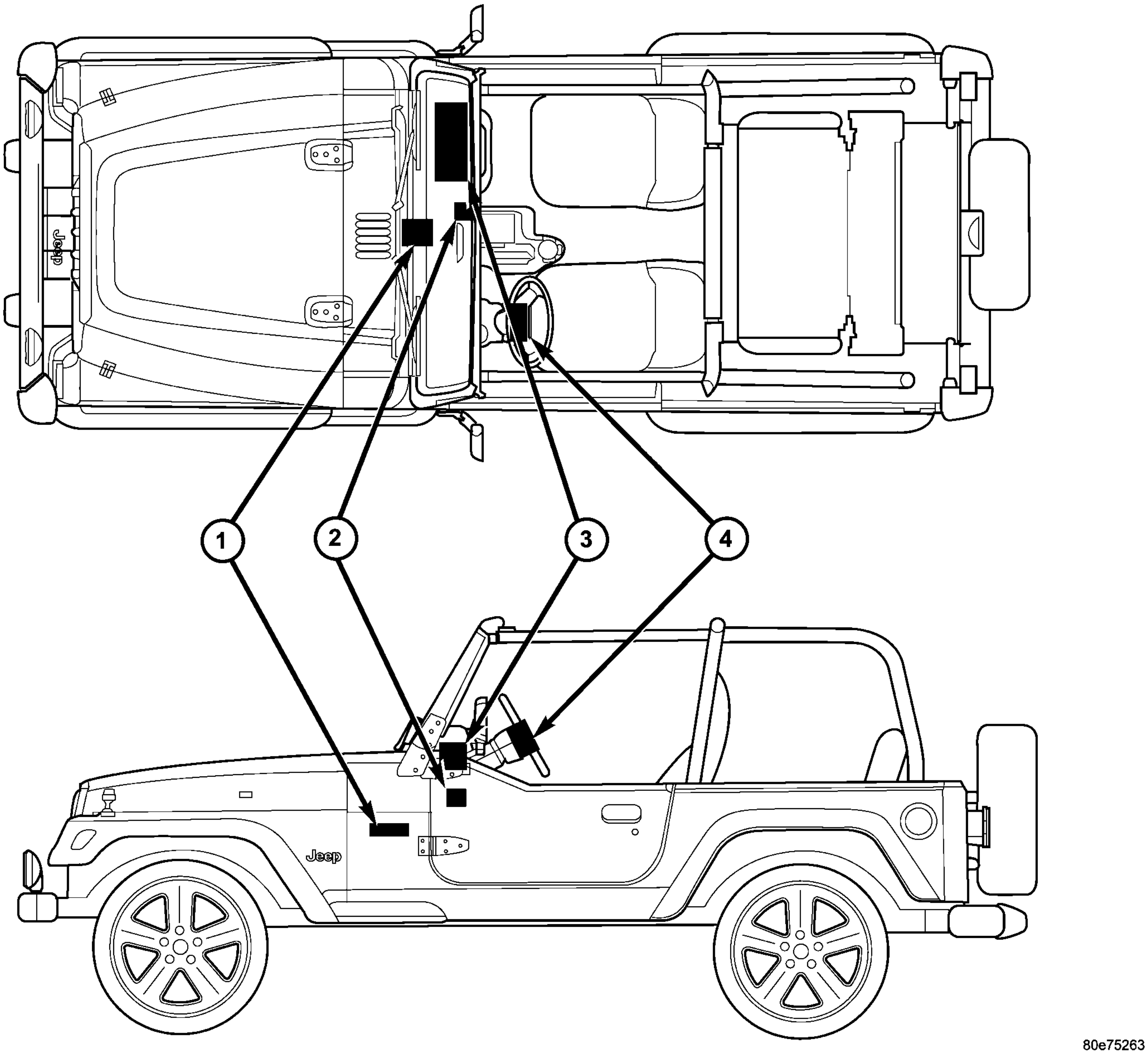

Fig. 1 Supplemental Restraint System

1 - AIRBAG CONTROL MODULE
2 - PASSENGER AIRBAG ON/OFF SWITCH (W/O REAR SEAT ONLY)
3 - PASSENGER AIRBAG
4 - DRIVER AIRBAG

sport bar, and a traveling end-release seat belt buckle secured to the inboard side of each front seat track. The front seat belt buckle for the driver side of all models includes an integral seat belt switch that electrically detects whether the driver seat belt has been fastened.

- **Rear Seat Belts** - On models equipped with a rear seat, both rear seating positions are equipped with three-point seat belt systems. The rear seating position belts employ a lower sport bar mounted inertia latch-type retractor, fixed upper sport bar mounted turning loops, a fixed lower seat belt anchor secured to the inner rear wheelhouse panel, and a fixed end-release seat belt buckle secured to the rear floor panel.
- **Child Restraint Anchors** - All vehicles without a rear seat are equipped with a single, fixed-position, child seat upper tether anchor and two fixed lower anchors for the front passenger seat. The upper anchor is integral to the seat riser bracket and is accessed from behind the front seat. The two lower anchors are also integral to the seat riser bracket,

RESTRAINTS (Continued)

but are accessed from the front of the seat where the seat back meets the seat cushion. Vehicles equipped with a rear seat have two fixed-position, child seat upper tether anchors on the rear floor panel behind the rear seat just forward of the tailgate opening, and four lower anchors that are integral to the rear seat back. The inboard rear seat lower anchors are accessed from the front of the seat where the seat back meets the seat cushion. The outboard rear seat lower anchors are accessed between the seat hinge bracket on each outboard end of the rear seat, just above the seat back pivot. The child seat tether and lower anchors for the front passenger seat are deleted on models equipped with a rear seat.

PASSIVE RESTRAINTS

The passive restraints available for this model include Next Generation driver and front passenger airbags. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by the "SRS - AIRBAG" logo molded into the driver airbag trim cover in the center of the steering wheel and also into the passenger airbag door on the instrument panel above the glove box (Fig. 2). Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the instrument cluster for about seven seconds as a bulb test each time the ignition switch is turned to the On position.

Fig. 2 SRS Logo

The supplemental restraint system includes the following major components, which are described in further detail elsewhere in this service information:

- **Airbag Control Module** - The Airbag Control Module (ACM) is located on a mount on the floor panel transmission tunnel, below the center of the instrument panel.
- **Airbag Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC), which is located on the instrument panel in front of the driver.
- **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel.
- **Driver Airbag** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.
- **Driver Knee Blocker** - The driver knee blocker is a molded plastic structural unit secured to the back side of and integral to the instrument panel steering column opening cover.
- **Passenger Airbag** - The passenger airbag is located on the instrument panel, beneath the passenger airbag door on the instrument panel above the glove box on the passenger side of the vehicle.
- **Passenger Airbag On/Off Switch** - Models without a rear seat are equipped with a passenger airbag on/off switch, which is located in a dedicated opening on the passenger side of the accessory switch bezel in the lower center stack area of the instrument panel.
- **Passenger Knee Blocker** - The passenger knee blocker is a structural reinforcement that is integral to and concealed within the glove box door.

The ACM and the EMIC each contain a central processing unit and programming that allow them to communicate with each other using the Programmable Communication Interface (PCI) data bus network. This method of communication is used by the ACM for control of the airbag indicator on all models equipped with dual front airbags. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ COMMUNICATION - DESCRIPTION).

Hard wired circuitry connects the supplemental restraint system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the supplemental restraint system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

RESTRAINTS (Continued)

OPERATION

ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts and child restraint anchors. Seat belts and child restraint anchors are referred to as an active restraint because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed active restraints.

PASSIVE RESTRAINTS

The passive restraints are referred to as a supplemental restraint system because they were designed and are intended to enhance the protection for the occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive restraints because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed supplemental restraint system.

The supplemental restraint system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) illuminates for about seven seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator is turned on or off by the ACM to indicate the status of the supplemental restraint system. If the airbag indicator comes on at any time other than during the bulb test, it indicates that there is a problem in the supplemental restraint system electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensors. When an impact is severe enough, the microprocessor in the ACM signals the inflator of the appropriate airbag units to deploy their airbag cushions. During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the front seat passenger to the structure of the instrument panel.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they do of an airbag deployment itself. This is because the airbag deployment and deflation occur very rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes about 40 milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat, depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ACM monitors a problem in any of the supplemental restraint system circuits or components, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends an electronic message to the EMIC to turn on the airbag indicator. Proper testing of the supplemental restraint system components, the Programmable Communication Interface (PCI) data bus, the electronic message inputs to and outputs from the EMIC or the ACM, as well as the retrieval or erasure of a DTC from the ACM or EMIC requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passive restraints.

RESTRAINTS (Continued)

WARNING

WARNINGS - RESTRAINT SYSTEM

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH ON VEHICLES EQUIPPED WITH AIRBAGS, BEFORE PERFORMING ANY WELDING OPERATIONS DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE AND DISCONNECT ALL WIRE HARNESS CONNECTORS FROM THE AIRBAG CONTROL MODULE (ACM). FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND OTHER POSSIBLE DAMAGE TO THE SUPPLEMENTAL RESTRAINT SYSTEM CIRCUITS AND COMPONENTS.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT ATTEMPT TO DISMANTLE AN AIRBAG UNIT OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURES EXCEEDING 93° C (200° F). AN AIRBAG INFLATOR UNIT MAY CONTAIN SODIUM AZIDE AND POTASSIUM NITRATE. THESE MATERIALS ARE POISONOUS AND EXTREMELY FLAMMABLE. CONTACT WITH ACID, WATER, OR HEAVY METALS MAY PRODUCE HARMFUL AND IRRITATING GASES (SODIUM HYDROXIDE IS FORMED IN THE PRESENCE OF MOISTURE) OR COMBUSTIBLE COMPOUNDS. AN AIRBAG INFLATOR UNIT MAY ALSO CONTAIN A GAS CANISTER PRESSURIZED TO OVER 2500 PSI.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, REPLACE ALL RESTRAINT SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE RESTRAINT SYSTEM COMPONENTS MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. THESE FASTENERS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE RESTRAINT SYSTEM. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, WHEN A STEERING COLUMN HAS AN AIRBAG UNIT ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR ANY OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG UNIT FACE DOWN.

RESTRAINTS (Continued)

DIAGNOSIS AND TESTING - SUPPLEMENTAL RESTRAINT SYSTEM

Proper diagnosis and testing of the supplemental restraint system components, the PCI data bus, the data bus electronic message inputs to and outputs from the ElectroMechanical Instrument Cluster (EMIC), or the Airbag Control Module (ACM) as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

STANDARD PROCEDURE

STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment. In addition, the supplemental restraint system should be disarmed whenever any steering wheel, steering column, driver airbag, passenger airbag, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury.

All damaged, faulty, or non-deployed airbags which are replaced on vehicles are to be handled and disposed of properly. If an airbag unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Dispose of all non-deployed and deployed airbags in a manner consistent with state, provincial, local and federal regulations.

SUPPLEMENTAL RESTRAINT STORAGE

Airbags must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a supplemental restraint deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring must be replaced. If the passenger airbag is deployed, the passenger airbag door must be replaced. These components are not intended for reuse and will be damaged or weakened as a result of a supplemental restraint deployment, which may or may not be obvious during a visual inspection.

It is also critical that the mounting surfaces and/or mounting bracket for the Airbag Control Module (ACM) be closely inspected and restored to its original condition following any vehicle impact damage. Because the ACM contains impact sensors that are used by the supplemental restraint system to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of this component may cause airbags not to deploy when required, or to deploy when not required. All other vehicle components should be closely inspected following any supplemental restraint deployment, but are to be replaced only as required by the extent of the visible damage incurred.

CLEANUP PROCEDURE

Following a supplemental restraint deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a supplemental restraint. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be certain to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup (Fig. 3).

RESTRAINTS (Continued)

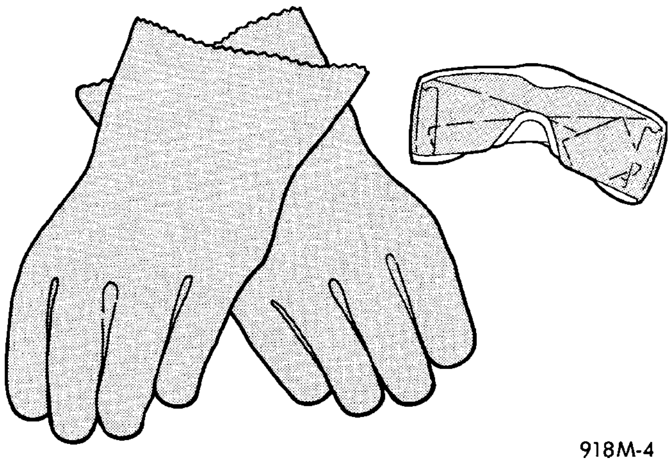

Fig. 3 Wear Safety Glasses and Rubber Gloves - Typical

WARNING: TO AVOID PERSONAL INJURY OR DEATH, IF YOU EXPERIENCE SKIN IRRITATION DURING CLEANUP, RUN COOL WATER OVER THE AFFECTED AREA. ALSO, IF YOU EXPERIENCE IRRITATION OF THE NOSE OR THROAT, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

(1) Begin the cleanup by using a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.

(2) Be certain to vacuum the heater and air conditioning outlets as well (Fig. 4). Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.

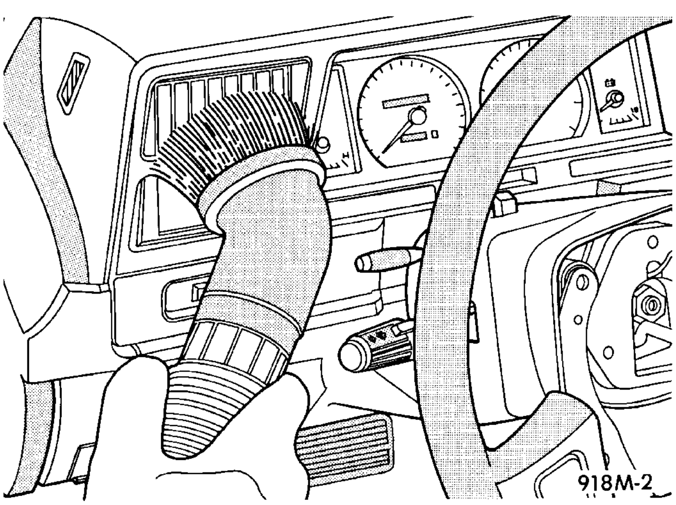

Fig. 4 Vacuum Heater and A/C Outlets - Typical

CAUTION: All damaged, faulty, or non-deployed supplemental restraints which are replaced on vehicles are to be handled and disposed of properly. If an airbag unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Be certain to dispose of all non-deployed and deployed supplemental restraints in a manner consistent with state, provincial, local and federal regulations.

(3) Next, remove the deployed supplemental restraints from the vehicle. Refer to the appropriate service removal procedures.

(4) You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

STANDARD PROCEDURE - VERIFICATION TEST

The following procedure should be performed using a DRBIII® scan tool to verify proper supplemental restraint system operation following the service or replacement of any supplemental restraint system component.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) During the following test, the battery negative cable remains disconnected and isolated, as it was during the supplemental restraint system component removal and installation procedures.

(2) Be certain that the DRBIII® scan tool contains the latest version of the proper DRBIII® software. Connect the DRBIII® to the 16-way Data Link Connector (DLC). The DLC is located on the driver side lower edge of the instrument panel, outboard of the steering column (Fig. 5).

(3) Turn the ignition switch to the On position and exit the vehicle with the DRBIII® scan tool.

(4) Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.

(5) Using the DRBIII®, read and record the active (current) Diagnostic Trouble Code (DTC) data.

(6) Next, use the DRBIII® to read and record any stored (historical) DTC data.

(7) If any DTC is found in Step 5 or Step 6, refer to the appropriate diagnostic information.

(8) Use the DRBIII® to erase the stored DTC data. If any problems remain, the stored DTC data will not

RESTRAINTS (Continued)

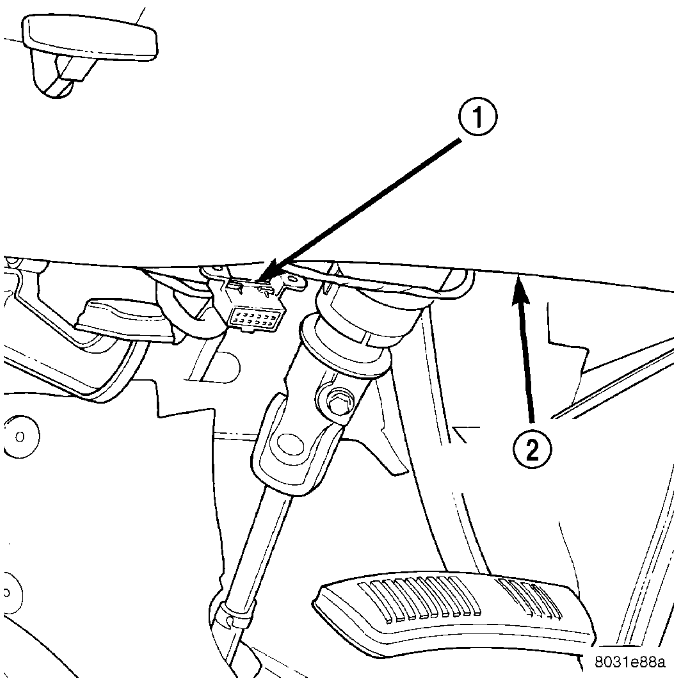

Fig. 5 16-Way Data Link Connector - Typical

1 - 16–WAY DATA LINK CONNECTOR
2 - BOTTOM OF INSTRUMENT PANEL

erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to Step 9.

(9) Turn the ignition switch to the Off position for about fifteen seconds, and then back to the On position. Observe the airbag indicator in the instrument cluster. It should illuminate for six to eight seconds, and then go out. This indicates that the supplemental restraint system is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays on, there is still an active supplemental restraint system fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.

AIRBAG CONTROL MODULE

DESCRIPTION

The Airbag Control Module (ACM) is secured with four screws to the top mounting surface of a stamped steel bracket welded onto the top of the floor panel transmission tunnel below the instrument panel and forward of the center floor console in the passenger compartment of the vehicle (Fig. 6). Concealed within a hollow in the center of the die cast aluminum ACM housing is the electronic circuitry of the ACM which includes a microprocessor, an electronic impact sensor, an electromechanical safing sensor, and an energy storage capacitor. A stamped metal cover

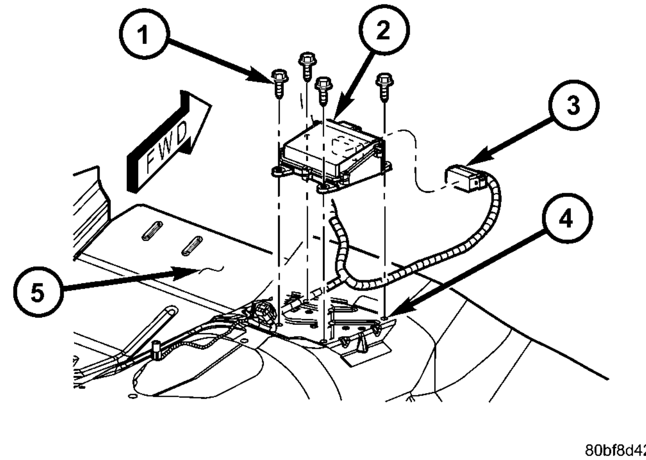

Fig. 6 Airbag Control Module

1 - SCREW (4)
2 - AIRBAG CONTROL MODULE
3 - WIRE HARNESS CONNECTOR
4 - MOUNTING BRACKET
5 - FRONT FLOOR PANEL

plate is secured to the bottom of the ACM housing with four screws to enclose and protect the internal electronic circuitry and components.

The ACM housing has an integral mounting flange on each side. Each mounting flange has an integral locating pin on its lower surface and two round mounting holes. An arrow cast into the top of the ACM housing near the rear provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle. A molded plastic electrical connector receptacle containing twenty-three terminal pins exits the forward facing side of the ACM housing. These terminal pins connect the ACM to the vehicle electrical system through a dedicated take out and connector of the body wire harness.

The impact sensor and safing sensor internal to the ACM are calibrated for the specific vehicle, and are only serviced as a unit with the ACM. The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the Airbag Control Module (ACM) contains the front supplemental restraint system logic circuits and controls all of the supplemental restraint system components. The ACM uses On-Board Diagnostics (OBD) and can communicate with other electronic modules in the vehicle as well as with the DRBIII® scan tool using the Programmable Communications Interface (PCI) data bus network. This method of communication is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and for supplemental

AIRBAG CONTROL MODULE (Continued)

restraint system diagnosis and testing through the 16-way data link connector located on the driver side lower edge of the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/AIRBAG INDICATOR - OPERATION).

The ACM microprocessor continuously monitors all of the front supplemental restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets an active and stored Diagnostic Trouble Code (DTC) and sends electronic messages to the EMIC over the PCI data bus to turn on the airbag indicator. An active fault only remains for the duration of the fault, or in some cases, the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ACM. For some DTCs, if a fault does not recur for a number of ignition cycles, the ACM will automatically erase the stored DTC. For other internal faults, the stored DTC is latched forever.

In models not equipped with a rear seat, the ACM also monitors a resistor multiplexed input from the passenger airbag on/off switch and provides a control output for the Off indicator in the switch through a passenger airbag indicator driver circuit. If the passenger airbag on/off switch is set to the Off position, the ACM turns on the passenger airbag on/off switch Off indicator and will internally disable the passenger airbag from being deployed if an impact is detected that is sufficient for an airbag deployment. The ACM also turns on the on/off switch Off indicator for about seven seconds each time the ignition switch is turned to the On position as a bulb test. Following the bulb test, the ACM controls the status of the Off indicator based upon the resistance of the input from the on/off switch. The ACM will also set and/or store a DTC for faults it detects in the passenger airbag on/off switch circuits, and will turn on the airbag indicator in the EMIC if a fault has been detected.

The ACM receives battery current through two circuits; a fused ignition switch output (run) circuit through a fuse in the fuse block, and a fused ignition switch output (run-start) circuit through a second fuse in the fuse block. The ACM receives ground through a ground circuit and take out of the body wire harness. This take out has a single eyelet terminal connector that is secured by a ground screw to the right cowl side inner panel below the instrument panel. These connections allow the ACM to be operational whenever the ignition switch is in the Start or On positions. The ACM also contains an energy-storage capacitor. When the ignition switch is in the Start or On positions, this capacitor is continually being charged with enough electrical energy to deploy the front supplemental restraint components for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup supplemental restraint system protection in case there is a loss of battery current supply to the ACM during an impact.

Two sensors are contained within the ACM; an electronic impact sensor, and a safing sensor. The electronic impact sensor is an accelerometer that senses the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. The safing sensor is an electromechanical sensor within the ACM that provides an additional logic input to the ACM microprocessor. The safing sensor is a normally open switch that is used to verify the need for a front supplemental restraint deployment by detecting impact energy of a lesser magnitude than that of the electronic impact sensor, and must be closed in order for the front airbags to deploy. A pre-programmed decision algorithm in the ACM microprocessor determines when the deceleration rate as signaled by the impact sensor and the safing sensor indicate an impact that is severe enough to require front supplemental restraint system protection and, based upon the status of the passenger airbag on/off switch input and the severity of the monitored impact, determines what combination of front airbag deployment is required for each front seating position. When the programmed conditions are met, the ACM sends the proper electrical signals to deploy the dual front airbags.

The hard wired inputs and outputs for the ACM may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM, the PCI data bus network, or the electronic message inputs to and outputs from the ACM. The most reliable, efficient, and accurate means to diagnose the ACM, the PCI data bus network, and the electronic message inputs to and outputs from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

AIRBAG CONTROL MODULE (Continued)

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, NEVER STRIKE OR DROP THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE SUPPLEMENTAL RESTRAINTS. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER SUPPLEMENTAL RESTRAINT DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Pull the carpet on the right and left sides of the floor panel transmission tunnel rearward far enough to access the Airbag Control Module (ACM), which is forward of the floor console.

(3) On models equipped with the optional Anti-lock Brake System (ABS), remove the acceleration switch from the left side of the mounting bracket on the floor panel transmission tunnel. (Refer to 5 - BRAKES/ELECTRICAL/G-SWITCH - REMOVAL).

(4) Remove the four screws that secure the Airbag Control Module (ACM) to the mounting bracket on the floor panel transmission tunnel (Fig. 7).

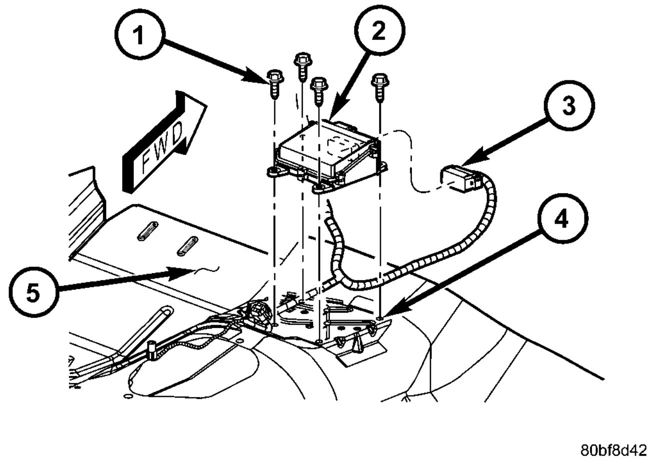

Fig. 7 Airbag Control Module Remove/Install

1 - SCREW (4)
2 - AIRBAG CONTROL MODULE
3 - WIRE HARNESS CONNECTOR
4 - MOUNTING BRACKET
5 - FRONT FLOOR PANEL

(5) Lift the ACM upward far enough to disengage the locator pins on the bottom of the ACM mounting flanges from the locating holes in the mounting bracket, then slide the ACM out from under the instrument panel far enough to access the wire harness connector.

(6) Disconnect the body wire harness connector for the ACM from the ACM connector receptacle located on the forward facing side of the module. To disconnect the body wire harness connector from the ACM (Fig. 8):

(a) Pull the white Connector Positive Assurance (CPA) locks on each side of the connector out about 3 millimeters (0.125 inch).

(b) Squeeze the latch tabs on each side of the connector between the thumb and forefinger and pull the connector straight away from the ACM connector receptacle.

(7) Remove the ACM from beneath the instrument panel.

AIRBAG CONTROL MODULE (Continued)

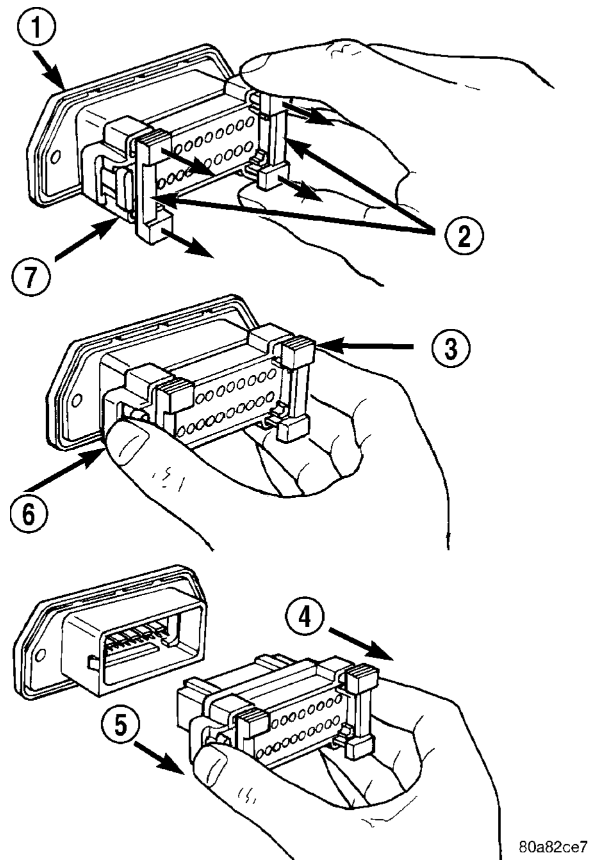

Fig. 8 Airbag Control Module Connector Removal

1 - AIRBAG CONTROL MODULE
2 - PULL TWO LOCKS OUT
3 - SQUEEZE LATCHES
4 - PULL
5 - PULL
6 - SQUEEZE LATCHES
7 - WIRE HARNESS CONNECTOR

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, NEVER STRIKE OR DROP THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE SUPPLEMENTAL RESTRAINTS. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER SUPPLEMENTAL RESTRAINT DEPLOYMENT.

(1) Position the Airbag Control Module (ACM) beneath the instrument panel.

(2) Reconnect the body wire harness connector for the ACM to the ACM connector receptacle located on the forward facing side of the module (Fig. 8). Be certain that both connector latches and the white Connector Positive Assurance (CPA) locks are fully engaged.

(3) Position the ACM to the mounting bracket on the floor panel transmission tunnel (Fig. 7). When the ACM is correctly positioned, the locator pins on the bottom of the ACM mounting flanges will be engaged in the locating holes in the mounting bracket, and the arrow on the ACM label will be pointed forward in the vehicle.

(4) Install and tighten the four screws that secure the ACM to the mounting bracket on the floor panel transmission tunnel. Tighten the screws to 14 N·m (125 in. lbs.).

(5) On models equipped with the optional ABS brakes, reinstall the acceleration switch onto the left side of the mounting bracket on the floor panel transmission tunnel. (Refer to 5 - BRAKES/ELECTRICAL/G-SWITCH - INSTALLATION).

(6) Restore the carpet on the right and left sides of the floor panel transmission tunnel to its proper position beneath the instrument panel.

(7) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

CHILD RESTRAINT ANCHOR

DESCRIPTION

This model is equipped with a Lower Anchors and Tether for CHildren, or LATCH child restraint anchorage system (Fig. 9). The LATCH system provides for the installation of suitable child restraints in certain seating positions without using the standard equipment seat belt provided for that seating position. All vehicles without a rear seat are equipped with a fixed-position child restraint upper tether anchor (Fig. 10) and two child restraint lower anchors (Fig. 11) for the front passenger seating position. Vehicles with an optional rear seat are equipped with fixed-position child restraint upper tether anchors (Fig. 12) and two child restraint lower anchors (Fig. 13) for each rear outboard seating position. All front passenger seat child restraint anchors are deleted on models equipped with the optional rear seat.

The upper tether anchor and both lower anchors for the front passenger seat are integral to the front passenger seat riser bracket. The upper tether anchor is accessed from behind the front seat. The lower anchors for the front passenger seat are formed from round steel bar stock that is formed into a U-shape, then securely welded to the seat riser bracket. They are accessed from the front of the seat, at each side where the seat back meets the seat cushion. The upper and lower front seat child restraint anchors cannot be adjusted or repaired and, if faulty or damaged, they must be replaced as a unit with the seat riser bracket.

The upper tether anchors for the rear seat are stamped steel brackets that are secured by screws to the rear cargo floor panel just forward of the tailgate

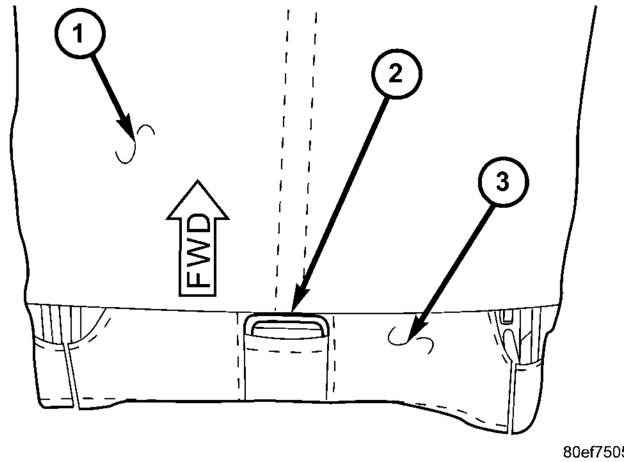

Fig. 10 Front Passenger Seat Upper Anchor

1 - SEAT BACK
2 - UPPER ANCHOR
3 - SEAT CUSHION

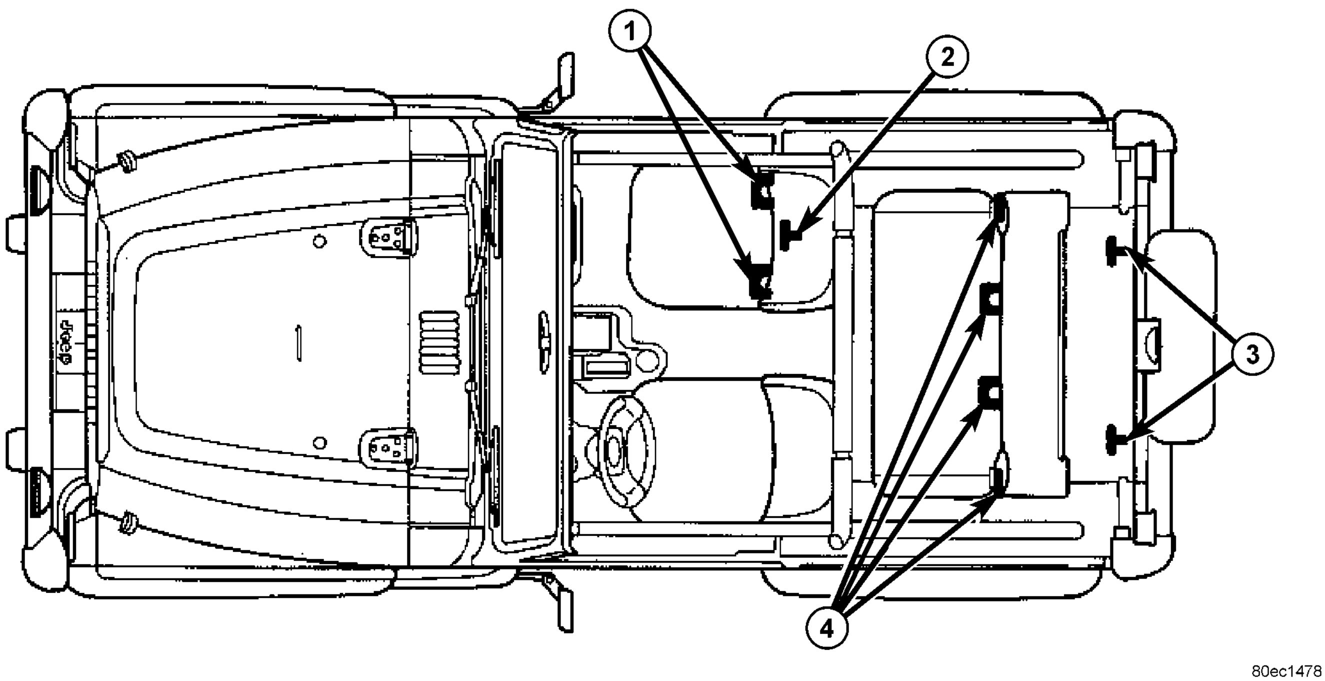

Fig. 9 Child Restraint Anchor Locations

1 - LOWER ANCHOR (MODELS WITHOUT A REAR SEAT ONLY)
2 - TETHER ANCHOR (MODELS WITHOUT A REAR SEAT ONLY)
3 - LOWER ANCHOR (PROVIDED FOR REAR OUTBOARD SEATING POSITIONS ONLY)
4 - TETHER ANCHOR (PROVIDED FOR REAR OUTBOARD SEATING POSITIONS ONLY)

CHILD RESTRAINT ANCHOR (Continued)

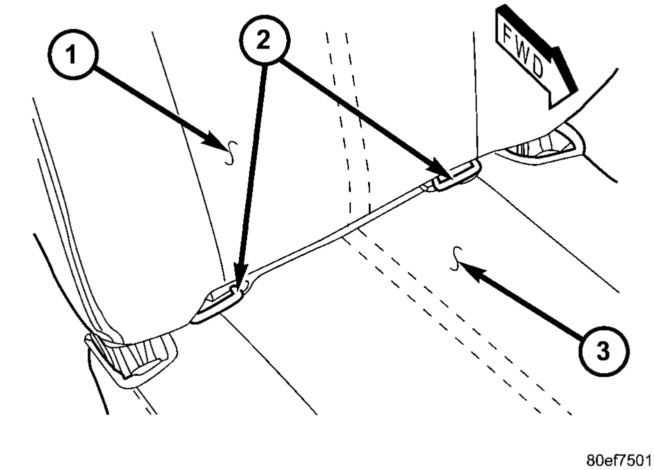

Fig. 11 Front Passenger Seat Lower Anchors

1 - SEAT BACK
2 - LOWER ANCHOR (2)
3 - SEAT CUSHION

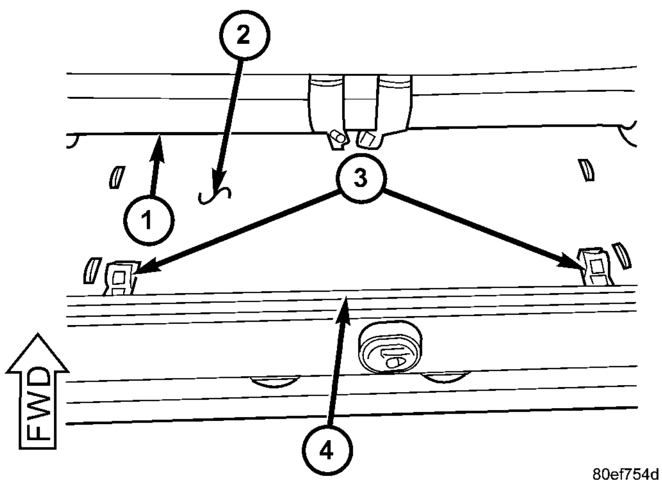

Fig. 12 Rear Seat Upper Anchors

1 - REAR SEAT
2 - REAR CARGO FLOOR
3 - UPPER ANCHOR (2)
4 - TAILGATE OPENING SILL

opening, and are accessed from behind the rear seat. The upper tether anchors for the rear seat are available for individual service replacement. The four fixed lower anchors are integral to the rear seat back frame and are accessed from the front of the rear seat, where the seat back meets the seat cushion. The two inboard lower anchors are constructed from round steel bar stock that is formed into a U-shape, then securely welded at each end to the rear seat back frame. The two outboard lower anchors are machined steel pins that are secured between the two seat back hinge plates above the pivot pin on each outboard side of the rear seat back frame. These lower anchors cannot be adjusted or repaired and, if

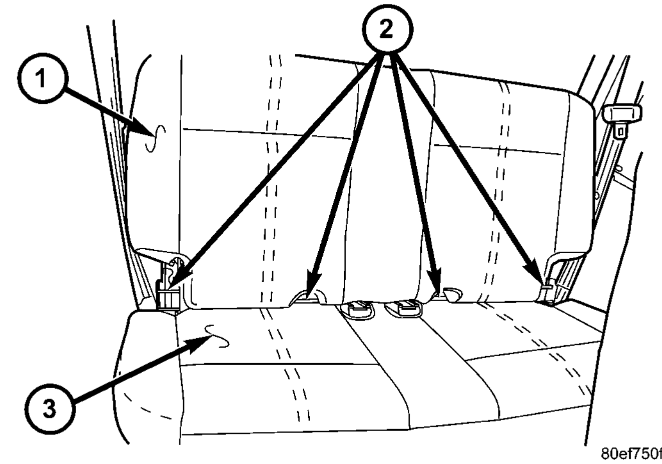

Fig. 13 Rear Seat Lower Anchors

1 - SEAT BACK
2 - LOWER ANCHOR (4)
3 - SEAT CUSHION

faulty or damaged, they must be replaced as a unit with the rear seat back frame.

WARNING: DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

OPERATION

See the owner's manual in the vehicle glove box for more information on the proper use of all of the factory-installed child restraint anchors.

REMOVAL

The following procedure applies only to the rear seat upper child tether anchors used on models equipped with an optional rear seat. The child

CHILD RESTRAINT ANCHOR (Continued)

restraint anchors used in this model in all other locations are integral to other components and cannot be serviced separately.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Remove the screw that secures the upper child restraint tether anchor to the rear cargo floor panel just forward of the tailgate opening sill (Fig. 14).

(2) Remove the upper tether anchor from the rear cargo floor panel.

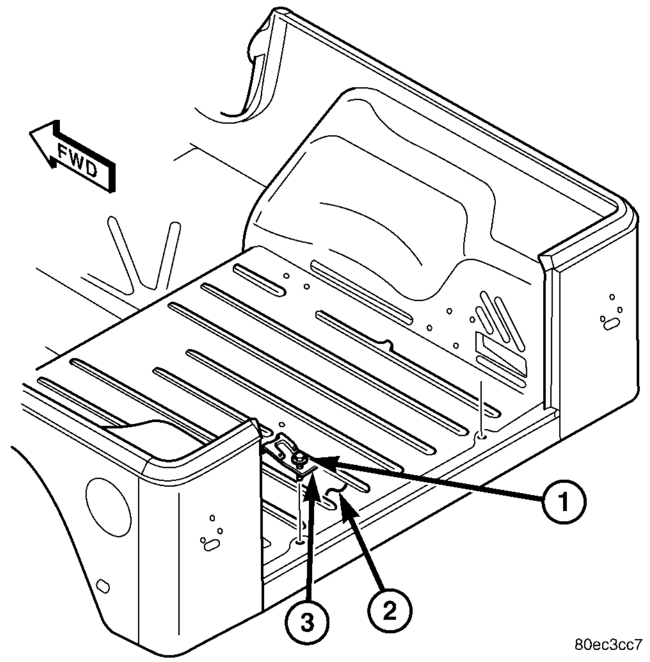

Fig. 14 Rear Upper Tether Anchor Remove/Install

1 - SCREW (2)
2 - FLOOR PANEL
3 - ANCHOR (2)

INSTALLATION

The following procedure applies only to the rear seat upper child tether anchors used on models equipped with an optional rear seat. The child restraint anchors used in this model in all other locations are integral to other components and cannot be serviced separately.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the upper tether anchor onto the rear cargo floor panel (Fig. 14).

(2) Install and tighten the screw that secures the upper tether anchor to the rear cargo floor panel just forward of the tailgate opening sill. Tighten the screw to 26 N·m (19 ft. lbs.).

CLOCKSPRING

DESCRIPTION

The clockspring assembly is secured with two integral plastic latches onto the steering column lock housing near the top of the steering column behind the steering wheel (Fig. 15). The clockspring consists of a flat, round molded plastic case with a stubby tail that hangs below the steering column (Fig. 16). The tail contains two connector receptacles that face toward the instrument panel. Within the plastic case is a spool-like molded plastic rotor with a large exposed hub. The upper surface of the rotor hub has a large center hole, two large flats, and four short

CLOCKSPRING (Continued)

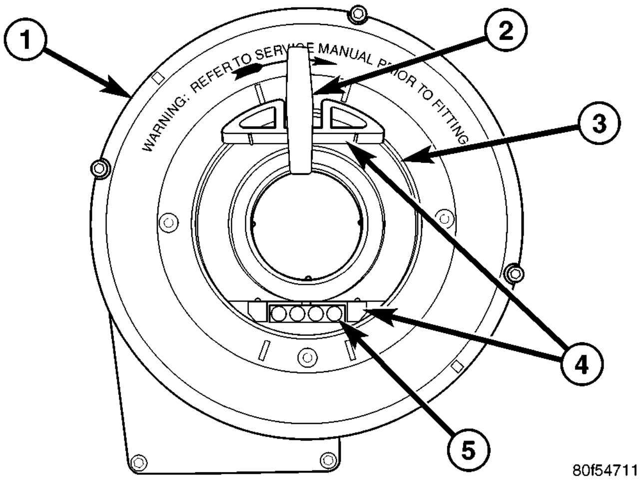

Fig. 15 Clockspring

1 - CASE
2 - LOCKING PIN
3 - ROTOR
4 - ROTOR FLAT (2)
5 - CLOCKSPRING PIGTAIL WIRES (NOT SHOWN)

pigtail wires with connectors that face toward the steering wheel.

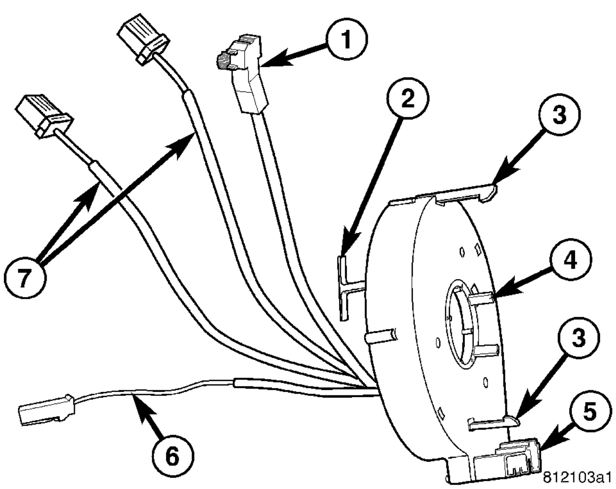

Fig. 16 Turn Signal Cancel Cam

1 - AIRBAG PIGTAIL
2 - LOCKING PIN
3 - LATCH (2)
4 - CANCEL CAM
5 - LOWER CONNECTOR RECEPTACLE (2)
6 - HORN SWITCH FEED PIGTAIL
7 - SPEED CONTROL SWITCH PIGTAIL (2)

The lower surface of the rotor hub has a molded plastic turn signal cancel cam consisting of two lobes that are molded into the rotor. Within the plastic case and wound around the rotor spool is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at the connector receptacles that face the instrument panel, while the inner end of the tape terminates at the pigtail wires on the hub of the clockspring rotor that face the steering wheel.

Service replacement clocksprings are shipped precentered and with a molded plastic locking pin that snaps into a receptacle in the rotor and has a tab that is engaged between two ribs on the upper surface of the clockspring case. The locking pin secures the centered clockspring rotor to the clockspring case during shipment, but the locking pin must be removed from the clockspring after it is installed on the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver airbag has been deployed, the clockspring must be replaced.

OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed body wire harness on the steering column and the electrical components mounted on or in the rotating steering wheel. On this model the rotating electrical components include the driver airbag, the horn switch, and the speed control switches if the vehicle is so equipped. The clockspring case is positioned and secured to the upper steering column housing near the top of the steering column. The connector receptacles on the tail of the fixed clockspring case connect the clockspring to the vehicle electrical system through two take outs with connectors from the body wire harness.

The clockspring rotor is movable and is keyed by two flats molded into the rotor hub to two flats that are cast into the lower surface of the steering wheel armature. The two lobes on the turn signal cancel cam on the lower surface of the clockspring rotor hub contact a turn signal cancel actuator of the multi-function switch to provide automatic turn signal cancellation. The pigtail wires on the upper surface of the clockspring rotor connect the clockspring to the driver airbag, the horn switch, and the two speed control switches if the vehicle is so equipped.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to the movable steering components so that the tape can operate within its designed travel limits. However, if the clockspring is removed from the steering column or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the

CLOCKSPRING (Continued)

movable steering components. The clockspring must be re-centered following completion of this service or the tape may be damaged.

Service replacement clocksprings are shipped pre-centered and with a plastic locking pin installed. This locking pin should not be disengaged until the clockspring has been installed on the steering column. If the locking pin is removed or damaged before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

STANDARD PROCEDURE - CLOCKSPRING CENTERING

The clockspring is designed to wind and unwind when the steering wheel is rotated, but is only designed to rotate the same number of turns (about five complete rotations) as the steering wheel can be turned from stop to stop. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. The rotor of a centered clockspring can be rotated two and one-half turns in either direction from the centered position, without damaging the clockspring tape.

However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear, the clockspring tape can change position relative to the other steering components. The clockspring must then be re-centered following completion of such service or the clockspring tape may be damaged. Service replacement clocksprings are shipped pre-centered, with a plastic locking pin installed (Fig. 17). This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

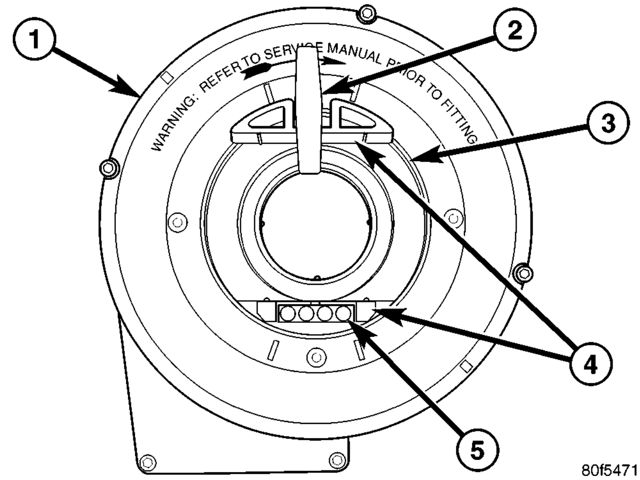

Fig. 17 Clockspring

1 - CASE
2 - LOCKING PIN
3 - ROTOR
4 - ROTOR FLAT (2)
5 - CLOCKSPRING PIGTAIL WIRES (NOT SHOWN)

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the clockspring from the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

(3) Rotate the clockspring rotor clockwise to the end of its travel. **Do not apply excessive torque.**

(4) From the end of the clockwise travel, rotate the rotor about two and one-half turns counterclockwise, until the rotor flats are horizontal. If the clockspring pigtail wires are not oriented towards the bottom of the clockspring, rotate the rotor another one-half turn in the counterclockwise direction. The clockspring is now centered.

(5) Lock the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column.

(6) The front wheels should still be in the straight-ahead position. Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

REMOVAL

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

CLOCKSPRING (Continued)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight ahead position.

(2) Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(3) Disconnect the two upper clockspring pigtail wire connectors from the two speed control switches or the two trim bezels located within the two spoke cavities of the steering wheel.

CAUTION: Be certain that the screws that secure the steering wheel puller to the steering wheel are fully engaged in the steering wheel armature without passing through the steering wheel and damaging the clockspring.

(4) Remove the steering wheel from the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).

(5) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(6) From below the steering column, remove the two screws that secure the lower steering column shroud to the upper shroud (Fig. 18).

(7) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.

(8) Using hand pressure, push gently inward on both sides of the upper shroud near the parting line between the upper and lower shrouds to release the snap features that secure it to the lower shroud.

(9) Remove both the upper and lower shrouds from the steering column.

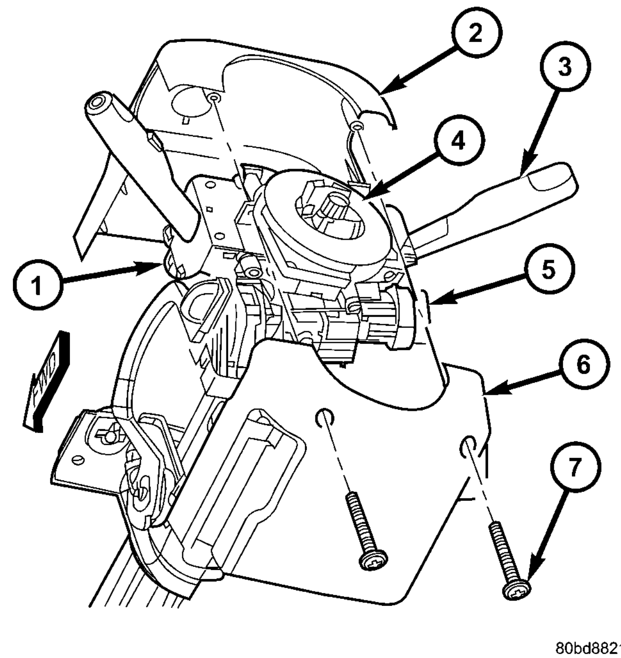

Fig. 18 Steering Column Shrouds Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - UPPER SHROUD
3 - RIGHT MULTI-FUNCTION SWITCH
4 - CLOCKSPRING
5 - IGNITION LOCK CYLINDER HOUSING
6 - LOWER SHROUD
7 - SCREW (2)

(10) Disconnect the two body wire harness connectors for the clockspring from the two connector receptacles below the steering column on the back of the clockspring housing (Fig. 19).

(11) Using a small screwdriver, gently pry both plastic latches that secure the clockspring away from the steering column upper housing far enough to pull the clockspring away from the upper housing.

NOTE: If the clockspring plastic latches are broken, be certain to remove the broken pieces from the steering column upper housing.

(12) Remove the clockspring from the steering column upper housing. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

(13) If the removed clockspring is to be reused, be certain to secure the clockspring rotor to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before it is reinstalled. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

CLOCKSPRING (Continued)

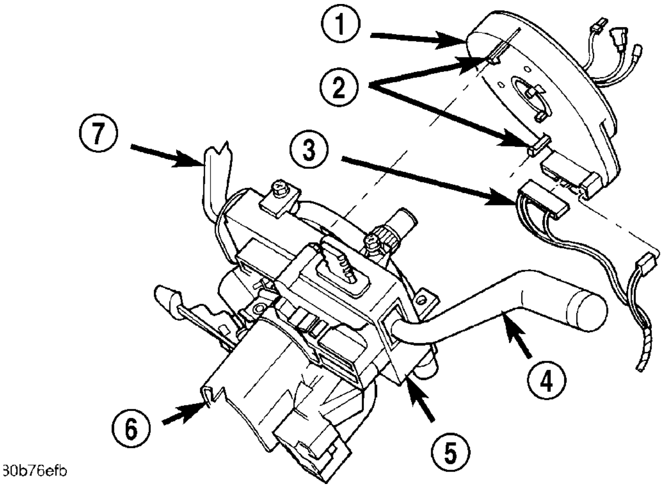

Fig. 19 Clockspring Remove/Install - Typical

1 - CLOCKSPRING
2 - LATCHES
3 - BODY WIRE HARNESS
4 - LEFT MULTI-FUNCTION SWITCH
5 - SWITCH HOUSING
6 - STEERING COLUMN
7 - RIGHT MULTI-FUNCTION SWITCH

INSTALLATION

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING). Service replacement clocksprings are shipped pre-centered and with a plastic locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) Be certain that the left multi-function switch control stalk is in the neutral position, then carefully slide the centered clockspring down over the steering column upper shaft until both the upper and lower clockspring latches engage the steering column upper housing (Fig. 19).

(2) Reconnect the two body wire harness connectors for the clockspring to the two connector receptacles below the steering column on the back of the clockspring housing.

(3) Position both the upper and lower shrouds onto the steering column (Fig. 18). Be certain that the locating tabs for the left and right multi-function switch control stalk watershields are properly engaged in the openings of both the upper and lower shrouds.

(4) Align the snap features on the upper shroud with the receptacles on the lower shroud and apply hand pressure to snap them together.

(5) From below the steering column, install and tighten the two screws that secure the lower steering column shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).

(6) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully raised position and secure it in place by moving the tilt release lever back to the locked (up) position.

(7) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(8) If a new clockspring has been installed, remove the locking pin that is securing the clockspring rotor to the clockspring case to maintain clockspring centering.

(9) Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

(10) Reconnect the two upper clockspring pigtail wire connectors to the two speed control switches or the two trim bezels located within the two spoke cavities of the steering wheel.

(11) Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

DRIVER AIRBAG

DESCRIPTION

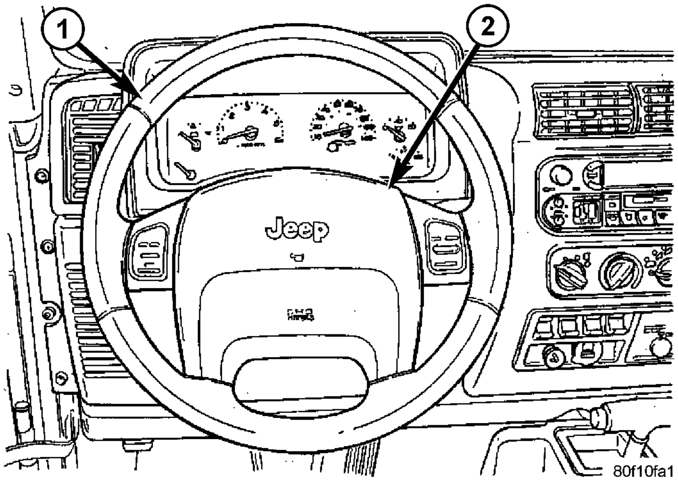

Fig. 20 Driver Airbag Trim Cover

1 - STEERING WHEEL
2 - TRIM COVER

The color-keyed, injection molded, thermoplastic driver airbag protective trim cover is the most visible part of the driver airbag (Fig. 20). The driver airbag is located in the center of the steering wheel, where it is secured with two screws to the two horizontal spokes of the four-spoke steering wheel armature. All models have a Jeep logo embossed in the center of the trim cover. Concealed beneath the driver airbag trim cover are the horn switch, the folded airbag cushion, the airbag cushion retainer, the airbag housing, the airbag inflator, and the retainers that secure the inflator to the airbag housing.

The airbag cushion, housing, and inflator unit is secured within an integral receptacle on the back of the trim cover (Fig. 21). The driver airbag trim cover has locking blocks molded into the back side of it that engage a lip formed around the perimeter of the airbag housing. Two stamped metal retainers then fit over the inflator mounting studs on the back of the airbag housing and tabs on the retainers are engaged in slots within the upper and lower trim cover locking blocks, securely locking the cover into place. The stamped metal retainers are secured to the four airbag inflator mounting studs with nuts.

The resistive membrane-type horn switch is secured within a plastic tray that is inserted into a pocket or pouch sewn onto the airbag cushion retainer strap, between the trim cover and the folded airbag cushion. The horn switch ground pigtail wire has an eyelet terminal connector that is captured on the upper right inflator mounting stud between the inflator and the upper trim cover retainer. The horn switch feed pigtail wire has a white, molded plastic

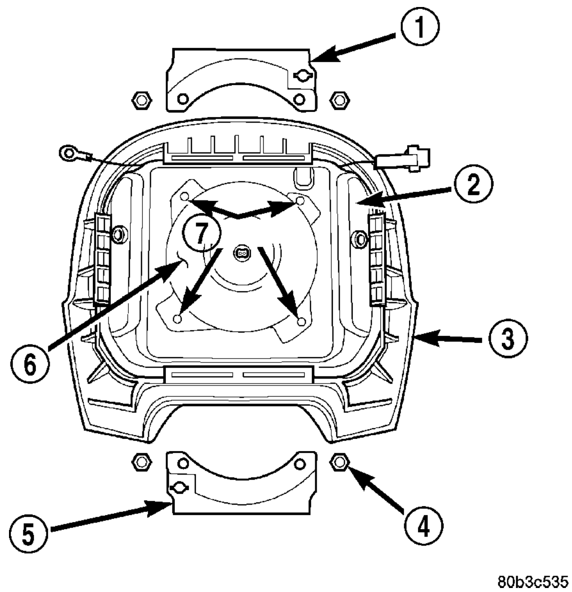

Fig. 21 Driver Airbag Trim Cover

1 - UPPER RETAINER
2 - AIRBAG HOUSING
3 - TRIM COVER
4 - NUT (4)
5 - LOWER RETAINER
6 - INFLATOR
7 - STUD (4)

insulator that is secured by an integral retainer to a mounting hole located in the upper trim cover retainer near the upper left corner on the back of the airbag housing, and is connected to the vehicle electrical system through a dedicated pigtail wire and connector from the clockspring.

The airbag used in this model is a Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. A radial deploying fabric cushion with internal tethers is used. The airbag inflator is a conventional pyrotechnic-type unit that is secured by four hex nuts to four studs that extend through the back of the stamped metal airbag housing from the airbag cushion retainer ring. A keyed connector receptacle on the driver airbag inflator connects the inflator initiator to the vehicle electrical system through a yellow-jacketed, two-wire pigtail harness of the clockspring. The driver airbag cannot be repaired, and must be replaced if deployed or in any way damaged. The driver airbag trim cover and the horn switch are available individually, and may be disassembled from the driver airbag for service replacement.

OPERATION

The driver airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver airbag squib circuit to the initiator in the airbag inflator. When the ACM sends the

DRIVER AIRBAG (Continued)

proper electrical signal to the initiator the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch unit. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas towards the instrument panel through the porous fabric material used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, all potentially hazardous chemicals are burned during an airbag deployment event. The inert gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

REMOVAL

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG CUSHION AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) From the underside of the steering wheel, remove the two screws that secure the driver airbag to the steering wheel armature (Fig. 22).

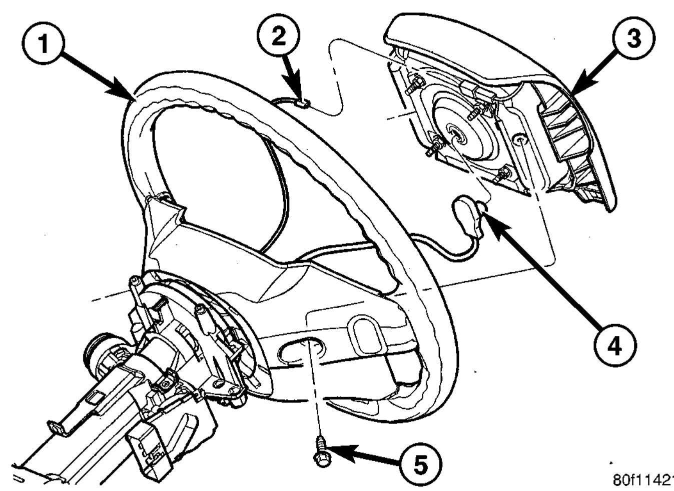

Fig. 22 Driver Airbag Remove/Install

1 - STEERING WHEEL
2 - CLOCKSPRING PIGTAIL WIRE (HORN SWITCH)
3 - DRIVER AIRBAG
4 - CLOCKSPRING PIGTAIL WIRE (AIRBAG)
5 - SCREW (2)

(3) Pull the driver airbag away from the steering wheel far enough to access the two electrical connections at the back of the airbag housing.

(4) Disconnect the clockspring pigtail wire connector for the horn switch from the horn switch feed pigtail wire connector located on the back of the driver airbag.

DRIVER AIRBAG (Continued)

CAUTION: Do not pull on the clockspring pigtail wires to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulators can result in damage to the airbag circuits or connector insulators.

(5) The clockspring driver airbag pigtail wire connector is secured by a tight snap fit into the airbag inflator connector receptacle, which is located on the back of the driver airbag housing. Firmly grasp and pull or gently pry on the clockspring driver airbag pigtail wire connector insulator and pull the insulator straight out from the airbag inflator to disconnect it from the connector receptacle.

(6) Remove the driver airbag from the steering wheel.

(7) If the driver airbag has been deployed, the clockspring must be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

DISASSEMBLY

The following procedures can be used to replace the driver airbag trim cover and/or to access the horn switch unit for service. If the driver airbag is faulty or deployed, the entire driver airbag, trim cover, and horn switch must be replaced as a unit.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, SERVICE OF THIS UNIT SHOULD BE PERFORMED ONLY BY DAIMLERCHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE DRIVER AIRBAG TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the driver airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(3) Place the driver airbag on a suitable work surface with the trim cover facing down. If the trim cover will be reused, be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.

(4) Remove the four nuts that secure the upper and lower trim cover retainers to the studs on the back of the driver airbag housing (Fig. 23).

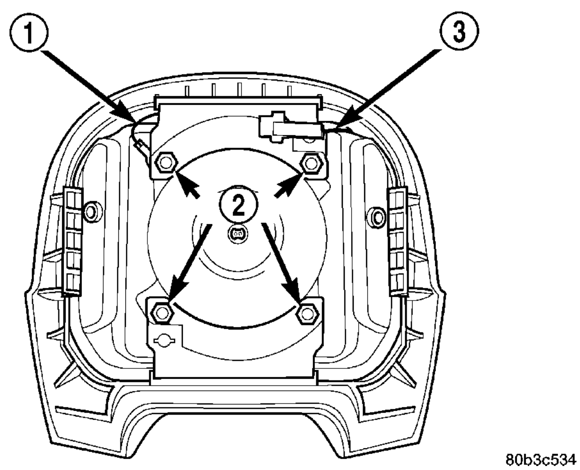

Fig. 23 Horn Switch Feed Wire Remove/Install

1 - HORN SWITCH GROUND PIGTAIL WIRE
2 - NUT (4)
3 - HORN SWITCH FEED PIGTAIL WIRE

DRIVER AIRBAG (Continued)

(5) Remove the upper and lower trim cover retainers from the airbag housing studs (Fig. 24).

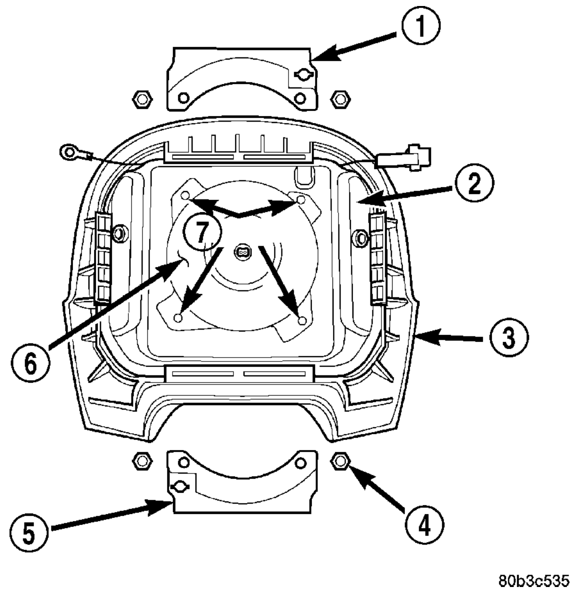

Fig. 24 Driver Airbag Trim Cover

1 - UPPER RETAINER
2 - AIRBAG HOUSING
3 - TRIM COVER
4 - NUT (4)
5 - LOWER RETAINER
6 - INFLATOR
7 - STUD (4)

(6) Disengage the horn switch feed pigtail wire connector retainer from the mounting hole in the upper trim cover retainer.

(7) Remove the horn switch ground pigtail wire eyelet terminal from the upper right inflator stud on the back of the driver airbag housing.

(8) Disengage the four trim cover locking blocks from the lip around the outside edge of the driver airbag housing and remove the housing from the trim cover receptacle (Fig. 25).

ASSEMBLY

The following procedures can be used to replace the driver airbag trim cover and/or to access the horn switch unit for service. If the driver airbag is faulty or deployed, the entire driver airbag, trim cover, and horn switch must be replaced as a unit.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

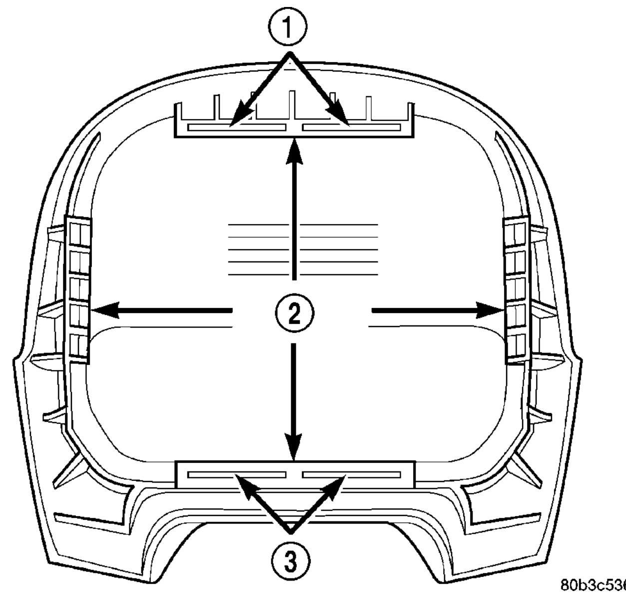

Fig. 25 Driver Airbag Trim Cover Remove/Install

1 - UPPER RETAINER SLOT (2)
2 - LOCKING BLOCK (4)
3 - LOWER RETAINER SLOT (2)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, SERVICE OF THIS UNIT SHOULD BE PERFORMED ONLY BY DAIMLERCHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

DRIVER AIRBAG (Continued)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE DRIVER AIRBAG TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

NOTE: If the horn switch and tray have been removed from the sewn pouch in the airbag cushion retaining strap, be certain that they are properly reinstalled with the horn switch feed and ground pigtail wires properly oriented before assembling the trim cover onto the airbag housing. (Refer to 8 - ELECTRICAL/HORN/HORN SWITCH - INSTALLATION).

(1) Place the new driver airbag trim cover on a suitable work surface with the airbag receptacle facing up. Be certain to take the proper precautions to prevent the trim cover from receiving cosmetic damage during the following procedures.

(2) Carefully position the driver airbag into the trim cover receptacle. Be certain that the horn switch feed and ground pigtail wires are not pinched between the airbag housing and the trim cover locking blocks.

(3) Engage the upper and lower trim cover locking blocks with the lip of the driver airbag housing, then engage the locking blocks on each side of the trim cover with the lip of the housing. Be certain that each of the locking blocks is fully engaged on the lip of the airbag housing (Fig. 26).

(4) Reinstall the horn switch ground pigtail wire eyelet terminal over the upper right inflator stud on the back of the driver airbag housing.

(5) Reinstall the upper and lower airbag trim cover retainers over the inflator studs on the back of the driver airbag housing. Be certain that the tabs on each retainer are engaged in the slots of the upper and lower trim cover locking blocks (Fig. 25).

(6) Install and tighten the four nuts that secure the trim cover retainers to the inflator studs on the back of the driver airbag housing. Tighten the nuts to 7 N·m (60 in. lbs.).

(7) Engage the horn switch feed pigtail wire connector retainer in the mounting hole in the upper trim cover retainer.

(8) Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

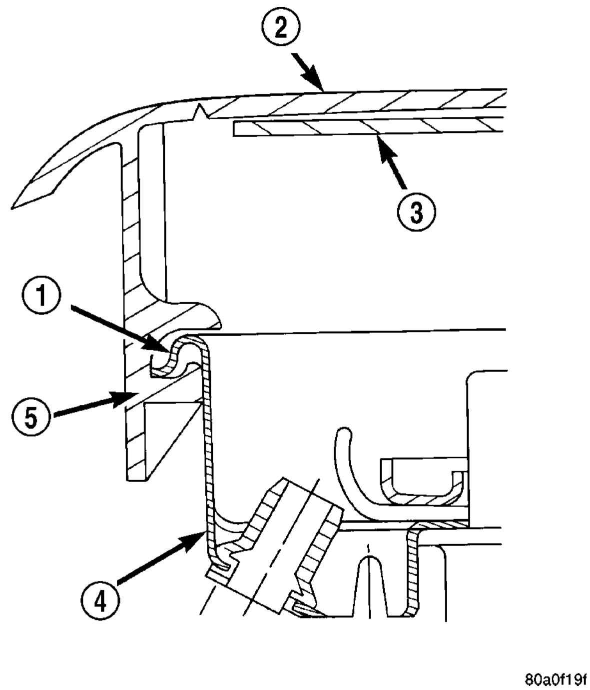

Fig. 26 Driver Airbag Trim Cover Locking Blocks Engaged

1 - LIP
2 - TRIM COVER
3 - HORN SWITCH
4 - AIRBAG HOUSING
5 - LOCKING BLOCK

INSTALLATION

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

DRIVER AIRBAG (Continued)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

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(1) Position the driver airbag close enough to the steering wheel to reconnect the two electrical connections at the back of the airbag housing.

(2) When installing the driver airbag, reconnect the clockspring driver airbag pigtail wire connector to the airbag inflator connector receptacle by pressing straight in on the connector (Fig. 22). You can be certain that the connector is fully engaged in its receptacle by listening carefully for a distinct, audible click as the connector snaps into place.

(3) Reconnect the clockspring horn switch pigtail wire connector to the horn switch feed pigtail wire connector located on the back of the driver airbag housing.

(4) Carefully position the driver airbag in the steering wheel. Be certain that the clockspring pigtail wires and the steering wheel wire harness in the steering wheel hub area are not pinched between the driver airbag and the steering wheel armature.

(5) From the underside of the steering wheel, install and tighten the two screws that secure the driver airbag to the steering wheel armature. Tighten the screws to 10 N·m (90 in. lbs.).

(6) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT SEAT BELT & RETRACTOR

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Move the front seat to its most forward position for easiest access to the lower seat belt anchor screw and retractor and the lower sport bar.

(2) Unsnap and lift the trim cover from the front seat belt turning loop to access the screw that secures the turning loop to the height adjuster near the top on the upper sport bar (Fig. 27).

(3) Remove the screw that secures the shoulder belt turning loop to the adjuster.

(4) Remove the shoulder belt turning loop and the support/guide washer from the adjuster.

(5) Remove the screw that secures the retractor and lower seat belt anchor to the lower sport bar (Fig. 28).

FRONT SEAT BELT & RETRACTOR (Continued)

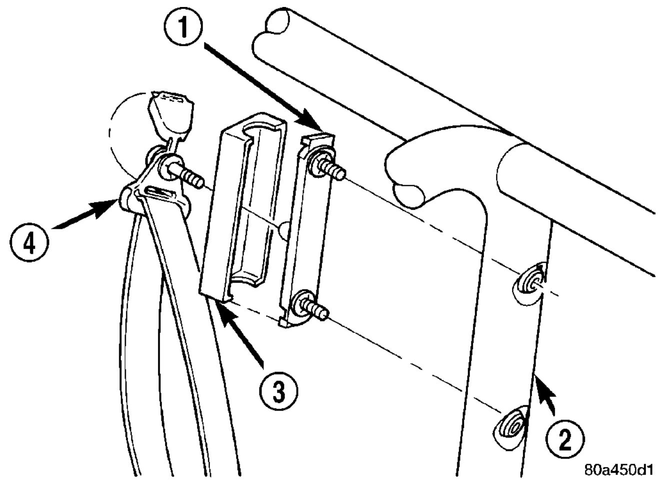

Fig. 27 Front Seat Belt Turning Loop

1 - ADJUSTER
2 - SPORT BAR
3 - TRIM COVER
4 - TURNING LOOP

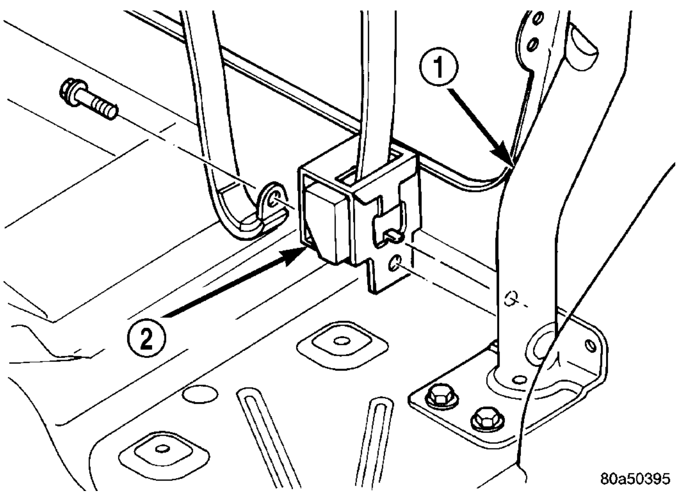

Fig. 28 Front Seat Belt and Retractor - Typical

1 - SPORT BAR
2 - RETRACTOR

(6) Remove the front seat belt and retractor from the lower sport bar.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the front seat belt and retractor and the lower seat belt anchor to the lower sport bar (Fig. 28). Be certain to engage the locator tab on the retractor in the locator hole on the sport bar.

(2) Install and tighten the screw that secures the front seat belt retractor and lower seat belt anchor to the lower sport bar. Tighten the screw to 43 N·m (32 ft. lbs.).

(3) Position the support/guide washer and the front seat belt turning loop onto the height adjuster on the upper sport bar (Fig. 27).

(4) Install and tighten the screw that secures the front seat belt turning loop to the height adjuster. Tighten the screw to 43 N·m (32 ft. lbs.).

(5) Fold and snap the trim cover back into place over the screw that secures the front seat belt turning loop to the adjuster.

FRONT SEAT BELT BUCKLE

REMOVAL

The seat belt buckle on the driver's side front seat for all models also includes a seat belt switch. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT SWITCH - DESCRIPTION).

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) On the driver side only, disconnect the seat belt switch pigtail wire connector from the body wire harness connector for the seat belt switch (Fig. 29).

(2) Remove the screw that secures the seat belt buckle lower anchor to the bracket on the rear of the upper inner front seat track (Fig. 30).

(3) Remove the front seat belt buckle from the front seat track bracket.

INSTALLATION

The seat belt buckle on the driver's side front seat for all models also includes a seat belt switch. The seat belt buckle on the driver's side front seat for all models also includes a seat belt switch. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT SWITCH - DESCRIPTION).

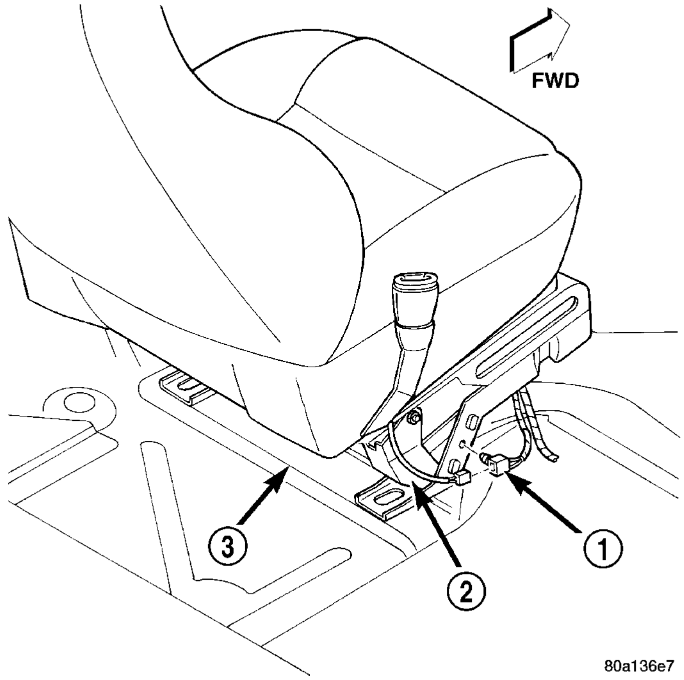

Fig. 29 Seat Belt Switch

1 - WIRE HARNESS CONNECTOR
2 - DRIVER SEAT RISER
4 - FLOOR PANEL

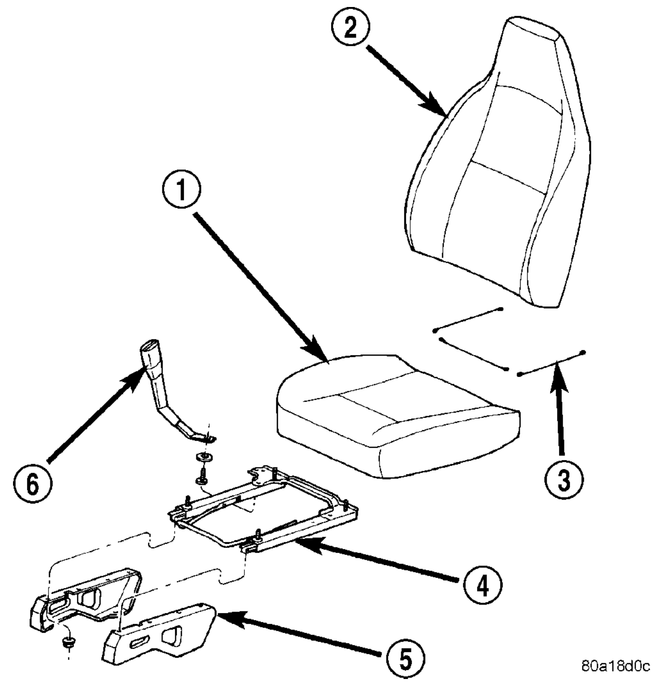

Fig. 30 Seat Belt Buckle

1 - SEAT CUSHION
2 - SEAT BACK
3 - TRIM ATTACHMENT WIRES
4 - SEAT TRACK
5 - SEAT RISER
6 - SEATBELT BUCKLE

FRONT SEAT BELT BUCKLE (Continued)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the front seat belt buckle lower anchor to the bracket on the rear of the upper inner front seat track.

(2) Install and tighten the screw that secures the front seat belt buckle lower anchor to the front seat track bracket (Fig. 30). Tighten the screw to 43 N·m (32 ft. lbs.).

(3) On the driver side only, reconnect the seat belt switch pigtail wire connector to the body wire harness connector for the seat belt switch (Fig. 29).

PASSENGER AIRBAG

DESCRIPTION

The rearward facing surface of the injection molded, thermoplastic passenger airbag door is the most visible part of the passenger airbag (Fig. 31). The passenger airbag door is located above the glove box opening on the instrument panel in front of the front seat passenger seating position. The passenger airbag door also serves as a trim cover and has two flanges and a stamped metal bracket that secure it to the instrument panel structural support. The upper flange is secured with screws to the top of the instrument panel structural support and the lower flange to the upper glove box opening reinforcement. A stamped metal passenger airbag door hinge bracket is secured to the back of the instrument panel structural support with two screws.

Located behind the passenger airbag door within the instrument panel is the passenger airbag unit. The passenger airbag unit has an upper rear bracket and a lower rear bracket that are secured by nuts to three weld studs on the instrument panel structural support, one stud at the top and two at the bottom. Two nuts secure a front lower bracket on the passenger airbag housing to two weld studs on the dash panel above the heater and air conditioner housing. The front lower bracket mounts are accessed through the instrument panel glove box opening.

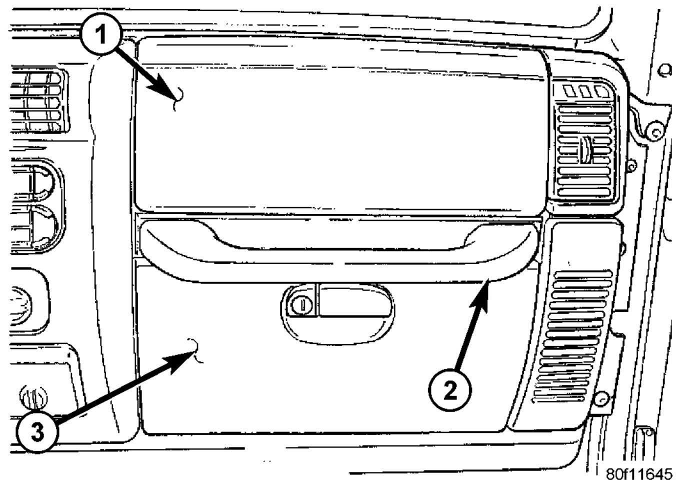

Fig. 31 Passenger Airbag Door

1 - PASSENGER AIRBAG DOOR
2 - GRAB HANDLE
3 - GLOVE BOX DOOR

The passenger airbag unit used in this model is a Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. The passenger airbag unit consists of a stamped and welded metal housing or retainer, the airbag cushion, and the airbag inflator. The airbag housing contains the airbag inflator and the folded airbag cushion. A rectangular fabric cushion is used. The airbag inflator is a hybrid-type unit that is secured to and sealed within the stamped metal airbag housing beneath the folded airbag cushion. The inflator initiator is connected to the vehicle electrical system through a yellow connector on the end of a short, two-wire pigtail harness and a take out of the body wire harness.

The passenger airbag and the passenger airbag door are available as separate service items. The passenger airbag cannot be repaired, and must be replaced if deployed, faulty, or in any way damaged. The passenger airbag door will be damaged and must be replaced following an airbag deployment.

OPERATION

The passenger airbag is deployed by an electrical signal generated by the Airbag Control Module (ACM) through the passenger airbag squib circuits to the initiator in the airbag inflator. The hybrid-type inflator assembly includes a small canister of highly

PASSENGER AIRBAG (Continued)

compressed inert gas. When the ACM sends the proper electrical signal to the airbag inflator, the electrical energy generates enough heat to ignite chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce the pressure necessary to rupture a burst disk in the inert gas canister.

The inflator is sealed to the airbag cushion so that all of the released inert gas is directed into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the passenger airbag door will split at predetermined tear seam lines integral to the door, then the door will fold up over the top of the instrument panel and out of the way. Following a passenger airbag deployment, the airbag cushion quickly deflates by venting the inert gas through the porous fabric material used to construct each end panel of the airbag cushion.

REMOVAL

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the instrument panel from the passenger compartment of the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(3) Place the instrument panel on a suitable work surface. Be certain to take the proper precautions to protect the instrument panel from any possible cosmetic damage.

(4) Remove the three nuts that secure the passenger airbag to the weld studs on the instrument panel structural support (Fig. 32).

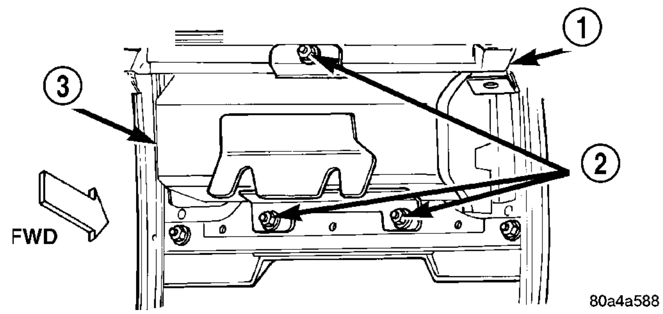

Fig. 32 Passenger Airbag Remove/Install

1 - STRUCTURAL SUPPORT
2 - NUT (3)
3 - PASSENGER AIRBAG

(5) Remove the passenger airbag from the instrument panel structural support.

INSTALLATION

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

PASSENGER AIRBAG (Continued)

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT AIRBAG DOORS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Carefully position the passenger airbag onto the weld studs on the instrument panel structural support (Fig. 32).

(2) Install and tighten the three nuts that secure the passenger airbag upper and lower rear mounting brackets to the weld studs on the instrument panel structural support. Tighten the nuts to 12 N·m (105 in. lbs.).

(3) Reinstall the instrument panel into the passenger compartment of the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION). When installing the instrument panel, be certain the passenger airbag pigtail wire connector is fully engaged and latched.

(4) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

PASSENGER AIRBAG DOOR

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the passenger airbag from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).

(3) Remove the five screws that secure the upper flange of the passenger airbag door to the top of the instrument panel structural support (Fig. 33).

(4) Remove the grab handle bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE BEZEL - REMOVAL).

(5) Remove the five screws that secure the lower flange of the passenger airbag door to the upper glove box opening reinforcement.

(6) Remove the two screws that secure the ends of the passenger airbag door bracket to the instrument panel structural support (Fig. 34).

(7) Remove and discard the two passenger airbag door bracket J-nuts from the instrument panel structural support. These J-nuts must be replaced with new parts whenever the passenger airbag door bracket screws are removed.

(8) Remove the passenger airbag door from the instrument panel.

PASSENGER AIRBAG DOOR (Continued)

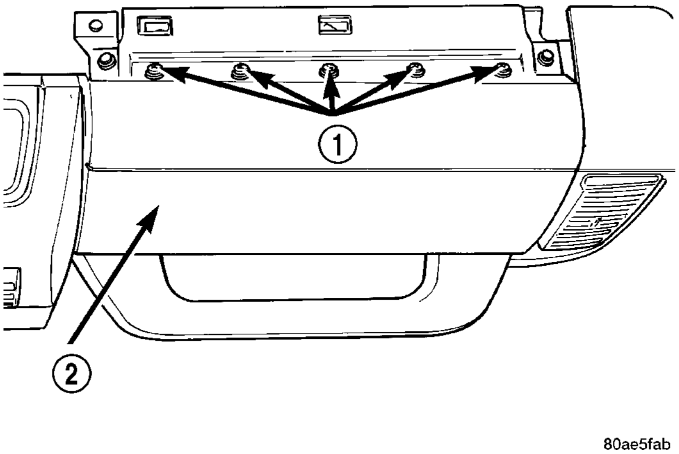

Fig. 33 Passenger Airbag Door Upper Flange Remove/Install

1 - SCREW (5)
2 - PASSENGER AIRBAG DOOR

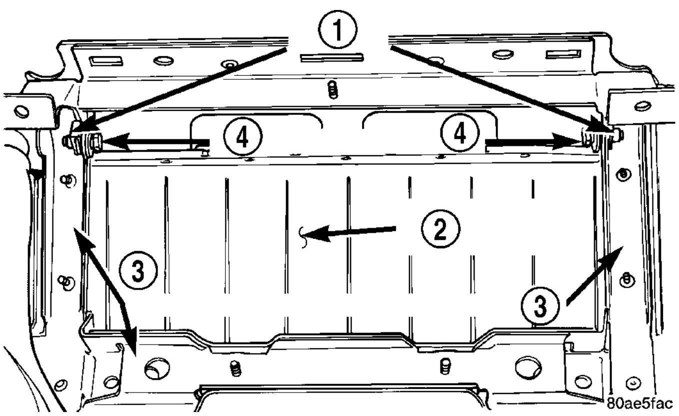

Fig. 34 Passenger Airbag Door Remove/Install

1 - J-NUT (2)
2 - PASSENGER AIRBAG DOOR
3 - STRUCTURAL SUPPORT
4 - SCREW (2)

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT AIRBAG DOORS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Install two new passenger airbag door bracket J-nuts onto the instrument panel structural support (Fig. 34). These J-nuts must be replaced with new parts whenever the passenger airbag door bracket screws are removed.

(2) Position the passenger airbag door onto the instrument panel and align the mounting holes in each end of the airbag door bracket with the J-nuts on the instrument panel structural support.

(3) Install and tighten the two screws that secure the passenger airbag door bracket to the instrument panel structural support. Tighten the screws to 12 N·m (105 in. lbs.).

(4) Install and tighten the five screws that secure the lower flange of the passenger airbag door to the upper glove box opening reinforcement. Tighten the screws to 2 N·m (20 in. lbs.).

(5) Reinstall the grab handle bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE BEZEL - INSTALLATION).

(6) Install and tighten the five screws that secure the upper flange of the passenger airbag door to the top of the instrument panel structural support (Fig. 33). Tighten the screws to 2 N·m (20 in. lbs.).

(7) Reinstall the passenger airbag onto the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).

PASSENGER AIRBAG ON/OFF SWITCH

DESCRIPTION

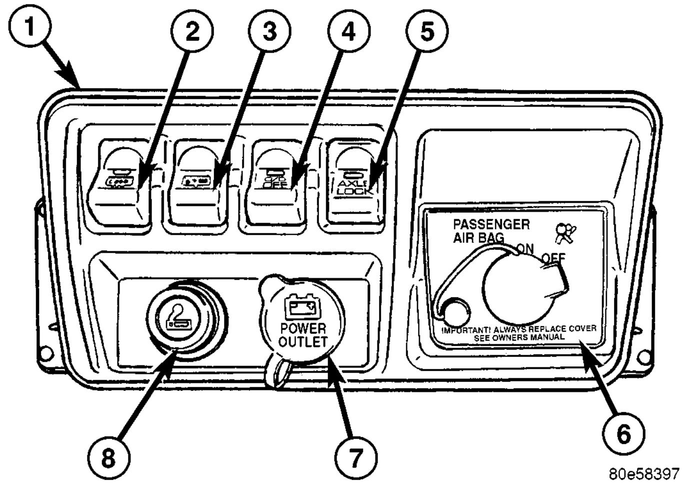

Fig. 35 Accessory Switch Bezel

1 - ACCESSORY SWITCH BEZEL
2 - REAR WINDOW DEFOGGER SWITCH (HARDTOP ONLY)
3 - REAR WIPER/WASHER SWITCH (HARDTOP ONLY)
4 - OVERDRIVE-OFF SWITCH (AUTOMATIC TRANSMISSION ONLY)
5 - AXLE LOCK SWITCH (OFF ROAD PACKAGE ONLY)
6 - PASSENGER AIRBAG ON/OFF SWITCH (WITHOUT REAR SEAT ONLY)
7 - ACCESSORY POWER OUTLET
8 - CIGAR LIGHTER

The passenger airbag on/off switch is standard equipment on all versions of this model that are equipped with the dual front airbag system, but are not equipped with a rear seat (Fig. 35). This switch is a two-position, resistor multiplexed switch with a single integral red Light-Emitting Diode (LED), and a non-coded key cylinder-type actuator. The switch is located on the passenger side end of the accessory switch bezel near the bottom of the instrument cluster center bezel to make the Off indicator visible to the front passenger seat occupant. When the switch is in its installed position, the only component visible through the dedicated opening of the accessory switch bezel is the key cylinder actuator. A small, tethered, molded plastic cap fits into the key cylinder actuator hole when the switch is not being used. The switch nomenclature and the Off indicator lens are integral to the accessory switch bezel. The text of the ″Off″ indicator is illuminated in amber when the Off position is selected with the ignition switch in the On position, while the On position of the switch is designated by text imprinted upon the accessory switch bezel, but is not illuminated. The remainder of the switch is concealed behind the accessory switch bezel.

The passenger airbag on/off switch housing is constructed of molded plastic and has three integral mounting tabs (Fig. 36). These mounting tabs are used to secure the switch to the back of the molded plastic accessory switch bezel with three small screws. The accessory switch bezel is secured to the instrument panel with four screws. A molded plastic connector receptacle on the back of the switch housing connects the switch to the vehicle electrical system through a dedicated take out of the body wire harness. The molded plastic harness connector insulator is keyed and latched to ensure proper and secure switch electrical connections. The passenger airbag on/off switch cannot be adjusted or repaired and, if faulty or damaged, the switch must be replaced.

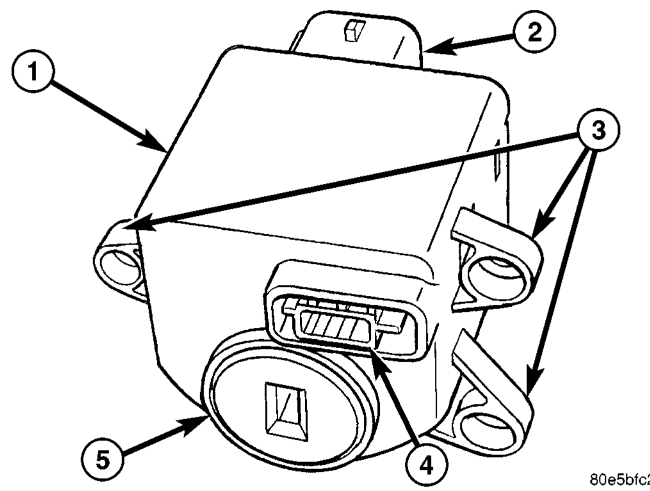

Fig. 36 Passenger Airbag On/Off Switch

1 - HOUSING
2 - CONNECTOR RECEPTACLE
3 - MOUNTING TAB (3)
4 - OFF INDICATOR
5 - KEY CYLINDER ACTUATOR

OPERATION

The passenger airbag on/off switch allows the customer to turn the passenger airbag function On or Off to accommodate certain uses of the right front seating position where airbag protection may not be desired. See the owner's manual in the vehicle glove box for specific recommendations on when to enable or disable the passenger airbag. The Off indicator of the switch will be illuminated whenever the switch is turned to the Off position and the ignition switch is in the On position.

The ignition key is the only key or object that should ever be inserted into the key cylinder actuator of the switch. The on/off switch requires only a partial key insertion to fully depress a spring-loaded locking plunger. The spring-loaded locking plunger prevents the user from leaving the key in the switch. The key will be automatically ejected when force is

PASSENGER AIRBAG ON/OFF SWITCH (Continued)

not applied. To actuate the passenger airbag on/off switch, insert the ignition key into the switch key actuator far enough to fully depress the plunger, then rotate the actuator to the desired switch position. When the switch key actuator is rotated to its clockwise stop (the key actuator slot will be aligned with the Off indicator), the Off indicator is illuminated and the passenger airbag is disabled. When the switch is rotated to its counterclockwise stop (the key actuator slot will be in a vertical position), the Off indicator will be extinguished and the passenger airbag is enabled.

The passenger airbag on/off switch connects one of two internal resistors in series between the passenger airbag mux switch sense and passenger airbag mux switch return circuits of the Airbag Control Module (ACM). The ACM continually monitors the resistance in these circuits to determine the switch position that has been selected. When the switch is in the Off position, the ACM provides a ground input to the switch through the passenger airbag indicator driver circuit, which energizes the Light-Emitting Diode (LED) that illuminates the Off indicator of the switch.

The ACM will also illuminate the Off indicator of the switch for about seven seconds each time the ignition switch is turned to the On position as a bulb test. The ACM will store a Diagnostic Trouble Code (DTC) for any fault it detects in the passenger airbag on/off switch or Off indicator circuits, and will illuminate the airbag indicator in the instrument cluster if a fault is detected. For proper diagnosis of the passenger airbag on/off switch or the ACM, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the passenger airbag on/off switch and accessory switch bezel from the instrument panel as a unit. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL).

(3) From the back of the accessory switch bezel, remove the three screws that secure the passenger airbag on/off switch to the back of the bezel (Fig. 37).

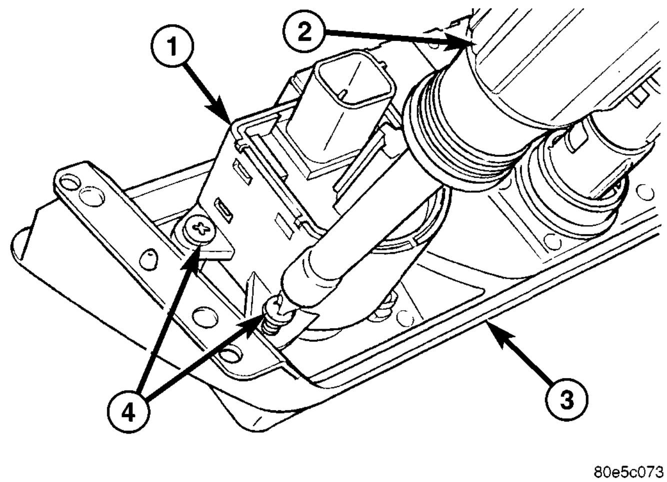

Fig. 37 Passenger Airbag On/Off Switch Remove/Install

1 - PASSENGER AIRBAG ON/OFF SWITCH
2 - SCREW DRIVER
3 - ACCESSORY SWITCH BEZEL
4 - SCREW (3)

(4) Remove the passenger airbag on/off switch from the accessory switch bezel.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Position the passenger airbag on/off switch to the back of the accessory switch bezel (Fig. 37).

(2) Install and tighten the three screws that secure the passenger airbag on/off switch to the back of the accessory switch bezel. Tighten the screws to 2 N·m (20 in. lbs.).

PASSENGER AIRBAG ON/OFF SWITCH (Continued)

(3) Reinstall the passenger airbag on/off switch and accessory switch bezel unit to the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ ACCESSORY SWITCH BEZEL - INSTALLATION).

(4) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

REAR SEAT BELT & RETRACTOR

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Slide both rear seat belt buckle units between the seat cushion and seat back into the cargo area.

(2) Lift the rear seat back release lever and fold the rear seat back forward, then tumble the folded rear seat cushion and back unit forward against the backs of the two front bucket seats.

(3) Remove the screw that secures the lower sear belt anchor to the inner rear wheel house panel (Fig. 38).

(4) Remove the rear seat belt lower anchor from the inner rear wheel house panel.

(5) Unsnap and lift the trim cover from the rear seat belt turning loop to access the screw that secures the turning loop to the upper sport bar (Fig. 39).

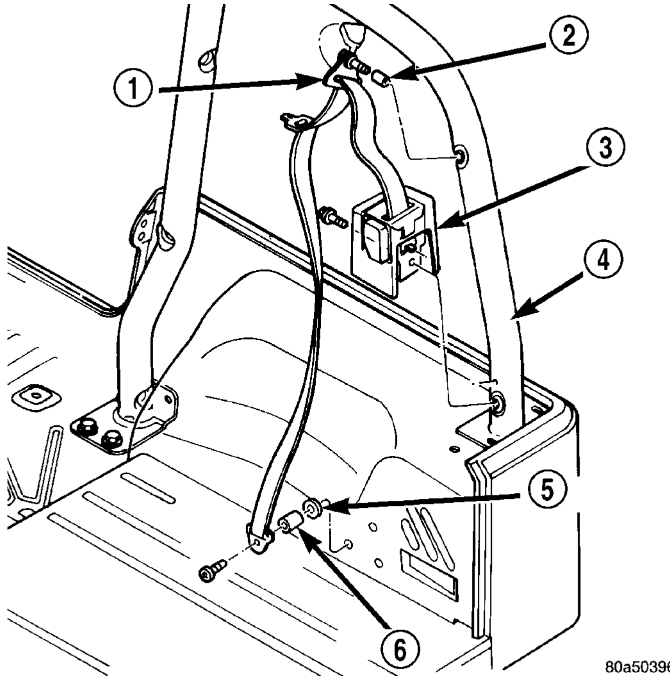

Fig. 38 Rear Seat Shoulder Belt & Retractor Remove/Install

1 - TURNING LOOP
2 - SPACER
3 - BELT & RETRACTOR
4 - SPORT BAR
5 - WASHER
6 - SPACER

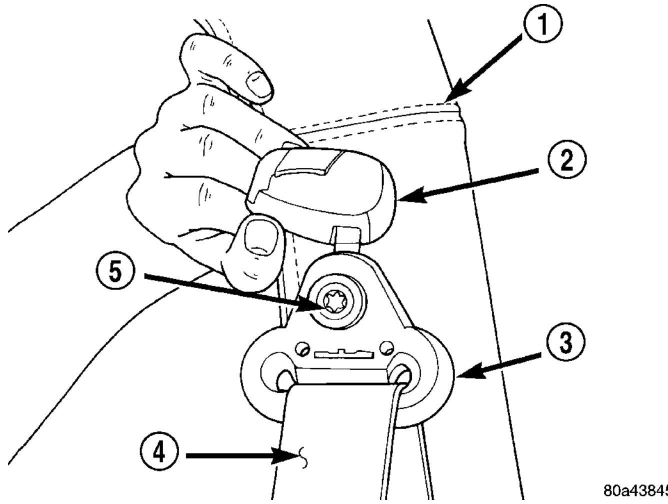

Fig. 39 Turning Loop

1 - SPORT BAR
2 - TURNING LOOP COVER
3 - TURNING LOOP
4 - REAR SEAT BELT
5 - SCREW

(6) Remove the screw that secures the seat belt turning loop to the upper sport bar.

(7) Remove the seat belt turning loop from the upper sport bar.

REAR SEAT BELT & RETRACTOR (Continued)

(8) Remove the screw that secures the rear seat belt retractor to the lower sport bar near the top of the inner rear wheel house panel.

(9) Remove the rear seat belt and retractor from the lower sport bar.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the rear seat belt and retractor to the lower sport bar near the top of the inner rear wheel house panel (Fig. 38). Be certain to engage the locator tab on the retractor in the locator hole on the sport bar.

(2) Install and tighten the screw that secures the rear seat belt retractor to the lower sport bar. Tighten the screw to 43 N·m (32 ft. lbs.).

(3) Position the rear seat belt turning loop to the upper sport bar (Fig. 39).

(4) Install and tighten the screw that secures the rear seat belt turning loop to the upper sport bar. Tighten the screw to 43 N·m (32 ft. lbs.).

(5) Fold and snap the trim cover for the rear seat belt turning loop back into place over the screw that secures the turning loop to the upper sport bar.

(6) Position the rear seat belt lower anchor to the inner rear wheel house panel.

(7) Install and tighten the screw that secures the rear seat belt lower anchor to the inner rear wheel house panel. Tighten the screw to 43 N·m (32 ft. lbs.).

(8) Tumble the folded rear seat cushion and back unit rearward onto the rear floor panel.

(9) Slide both rear seat belt buckle units between the seat cushion and the seat back.

(10) Unfold the rear seat back from the seat cushion until the seat back latch is fully engaged.

REAR SEAT BELT BUCKLE

REMOVAL

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(1) Slide both rear seat belt buckle units between the seat cushion and seat back into the rear cargo area.

(2) Lift the rear seat back release lever and fold the rear seat back forward, then tumble the folded rear seat cushion and back unit forward against the backs of the two front bucket seats.

(3) Lift the rear cargo area carpet between the two rear seat belt buckle units far enough to access and remove the screw that secures the anchor of the rear seat belt buckle units to the rear cargo floor panel through one of the clearance slots in the carpet (Fig. 40).

(4) Remove the rear seat belt buckle unit from the rear floor panel through one of the clearance slots in the rear cargo area carpet.

REAR SEAT BELT BUCKLE (Continued)

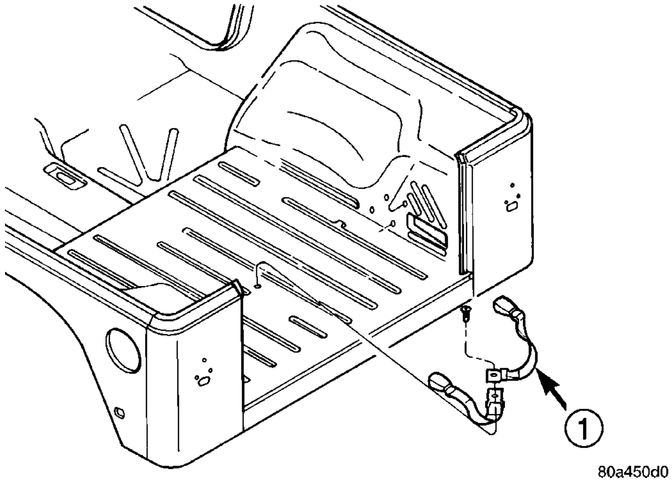

Fig. 40 Rear Seat Belt Buckles Remove/Install

1 - REAR SEAT BELT BUCKLE UNIT

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Lift the rear cargo area carpet far enough to position the rear seat belt buckle unit onto the rear cargo floor panel through one of the clearance slots in the carpet.

(2) Working through one of the clearance slots in the rear cargo area carpet, install and tighten the screw that secures the anchor of the rear seat belt buckle unit to the rear cargo floor panel (Fig. 40). Tighten the screw to 43 N·m (32 ft. lbs.).

(3) Tumble the folded rear seat cushion and back unit rearward onto the rear cargo floor panel.

(4) Slide both rear seat belt buckle units between the seat cushion and the seat back.

(5) Unfold the rear seat back from the seat cushion until the seat back latch is fully engaged.

SEAT BELT SWITCH

DESCRIPTION

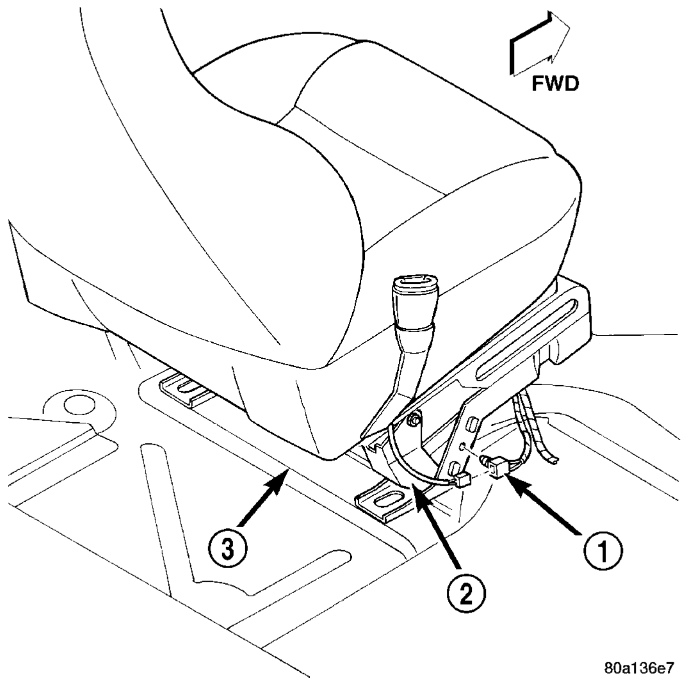

Fig. 41 Seat Belt Switch

1 - WIRE HARNESS CONNECTOR
2 - DRIVER SEAT RISER
4 - FLOOR PANEL

The seat belt switch is a small, normally closed, single pole, single throw, leaf contact, momentary switch. Only one seat belt switch is installed in the vehicle, and it is integral to the buckle of the driver side front seat belt buckle-half, located on the inboard side of the driver side front seat track (Fig. 41). The seat belt switch is connected to the vehicle electrical system through a two-wire pigtail wire and connector on the seat belt buckle-half, which is connected to a wire harness connector and take out of the body wire harness routed along the left side of the body sill in the passenger compartment.

The seat belt switch cannot be adjusted or repaired and, if faulty or damaged, the entire driver side front seat belt buckle-half unit must be replaced.

OPERATION

The seat belt switch is designed to control a path to ground for the seat belt switch sense input of the ElectroMechanical Instrument Cluster (EMIC). When

SEAT BELT SWITCH (Continued)

the driver side front seat belt tip-half is inserted into the seat belt buckle, the switch opens the path to ground; and, when the driver side front seat belt tip-half is removed from the seat belt buckle, the switch closes the ground path. The switch is actuated by the latch mechanism within the seat belt buckle.

The seat belt switch is connected in series between ground and the seat belt switch sense input of the instrument cluster. The seat belt switch receives ground at all times through its pigtail wire connection to the body wire harness from another take out of the body wire harness. An eyelet terminal connector on that ground take out is secured beneath a ground screw on the left cowl side inner panel, beneath the instrument panel. The seat belt switch may de diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - SEAT BELT SWITCH

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Disconnect the seat belt switch pigtail wire connector from the body wire harness connector for the seat belt switch on the floor near the driver side front seat belt buckle-half anchor. Check for continuity between the seat belt switch sense circuit and the ground circuit cavities of the seat belt switch pigtail wire connector. There should be continuity with the seat belt unbuckled, and no continuity with the seat belt buckled. If OK, go to Step 2. If not OK, replace the faulty front seat belt buckle-half assembly.

(2) Check for continuity between the ground circuit cavity in the body wire harness connector for the seat belt switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground (G302) as required.

(3) Remove the instrument cluster from the instrument panel. Check for continuity between the seat belt switch sense circuit cavity of the body wire harness connector for the seat belt switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted seat belt switch sense circuit between the seat belt switch and the instrument cluster as required.

(4) Check for continuity between the seat belt switch sense circuit cavities of the body wire harness connector for the seat belt switch and the instrument panel wire harness connector (Connector C2) for the instrument cluster. There should be continuity. If OK, test and replace the faulty instrument cluster as required. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If not OK, repair the open seat belt switch sense circuit between the seat belt switch and the instrument cluster as required.

SEAT BELT TURNING LOOP ADJUSTER

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Unsnap and lift the trim cover from the front seat belt turning loop to access the screw that

SEAT BELT TURNING LOOP ADJUSTER (Continued)

secures the turning loop to the height adjuster on the upper sport bar (Fig. 42).

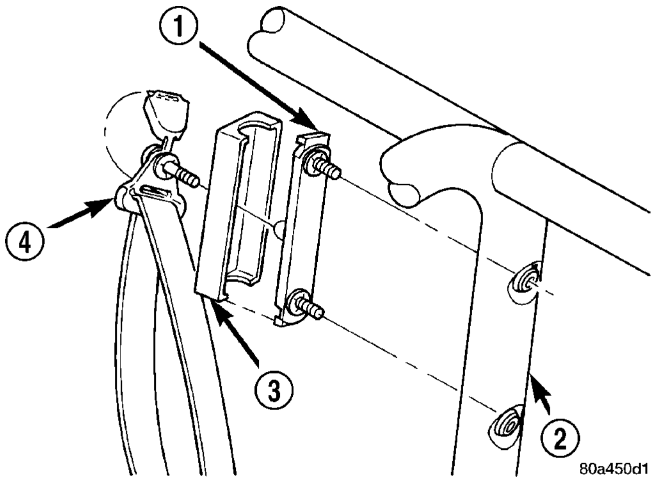

Fig. 42 Front Turning Loop Height Adjuster

1 - ADJUSTER
2 - SPORT BAR
3 - TRIM COVER
4 - TURNING LOOP

(2) Remove the screw that secures the shoulder belt turning loop to the height adjuster.

(3) Remove the front seat belt turning loop and the support/guide washer from the height adjuster.

(4) Unsnap and remove the trim cover from the front seat belt turning loop height adjuster to access the screws that secure the adjuster to the upper sport bar.

(5) Remove the two screws that secure the height adjuster to the upper sport bar.

(6) Remove the front seat belt turning loop height adjuster from the upper sport bar.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, DURING AND FOLLOWING ANY SEAT BELT OR CHILD RESTRAINT ANCHOR SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. REPLACE ANY CHILD RESTRAINT ANCHOR OR THE UNIT TO WHICH THE ANCHOR IS INTEGRAL THAT HAS BEEN BENT OR DAMAGED. NEVER ATTEMPT TO REPAIR A SEAT BELT OR CHILD RESTRAINT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT AND CHILD RESTRAINT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the front seat belt turning loop height adjuster onto the upper sport bar (Fig. 42). Be certain that the word “Up” stamped on the adjuster is properly oriented.

(2) Install and tighten the two screws that secure the seat belt turning loop height adjuster to the upper sport bar. Tighten the screws to 43 N·m (32 ft. lbs.).

(3) Align the trim cover over the front seat belt turning loop height adjuster and, using hand pressure, press firmly and evenly on the cover until it snaps into place over the adjuster on the upper sport bar.

(4) Position the support/guide washer and the front seat belt turning loop onto the height adjuster.

(5) Install and tighten the screw that secures the front seat belt turning loop to the height adjuster. Tighten the screw to 43 N·m (32 ft. lbs.).

(6) Fold and snap the trim cover for the seat belt turning loop back into place over the screw that secures the turning loop to the height adjuster.

SPEED CONTROL

TABLE OF CONTENTS

SPEED CONTROL

DESCRIPTION

The speed control system is electronically controlled and vacuum operated. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in PCM RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal (if equipped).

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the PCM when the RES/ACCEL is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

SPEED CONTROL (Continued)

A “tap down” feature is used to decelerate without disengaging the speed control system. To decelerate from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

OVERSHOOT/UNDERSHOOT

If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as a “lift foot set”), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h). It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly. If the “lift foot sets” are continually used, a speed control overshoot/undershoot condition will develop.

To “unlearn” the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating), and then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

DIAGNOSIS AND TESTING - ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8J, Instrument Cluster for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment of both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

SPECIFICATIONS

TORQUE - SPEED CONTROL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Servo Mounting Bracket-to-Servo Nuts	8.5	-	75
Speed Control Switch Mounting Screws	1.5	-	14
Vacuum Reservoir Mounting Bolt (screw)	1.2	-	10

CABLE

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

REMOVAL

2.4L

(1) Disconnect negative battery cable at battery.

(2) Hold throttle in wide open position. While held in this position, slide throttle control cable pin (Fig. 1) from throttle body bellcrank. Also slide servo cable pin from throttle body bellcrank.

(3) Using a pick or small screwdriver, press release tab (Fig. 1) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** To remove throttle cable from throttle body bracket, slide cable towards front of vehicle.

(4) After removing throttle control cable at throttle body, slide servo cable from throttle body.

(5) If necessary, disconnect opposite end of servo cable at servo. Refer to Servo Removal/Installation.

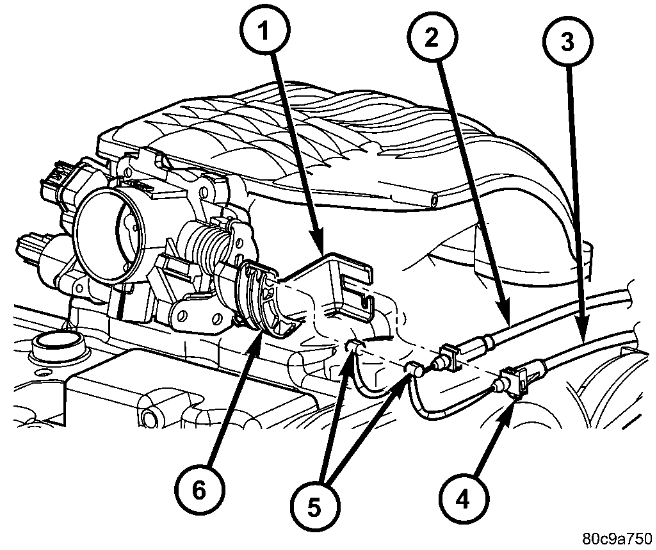

Fig. 1 SERVO CABLE AT THROTTLE BODY - 2.4L

1 - MOUNTING BRACKET
2 - SPEED CONTROL CABLE
3 - THROTTLE CABLE
4 - RELEASE TAB
5 - CABLE PINS
6 - BELLCRANK

4.0L

(1) Disconnect negative battery cable at battery.

(2) Using finger pressure only, remove cable connector by pushing connector off the throttle body bellcrank pin (Fig. 2). **DO NOT try to pull cable connector off perpendicular to the bellcrank pin. Connector will be broken.**

(3) Two release tabs are located on sides of speed control cable at cable bracket (Fig. 2). Squeeze tabs together and push cable out of bracket.

(4) Unclip cable from cable guide at valve cover.

(5) If necessary, disconnect opposite end of servo cable at servo. Refer to Servo Removal/Installation.

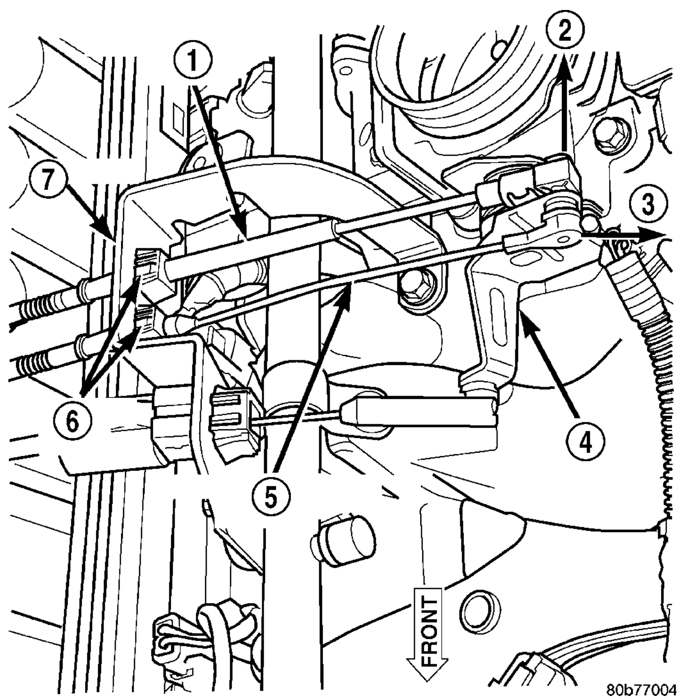

Fig. 2 SERVO CABLE AT THROTTLE BODY - 4.0L

1 - ACCELERATOR CABLE
2 - OFF
3 - OFF
4 - THROTTLE BODY BELLCRANK
5 - SPEED CONTROL CABLE
6 - RELEASE TABS
7 - BRACKET

INSTALLATION

2.4L

(1) Install end of cable to speed control servo. Refer to Servo Removal/Installation.

(2) Slide speed control cable plastic mount into throttle body bracket.

(3) Install speed control cable connector onto throttle body bellcrank pin (push rearward to snap into location).

CABLE (Continued)

(4) Slide throttle (accelerator) cable plastic mount into throttle body bracket. Continue sliding until cable release tab is aligned to hole in throttle body mounting bracket.

(5) While holding throttle to wide open position, place throttle cable pin into throttle body bellcrank.

(6) Connect negative battery cable at battery.

(7) Before starting engine, operate accelerator pedal to check for any binding.

4.0L

(1) Attach end of cable to speed control servo. Refer to Servo Removal/Installation.

(2) Install cable into cable bracket (snaps in).

(3) Install cable connector at throttle body bellcrank pin (snaps on).

(4) Clip cable to cable guide at valve cover.

(5) Connect negative battery cable to battery.

(6) Before starting engine, operate accelerator pedal to check for any binding.

SERVO

DESCRIPTION

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.

OPERATION

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo's by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids. When the brake is released, if vehicle speed exceeds 30 mph to resume, 35 mph to set, and the RES/ACCEL switch has been depressed, ground for the vent and vacuum circuits is restored.

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Disconnect vacuum line at servo (Fig. 3).

(3) Disconnect electrical connector at servo.

(4) Disconnect servo cable at throttle body. Refer to Cable Removal/Installation.

(5) Remove three bracket mounting bolts (Fig. 3).

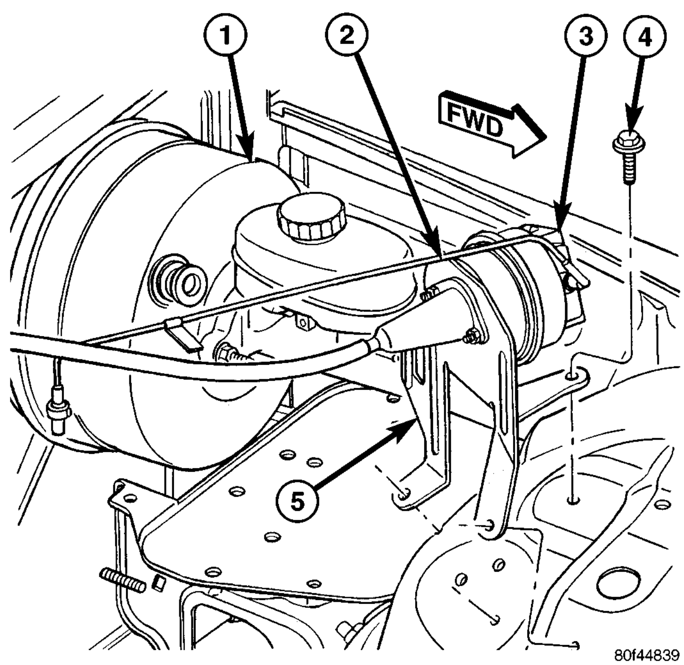

Fig. 3 SPEED CONTROL SERVO LOCATION

1 - BRAKE POWER BOOSTER
2 - VACUUM LINE
3 - SERVO
4 - BRACKET BOLTS (3)
5 - SERVO MOUNTING BRACKET

SERVO (Continued)

(6) Remove 2 mounting nuts holding servo cable sleeve to bracket (Fig. 4).

(7) Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (Fig. 4) and remove clip. Note: The servo mounting bracket displayed in (Fig. 4) is a typical bracket and may/may not be applicable to this model vehicle.

(8) Remove servo from mounting bracket. While removing, note orientation of servo to bracket.

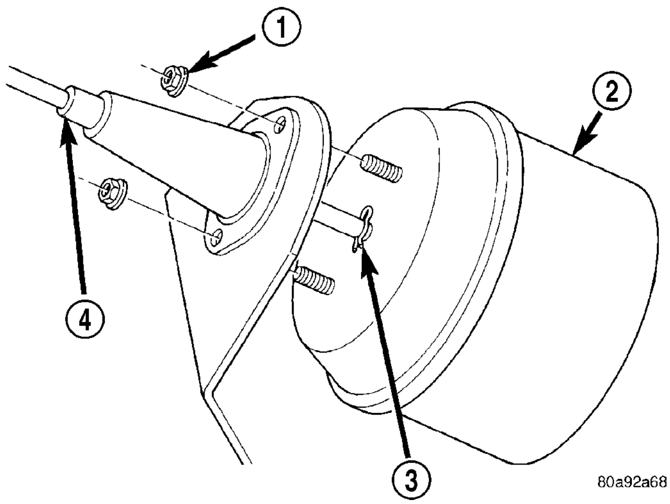

Fig. 4 SERVO CABLE CLIP REMOVE/INSTALL - TYPICAL

1 - SERVO MOUNTING NUTS (2)
2 - SERVO
3 - CABLE RETAINING CLIP
4 - SERVO CABLE AND SLEEVE

INSTALLATION

(1) Position servo to mounting bracket.

(2) Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip.

(3) Insert servo mounting studs through holes in servo mounting bracket.

(4) Install servo mounting nuts and tighten to 8.5 N·m (75 in. lbs.).

(5) Connect vacuum line at servo.

(6) Connect electrical connector at servo.

(7) Connect servo cable to throttle body. Refer to Cable Removal/Installation.

(8) Connect negative battery cable to battery.

(9) Before starting engine, operate accelerator pedal to check for any binding.

SWITCH

DESCRIPTION

There are two separate switch pods that operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

OPERATION

When speed control is selected by depressing the ON, OFF switch, the PCM allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between approximately 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- Depressing the clutch pedal.
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM.

SWITCH (Continued)

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the PCM's RAM when the ACCEL switch is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached. Then release the switch. The ON, OFF switch operates two components: the PCM's ON, OFF input, and the battery voltage to the brake switch, which powers the speed control servo.

Multiplexing

The PCM sends out 5 volts through a fixed resistor and monitors the voltage change between the fixed resistor and the switches. If none of the switches are depressed, the PCM will measure 5 volts at the sensor point (open circuit). If a switch with no resistor is closed, the PCM will measure 0 volts (grounded circuit). Now, if a resistor is added to a switch, then the PCM will measure some voltage proportional to the size of the resistor. By adding a different resistor to each switch, the PCM will see a different voltage depending on which switch is pushed.

Another resistor has been added to the 'at rest circuit' causing the PCM to never see 5 volts. This was done for diagnostic purposes. If the switch circuit should open (bad connection), then the PCM will see the 5 volts and know the circuit is bad. The PCM will then set an open circuit fault.

REMOVAL

WARNING: BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL AND STEERING COLUMN COMPONENTS, YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. WAIT 2 MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate negative battery cable from battery.

(2) Remove airbag module. Refer to 8, Passive Restraint Systems.

(3) From underside of steering wheel, remove speed control switch mounting screw (Fig. 5).

(4) Remove switch from steering wheel and unplug electrical connector.

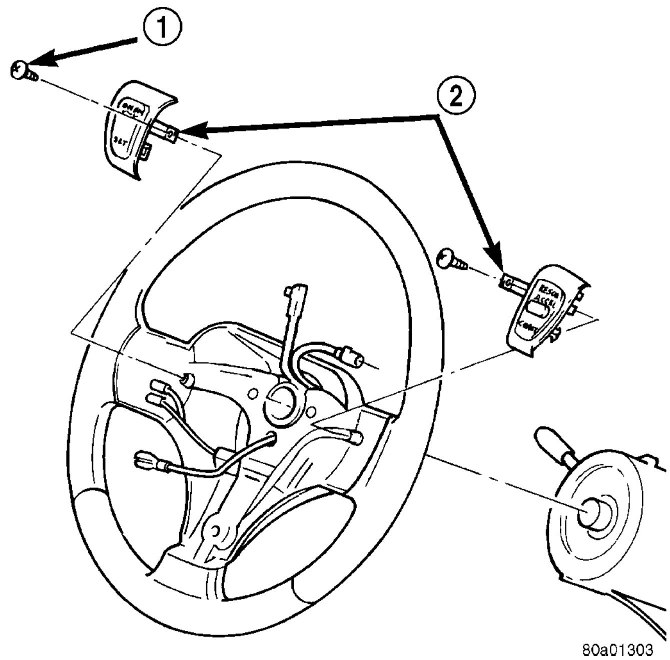

Fig. 5 Speed Control Switches - Remove / Install

1 - MOUNTING SCREW
2 - SPEED CONTROL SWITCHES

INSTALLATION

(1) Plug electrical connector into switch.

(2) Position switch to steering wheel.

(3) Install switch mounting screw and tighten to 1.5 N·m (14 in. lbs.) torque.

(4) Install airbag module. Refer to 8, Passive Restraint Systems.

(5) Connect negative battery cable to battery.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is a plastic storage tank connected to an engine vacuum source by vacuum lines.

OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

DIAGNOSIS AND TESTING - VACUUM RESERVOIR

(1) Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.

(4) If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.

(5) Verify operation of one-way check valve and check it for leaks.

(a) Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.

(b) Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.

(c) Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

REMOVAL

The vacuum reservoir is located under the vehicle battery tray (Fig. 6).

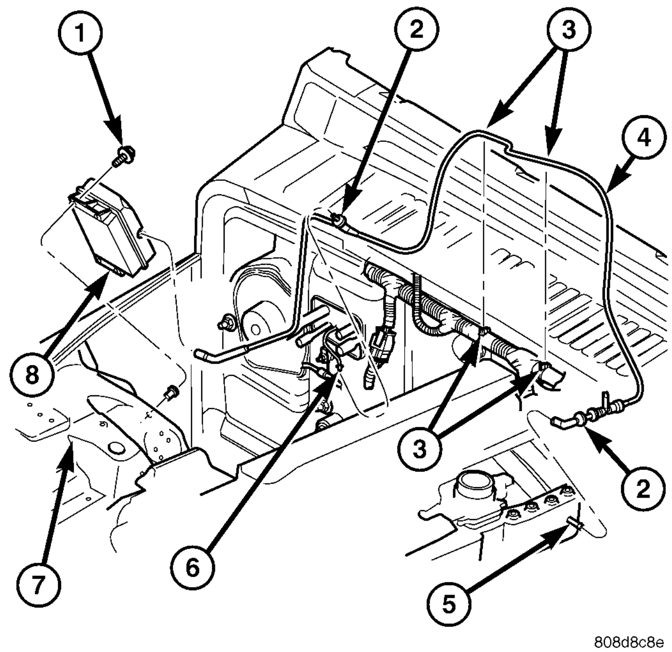

Fig. 6 Vacuum Reservoir Removal/Installation

1 - SCREW
2 - VACUUM CHECK VALVE (2)
3 - VACUUM LINE RETAINER (2)
4 - ACCESSORY VACUUM SUPPLY LINE
5 - ENGINE VACUUM FITTING
6 - HVAC VACUUM SUPPLY LINE
7 - INNER FENDER
8 - VACUUM RESERVOIR

(1) Remove battery and battery tray. Refer to Battery Removal/Installation.

(2) Disconnect vacuum supply line at reservoir (Fig. 6).

(3) Remove screw securing reservoir to inner fender.

(4) Remove reservoir from vehicle.

INSTALLATION

The vacuum reservoir is located under the vehicle battery tray (Fig. 6).

(1) Position reservoir to vehicle and install mounting screw.

(2) Tighten screw to 1.2 N·m (10 in. lbs.) torque.

(3) Connect vacuum line to reservoir.

(4) Install battery and battery tray. Refer to Battery Removal/Installation.

VEHICLE THEFT SECURITY

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VEHICLE THEFT SECURITY

DESCRIPTION

The Sentry Key Immobilizer System (SKIS) is available as a factory-installed option on this model. Vehicles equipped with this option can be readily identified by the presence of an amber SKIS indicator in the instrument cluster that will illuminate for about three seconds each time the ignition switch is turned to the On position, or by a gray molded rubber cap on the head of the ignition key. Models not equipped with SKIS still have a SKIS indicator in the cluster, but it will not illuminate when the ignition switch is turned to the On position. Also, models not equipped with the SKIS have a black molded rubber cap on the head of the ignition key.

The SKIS includes the following major components, which are described in further detail elsewhere in this service manual:

- **Powertrain Control Module (PCM)** - The PCM is located on the right side of the dash panel in the engine compartment.
- **Sentry Key Immobilizer Module (SKIM)** - The SKIM is located on the steering column near the ignition lock cylinder housing and an integral molded plastic antenna ring circles the ignition lock cylinder like a halo. The SKIM and its antenna are concealed beneath the steering column shrouds.
- **Sentry Key Transponder** - The Sentry Key transponder is molded into the head of the ignition key, and concealed by a gray molded rubber cap.
- **SKIS Indicator** - The SKIS indicator is located in the upper left corner of the instrument cluster overlay.

Except for the Sentry Key transponders, which rely upon Radio Frequency (RF) communication, hard wired circuitry connects the SKIS components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the SKIS components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by disabling the engine, after about two seconds of running, whenever any method other than a valid Sentry Key is used to start the vehicle. The SKIS is considered a passive protection system because it is always active when the ignition system is energized and does not require any customer intervention. The SKIS uses Radio Frequency (RF) communication to obtain confirmation that the key in the ignition switch is a valid key for operating the vehicle. The microprocessor-based SKIS hardware and software also uses electronic messages to communicate with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

VEHICLE THEFT SECURITY (Continued)

Pre-programmed Sentry Key transponders are provided with the vehicle from the factory. Each Sentry Key Immobilizer Module (SKIM) will recognize a maximum of eight Sentry Keys. If the customer would like additional keys other than those provided with the vehicle, they may be purchased from any authorized dealer. These additional keys must be programmed to the SKIM in the vehicle in order for the system to recognize them as valid keys. This can be done by the dealer using a DRBIII® scan tool or, if Customer Learn programming is an available SKIS feature in the market where the vehicle was purchased, the customer can program the additional keys, as long as at least two valid Sentry Keys are already available. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store fault information in the form of Diagnostic Trouble Codes (DTC's) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC's can be retrieved using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - SENTRY KEY IMMOBILIZER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

SENTRY KEY IMMOBILIZER SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
SKIS INDICATOR FAILS TO LIGHT DURING BULB TEST	1. Indicator faulty.	1. Test and replace the faulty instrument cluster or bulb as required.
	2. Fuse faulty.	2. Test and replace the SKIM fused B(+) and fused ignition switch output (run-start) fuses in the fuse block as required.
	3. Ground circuit faulty.	3. Test and repair the SKIM ground circuit as required.
	4. Fused B(+) circuit faulty.	4. Test and repair the SKIM fused B(+) circuit as required.
	5. Fised ignition switch output circuit faulty.	5. Terst and repair the SKIM fused ignition switch output (run-start) circuit as required.
SKIS INDICATOR FLASHES WHEN IGNITION SWITCH IS TURNED TO THE ″ON″ POSITION	1. Invalid key in ignition switch lock cylinder.	1. Replace the key with a known valid key.
	2. Key-related fault.	2. Use a DRBIII® scan tool to diagnose the key-related fault. Refer to the appropriate diagnostic information.
SKIS INDICATOR LIGHTS SOLID FOLLOWING BULB TEST	1. SKIS system malfunction/ fault detected.	1. Use a DRBIII® scan tool to diagnose the SKIS. Refer to the appropriate diagnostic information.

VEHICLE THEFT SECURITY (Continued)

SKIS INDICATOR FAILS TO LIGHT DURING BULB TEST

If the Sentry Key Immobilizer System (SKIS) indicator in the instrument cluster fails to illuminate for about three seconds after the ignition switch is turned to the On position (bulb test), perform the instrument cluster actuator test. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING - ACTUATOR TEST). If the SKIS indicator still fails to light during the bulb test, a wiring problem resulting in the loss of battery current or ground to the Sentry Key Immobilizer Module (SKIM) should be suspected, and the following procedure should be used for diagnosis. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

NOTE: The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Sentry Key Immobilizer System requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

(1) Check the B(+) fuse (Fuse 1 - 20 ampere) in the fuse block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the B(+) fuse (Fuse 1 - 20 ampere) in the fuse block. If OK, go to Step 3. If not OK, repair the open B(+) circuit between the fuse block and the battery as required.

(3) Check the ignition switch output (run-start) fuse (Fuse 12 - 10 ampere) in the fuse block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) fuse (Fuse 12 - 10 ampere) in the fuse block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run-start) circuit between the fuse block and the ignition switch as required.

(5) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the Sentry Key Immobilizer Module (SKIM) from the SKIM connector receptacle. Check for continuity between each of the two ground circuit cavities of the instrument panel wire harness connector for the SKIM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit(s) to ground (G105 and G302) as required.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the SKIM. If OK, go to Step 7. If not OK, repair the open fused B(+) circuit between the SKIM and the fuse block as required.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-start) circuit cavity of the instrument panel wire harness connector for the SKIM. If OK, use a DRBIII® scan tool to complete the diagnosis of the SKIS. Refer to the appropriate diagnostic information. If not OK, repair the open fused ignition switch output (run-start) circuit between the SKIM and the fuse block as required.

SKIS INDICATOR FLASHES OR LIGHTS SOLID FOLLOWING BULB TEST

A SKIS indicator that flashes following a successful bulb test indicates that an invalid key has been detected, or that a key-related fault has been set. A SKIS indicator that lights solid following a successful bulb test indicates that the SKIM has detected a system malfunction or that the SKIS is inoperative. In either case, fault information will be stored in the SKIM memory. For retrieval of this fault information and further diagnosis of the SKIS, the PCI data bus, the SKIM message outputs to the instrument cluster that control the SKIS indicator and/or chime service, or the message inputs and outputs between the SKIM and the Powertrain Control Module (PCM) that control engine operation, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information. Following are preliminary troubleshooting guidelines to be followed during diagnosis using a DRBIII® scan tool:

(1) Using the DRBIII® scan tool, read and record the faults as they exist in the SKIM when you first begin your diagnosis of the vehicle. It is important to document these faults because the SKIM does not differentiate between historical faults (those that have occurred in the past) and active faults (those that are currently present). If this problem turns out to be an intermittent condition, this information may become invaluable to your diagnosis.

(2) Using the DRBIII® scan tool, erase all of the faults from the SKIM.

(3) Cycle the ignition switch to the Off position, then back to the On position.

(4) Using the DRBIII® scan tool, read any faults that are now present in the SKIM. These are the active faults.

(5) Using this active fault information, refer to the proper procedure in the appropriate diagnostic information for the additional specific diagnostic steps.

VEHICLE THEFT SECURITY (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - SKIS INITIALIZATION

The Sentry Key Immobilizer System (SKIS) must be initialized following a Sentry Key Immobilizer Module (SKIM) replacement. SKIS initialization requires the use of a DRBIII® scan tool. Initialization will also require that you have access to the unique four-digit PIN code that was assigned to the original SKIM. The PIN code **must** be used to enter the Secured Access Mode in the SKIM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - STANDARD PROCEDURE - PCM/SKIM PROGRAMMING).

NOTE: If a Powertrain Control Module (PCM) is replaced on a vehicle equipped with the Sentry Key Immobilizer System (SKIS), the unique Secret Key data must be transferred from the Sentry Key Immobilizer Module (SKIM) to the new PCM using the PCM replacement procedure. This procedure also requires the use of a DRBIII® scan tool and the unique four-digit PIN code to enter the Secured Access Mode in the SKIM. Refer to the appropriate diagnostic information for the proper PCM replacement procedures.

STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING

All Sentry Keys included with the vehicle are preprogrammed to work with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to a total of eight Sentry Keys. When programming a blank Sentry Key transponder, the key must first be cut to match the ignition switch lock cylinder in the vehicle for which it will be used. Once the additional or new key has been cut, the SKIM must be programmed to recognize it as a valid key. There are two possible methods to program the SKIM to recognize a new or additional valid key, the Secured Access Method and the Customer Learn Method. Following are the details of these two programming methods.

SECURED ACCESS METHOD

The Secured Access method applies to all vehicles. This method requires the use of a DRBIII® scan tool. This method will also require that you have access to the unique four-digit PIN code that was assigned to the original SKIM. The PIN code **must** be used to enter the Secured Access Mode in the SKIM. This PIN number may be obtained from the vehicle owner, from the original vehicle invoice, or from the DaimlerChrysler Customer Center. Refer to the appropriate diagnostic information for the proper Secured Access method programming procedures.

CUSTOMER LEARN METHOD

The Customer Learn feature is only available on domestic vehicles, or those vehicles which have a U.S. country code designator. This programming method also requires access to at least two valid Sentry Keys. If two valid Sentry Keys are not available, or if the vehicle does not have a U.S. country code designator, the Secured Access Method **must** be used to program new or additional valid keys to the SKIM. The Customer Learn programming method procedures are as follows:

(1) Obtain the blank Sentry Key(s) that are to be programmed as valid keys for the vehicle. Cut the blank key(s) to match the ignition switch lock cylinder mechanical key codes.

(2) Insert one of the two valid Sentry Keys into the ignition switch and turn the ignition switch to the On position.

(3) After the ignition switch has been in the On position for longer than three seconds, but no more than fifteen seconds, cycle the ignition switch back to the Off position. Replace the first valid Sentry Key in the ignition switch lock cylinder with the second valid Sentry Key and turn the ignition switch back to the On position. The second valid Sentry Key must be inserted in the lock cylinder within fifteen seconds of removing the first valid key.

(4) About ten seconds after the completion of Step 3, the SKIS indicator in the instrument cluster will start to flash and a single audible chime will sound to indicate that the system has entered the Customer Learn programming mode.

(5) Within sixty seconds of entering the Customer Learn programming mode, turn the ignition switch to the Off position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the On position.

(6) About ten seconds after the completion of Step 5, a single audible chime will sound and the SKIS indicator will stop flashing, stay on solid for three seconds, then turn off to indicate that the blank Sentry Key has been successfully programmed. The SKIS will immediately exit the Customer Learn programming mode and the vehicle may now be started using the newly programmed valid Sentry Key.

VEHICLE THEFT SECURITY (Continued)

Each of these steps must be repeated and completed in their entirety for each additional Sentry Key that is to be programmed. If the above steps are not completed in the given sequence, or within the allotted time, the SKIS will exit the Customer Learn programming mode and the programming will be unsuccessful. The SKIS will also automatically exit the Customer Learn programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight (8) valid Sentry Keys, or if the ignition switch is turned to the Off position for more than about fifty seconds.

NOTE: If an attempt is made to start the vehicle while in the Customer Learn mode (SKIS indicator flashing), the SKIS will respond as though the vehicle were being started with an invalid key. In other words, the engine will stall after about two seconds of operation. No faults will be set.

NOTE: Once a Sentry Key has been programmed as a valid key to a vehicle, it cannot be programmed as a valid key for use on any other vehicle.

SKIS INDICATOR

DESCRIPTION

A Sentry Key Immobilizer System (SKIS) indicator is standard equipment on all instrument clusters, but is only operational on vehicles equipped with the optional SKIS. The SKIS indicator is located near the upper edge of the instrument cluster overlay, in the upper left quadrant of the cluster. The SKIS indicator consists of a stencil-like cutout of a graphical representation or icon of a key that is circled and crossed-out in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber lens behind the cutout in the opaque layer of the overlay causes the indicator to appear in amber through the translucent outer layer of the overlay when it is illuminated from behind by a Light Emitting Diode (LED) soldered onto the instrument cluster electronic circuit board. The SKIS indicator is serviced as a unit with the instrument cluster.

OPERATION

The Sentry Key Immobilizer System (SKIS) indicator gives an indication to the vehicle operator of the status of the SKIS. This indicator is controlled by the instrument cluster electronic circuit board based upon electronic messages received by the cluster from the Sentry Key Immobilizer Module (SKIM) over the Programmable Communications Interface (PCI) data bus. The SKIS indicator Light Emitting Diode (LED) receives battery current on the instrument cluster electronic circuit board through the fused ignition switch output (run-start) circuit whenever the ignition switch is in the On or Start positions; therefore, the indicator will always be off when the ignition switch is in any position except On or Start. The LED only illuminates when it is switched to ground by the instrument cluster transistor. The instrument cluster will turn on the SKIS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position, the SKIM tells the cluster to illuminate the SKIS indicator for about three seconds as a bulb test.
- **SKIM Lamp-On Message** - Each time the cluster receives a lamp-on message from the SKIM, the SKIS indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the SKIM message. For more information on the SKIS and the SKIS indicator control parameters, (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - OPERATION). The indicator remains illuminated until the cluster receives a lamp-off message from the SKIM or until the ignition switch is turned to the Off position, whichever occurs first.
- **Actuator Test** - Each time the cluster is put through the actuator test, the SKIS indicator will be turned on, then off again in a prescribed sequence to confirm the functionality of the LED and the cluster control circuitry.

The SKIM performs a self-test each time the ignition switch is turned to the On position to decide whether the system is in good operating condition. The SKIM then sends the proper SKIS lamp-on or lamp-off messages to the instrument cluster. For further diagnosis of the SKIS indicator or the instrument cluster circuitry that controls the indicator, (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING). If the instrument cluster turns on the SKIS indicator after the bulb test, either solid or flashing, it indicates that a SKIS malfunction has occurred or that the SKIS is inoperative. For proper diagnosis of the SKIS, the PCI data bus, or the message inputs to the instrument cluster that control the SKIS indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TRANSPONDER KEY

DESCRIPTION

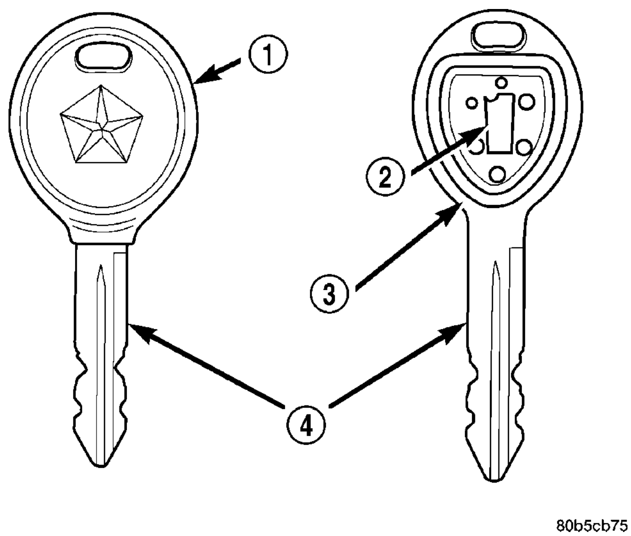

Fig. 1 Sentry Key Immobilizer Transponder

1 - MOLDED CAP
2 - TRANSPONDER CHIP
3 - MOLDED CAP REMOVED
4 - TRANSPONDER KEY

Each ignition key used in the Sentry Key Immobilizer System (SKIS) has an integral transponder chip (Fig. 1). Ignition keys with this feature can be readily identified by a gray rubber cap molded onto the head of the key, while conventional ignition keys have a black molded rubber cap. The transponder chip is concealed beneath the molded rubber cap, where it is molded within a plastic mount into the head of the metal key. In addition to being cut to match the mechanical coding of the ignition lock cylinder, each new Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. The Sentry Key transponder cannot be adjusted or repaired. If faulty or damaged, the entire key must be replaced.

OPERATION

When the ignition switch is turned to the On position, the Sentry Key Immobilizer Module (SKIM) communicates through its antenna with the Sentry Key transponder using a Radio Frequency (RF) signal. The SKIM then listens for a RF response from the transponder through the same antenna. The Sentry Key transponder chip is within the range of the SKIM transceiver antenna ring when it is inserted into the ignition lock cylinder. The SKIM determines whether a valid key is present in the ignition lock cylinder based upon the response from the transponder. If a valid key is detected, that fact is communicated by the SKIM to the Powertrain Control Module (PCM) over the Programmable Communications Interface (PCI) data bus, and the PCM allows the engine to continue running. If the PCM receives an invalid key message, or receives no message from the SKIM over the PCI data bus, the engine will be disabled after about two seconds of operation. The ElectroMechanical Instrument Cluster (EMIC) will also respond to the invalid key message on the PCI data bus by flashing the SKIS indicator on and off.

Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the SKIM has a unique Secret Key code programmed into it by the manufacturer. When a Sentry Key is programmed into the memory of the SKIM, the SKIM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the Secret Key code from the SKIM. Once the Sentry Key learns the Secret Key code of the SKIM, it is permanently stored in the memory of the transponder. Therefore, once a Sentry Key has been programmed to a particular vehicle, it cannot be used on any other vehicle. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE - SENTRY KEY TRANSPONDER PROGRAMMING).

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store key-related fault information in the form of Diagnostic Trouble Codes (DTC's) in SKIM memory if a Sentry Key transponder problem is detected. The Sentry Key transponder chip can be diagnosed, and any stored DTC's can be retrieved using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WIPERS/WASHERS

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FRONT WIPERS/WASHERS

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FRONT WIPERS/WASHERS

DESCRIPTION

An electrically operated intermittent front wiper and washer system is standard factory-installed safety equipment on this model (Fig. 1). The front wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Front Check Valve -** The front washer system check valve is located in the washer plumbing on the underside of the hood panel between the cowl and the front washer nozzle.

FRONT WIPERS/WASHERS (Continued)

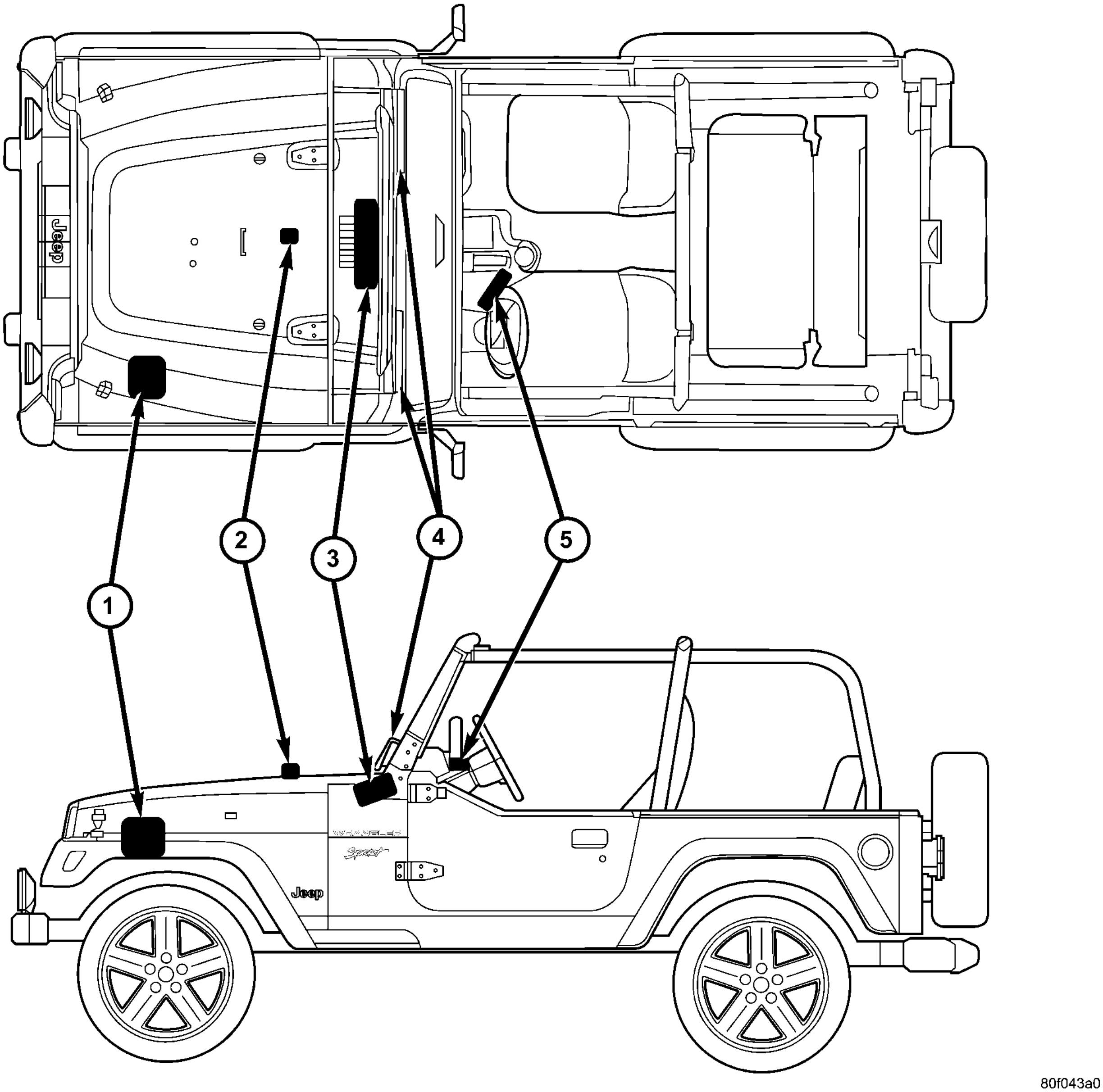


Fig. 1 Front Wiper & Washer System

1 - WASHER RESERVOIR, PUMP/MOTOR
2 - FRONT WASHER NOZZLE
3 - FRONT WIPER MODULE
4 - FRONT WIPER ARM & BLADE (2)
5 - RIGHT MULTI-FUNCTION SWITCH

- **Front Washer Nozzle -** The single fluidic front washer nozzle is secured by an integral latch feature to a dedicated opening near the rear of the hood panel. The washer plumbing fitting for the washer nozzle is concealed beneath the hood panel.
- **Front Washer Pump/Motor -** The front washer pump/motor unit is located in a dedicated hole on the lower inboard side of the washer reservoir, on the top of the left front wheel house in the engine compartment. The front washer pump/motor unit is located below and forward of the optional rear washer pump/motor unit mounting hole.
- **Front Washer Plumbing -** The plumbing for the front washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the left side of the engine compartment from the washer reservoir, and up the cowl panel to the hood panel rear reinforcement. Then along the hood panel rear reinforcement to the front washer nozzle fitting.
- **Front Wiper Arm -** The two front wiper arms are secured with integral latches to the serrated ends

FRONT WIPERS/WASHERS (Continued)

of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield.

- **Front Wiper Blade** - The two front wiper blades are secured to the two front wiper arms with integral latches, and are parked on the glass near the bottom of the windshield when the front wiper system is not in operation.
- **Front Wiper Module** - The front wiper pivot shafts are the only visible components of the front wiper module. The remainder of the module is concealed within the cowl plenum area beneath the cowl plenum cover/grille panel. The front wiper module includes the wiper module bracket, three rubber-isolated wiper module mounts, the front wiper motor, the front wiper motor crank arm, the front wiper drive link, the front wiper connector link, and the two front wiper pivots.
- **Right Multi-Function Switch** - The right multi-function switch is located near the top of the steering column, just below the steering wheel. The right multi-function switch includes a control stalk with a control knob on the end that extends through a dedicated opening on the right side of the steering column shrouds. The right multi-function switch is dedicated to providing all of the driver controls for the front wiper and washer systems.
- **Washer Reservoir** - The molded plastic washer reservoir is secured by two screws through integral mounting tabs to the top of the left front fender wheel house, in the left front corner of the engine compartment. The washer reservoir filler neck is accessed from the left front corner of the engine compartment.

Hard wired circuitry connects the front wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the front wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATING MODES

The components of the wiper and washer system are designed to work in concert to provide the following operating modes:

- **Continuous Wipe Modes** - The control stalk of the right multi-function switch has two continuous wipe positions, Low and High. When selected, these switch positions will cause the two-speed wiper motor to operate in a continuous low or high speed cycle.
- **Intermittent Wipe Mode** - The control stalk of the right multi-function switch has an intermittent wipe position, and the control knob has several minor detent positions which will each cause the wiper system to operate at different delay intervals between complete wipe cycles. The internal circuitry of the right multi-function switch provides the intermittent wipe mode and adjustable delay intervals between wipe cycles of about one second to about fifteen seconds.
- **Mist Wipe Mode** - The control stalk of the right multi-function switch has a momentary mist wipe position that will operate the front wipers for a single complete cycle, then park the wiper blades near the base of the windshield.
- **Washer Mode** - When the control stalk of right multi-function switch is pulled toward the steering wheel to the momentary Wash position while the front wiper system is operating, washer fluid will be dispensed onto the windshield glass through the washer nozzles for as long as the front washer pump is energized.
- **Wipe-After-Wash Mode** - When the control stalk of right multi-function switch is pulled toward the steering wheel to the momentary Wash position while the front wiper system is not operating, the internal circuitry of the right multi-function switch provides a wipe-after-wash feature which will operate the front washer pump/motor and the front wipers for as long as the washer system is activated, then provide one or two additional wipe cycles after the washer system is deactivated before parking the front wiper blades near the base of the windshield.

OPERATION

The front wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside windshield glass surface that might be encountered while driving the

FRONT WIPERS/WASHERS (Continued)

vehicle under numerous types of inclement operating conditions.

The vehicle operator initiates all front wiper and washer system functions with the control stalk and control knob of the right multi-function switch that extends from the right side of the steering column, just below the steering wheel. Moving the control stalk upward selects the front wiper system operating mode. The front wiper system allows the vehicle operator to select from two continuous wiper speeds, High or Low, or the intermittent wipe Delay mode. Pulling the control stalk downwards and releasing it selects the front wiper system Mist mode, which operates the front wipers for one complete wipe cycle after the control stalk is released. Rotating the control knob on the end of the control stalk allows the vehicle operator to select the intermittent wipe Delay interval. Pulling the control stalk towards the steering wheel activates the front washer pump/motor, which dispenses washer fluid onto the windshield glass through the front washer nozzle.

When the ignition switch is in the Accessory or On positions, battery current from a fuse in the Power Distribution Center (PDC) is provided to the front wiper and washer system fuse in the fuse block. This fuse provides battery current through separate fused ignition switch output (run-acc) circuits to the right multi-function switch, and to the front wiper motor. Within the right multi-function switch, this battery current is fed to one side of the control coil in the wiper motor relay, and to the electronic intermittent wipe logic circuit, which are both integral to the switch.

The intermittent wipe and wipe-after-wash features of the front wiper and washer system are both provided by the electronic intermittent wipe logic circuit within the right multi-function switch. In order to provide the intermittent wipe feature, the logic circuit monitors the wiper switch state, the intermittent delay resistance setting, and the wiper motor park switch state. In order to provide the wipe-after-wash feature, the logic circuit monitors both the front washer switch state and the wiper motor park switch state.

The hard wired circuits and components of the front wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods are not possible in the diagnosis of the intermittent wipe mode circuitry and logic within the right multi-function switch. If the front wiper and washer system operates satisfactorily in all modes except the Delay mode, the faulty right multi-function switch must be replaced. Refer to the appropriate diagnostic information.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the front wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the Low position of the right multi-function switch control stalk is selected, the Low mode circuitry within the switch directs battery current to the low speed brush of the front wiper motor, which causes the front wipers to cycle at a low speed. When the High position of the control stalk is selected, the High mode circuitry within the switch directs battery current to the high speed brush of the front wiper motor, which causes the front wipers to cycle at a high speed.

When the Off position of the right multi-function switch control stalk is selected, one of two events is possible. The event that occurs depends upon the position of the wiper blades on the windshield at the moment that the control stalk Off position is selected. If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the front wiper motor is closed to ground and the wiper motor ceases to operate.

If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is closed to battery current through the fused ignition switch output (run-acc) circuit of the front wiper motor. The park switch sense circuit directs this battery current to the low speed brush of the wiper motor through the normally closed circuit of the wiper motor relay and the Off mode circuitry of the wiper switch. This causes the wiper motor to continue running until the wiper blades are in the down position on the windshield and the park switch is again closed to ground.

INTERMITTENT WIPE MODE

When the control stalk of the right multi-function switch is moved to the Delay position, the Delay mode circuitry within the switch directs battery current to a request input of the integral logic circuit. The Delay mode circuitry also directs battery current through an internal variable resistor to the intermittent wipe delay sense input of the logic circuit, which indicates the delay interval that has been selected by the vehicle operator using the control knob on the end of the right multi-function switch control stalk.

The logic circuit responds to the Delay mode request inputs by calculating the correct delay interval. The logic circuit then energizes the wiper motor relay by pulling the relay control coil to ground. The energized wiper motor relay directs battery current from the normally open relay terminal through the

FRONT WIPERS/WASHERS (Continued)

common feed relay terminal and the Delay mode wiper switch circuitry to the low speed brush of the wiper motor. The logic circuit monitors the front wiper motor operation through the wiper park switch sense circuit, which allows the logic circuit to determine the proper timing to begin the next wiper blade sweep.

MIST MODE

When the control stalk of the right multi-function switch is moved to the momentary Mist position, the Mist mode circuitry within the switch directs battery current to the low speed brush of the front wiper motor, which causes the front wipers to cycle at low speed for as long as the switch is held in the Mist position. When the control stalk is released, the wiper motor completes the current wipe cycle then parks the wiper blades near the base of the windshield.

WASH MODE

When the momentary Wash position of the right multi-function switch control stalk is selected while the front wiper system is operating, the Wash mode circuitry within the switch directs battery current to the front washer pump/motor for as long as the Wash mode circuitry within the switch remains closed. When the control stalk is released the Wash mode circuitry within the switch opens and the front washer pump/motor ceases operation.

WIPE-AFTER-WASH MODE

When the washer switch is closed with the front wiper system turned Off, the intermittent wipe logic circuit operates the front wiper motor through the wiper motor relay in the same manner as it does to provide the Delay mode operation, but uses the Off mode circuitry of the wiper switch to feed battery current to the low speed brush of the front wiper motor. When the Wash mode circuitry state changes to open, the intermittent wipe logic circuit de-energizes the front washer pump/motor unit, but allows the wiper motor to operate for several additional wipe cycles before it de-energizes the wiper motor and parks the wiper blades near the base of the windshield. The intermittent wipe logic circuit monitors the front wiper motor through the wiper park switch sense circuit, which allows the logic circuit to count the number of wiper blade sweeps.

DIAGNOSIS AND TESTING - FRONT WIPER & WASHER SYSTEM

WIPER SYSTEM

The diagnosis found here addresses an electrically inoperative front wiper system. If the front wiper motor operates, but the wipers do not move on the windshield, replace the faulty front wiper module. If the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the front wiper system components as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - INSPECTION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Check the front wiper and washer system fuse (Fuse 14 - 25 ampere) in the fuse block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the front wiper and washer system fuse (Fuse 14 - 25 ampere) in the fuse block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run-acc) circuit between the fuse block and the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the right multi-function switch from the switch connector receptacle. Check for continuity between the ground circuit cavity of the body wire harness connector for the right multi-function switch and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground (G300) as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) circuit cavity of the body wire harness connector for the right multi-function switch. If OK, go to Step 5. If not OK, repair the open fused ignition switch out-

FRONT WIPERS/WASHERS (Continued)

put (run-acc) circuit between the right multi-function switch and the fuse block as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the right multi-function switch from the steering column and check the switch continuity. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/RIGHT MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). If OK, go to Step 6. If not OK, replace the faulty switch.

(6) Disconnect the body wire harness connector for the front wiper motor from the wiper motor pigtail wire connector. Check for continuity between the ground circuit cavity in the body wire harness connector for the front wiper motor and a good ground. There should be continuity. If OK, go to Step 7. If not OK, repair the open ground circuit to ground (G300) as required.

(7) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run-acc) circuit cavity of the body wire harness connector for the front wiper motor. If OK, go to Step 8. If not OK, repair the open fused ignition switch output (run-acc) circuit between the front wiper motor and the fuse block as required.

(8) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. The body wire harness connector for the right multi-function switch is still disconnected. Check each of the following circuits at the proper cavity of the body wire harness connector for the front wiper motor for continuity to ground. In each case, there should be no continuity. If OK, go to Step 9. If not OK, repair the shorted circuit between the front wiper motor and the right multi-function switch as required.

- Wiper park switch sense
- Wiper switch low speed output
- Wiper switch high speed output

(9) Check the continuity of each of the following circuits between the proper cavities of the body wire harness connectors for the front wiper motor and the right multi-function switch. In each case, there should be continuity. If OK, replace the faulty front wiper module. If not OK, repair the open circuit between the front wiper motor and the right multi-function switch as required.

- Wiper park switch sense
- Wiper switch low speed output
- Wiper switch high speed output

WASHER SYSTEM

The diagnosis found here addresses an electrically inoperative front washer system. If the front washer pump/motor operates, but no washer fluid is emitted from the washer nozzle, be certain to check the fluid level in the reservoir. Also clean and inspect the front washer system components as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - INSPECTION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Turn the ignition switch to the On position. Move the right multi-function switch control stalk to the Low or High continuous wipe position. Check whether the front wiper system operates. If OK, go to Step 2. If not OK, repair the front wiper system as required before you proceed with front washer system diagnosis. Refer to WIPER SYSTEM.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the headlamp and dash wire harness connector for the front washer pump/motor from the washer pump/motor connector receptacle. Check for continuity between the ground circuit cavity of the headlamp and dash wire harness connector for the front washer pump/motor and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground (G102) as required.

(3) Reconnect the battery negative cable. Turn the ignition switch to the On position. While pulling the right multi-function switch control stalk toward the steering wheel to close the washer switch, check for battery voltage at the washer pump control switch output circuit cavity of the headlamp and dash wire harness connector for the front washer pump/motor. If OK, replace the faulty front washer pump/motor. If not OK, go to Step 4.

(4) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable.

FRONT WIPERS/WASHERS (Continued)

Disconnect the body wire harness connector for the right multi-function switch from the switch connector receptacle. Check for continuity between the washer pump control switch output circuit cavity of the headlamp and dash wire harness connector for the front washer pump/motor and a good ground. There should be no continuity. If OK, go to Step 5 If not OK, repair the shorted washer pump control switch output circuit between the front washer pump/motor and the right multi-function switch as required.

(5) Check for continuity between the washer pump control switch output circuit cavities of the headlamp and dash wire harness connector for the front washer pump/motor and the body wire harness connector for the right multi-function switch. There should be continuity. If OK, replace the faulty right multi-function switch. If not OK, repair the open washer pump control switch output circuit between the front washer pump/motor and the right multi-function switch as required.

CLEANING - FRONT WIPER & WASHER SYSTEM

WIPER SYSTEM

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a nonabrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the front washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet filter screen and the washer reservoir using clean washer fluid, a mild detergent, or a nonabrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the front washer nozzle, then running the front washer pump/motor to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully backflushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

INSPECTION - FRONT WIPER & WASHER SYSTEM

WIPER SYSTEM

The front wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arms for any indications of damage, or contamination. If the wiper arms are contaminated with any foreign material, clean them as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

(2) Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if

FRONT WIPERS/WASHERS (Continued)

it has comparatively lower spring tension, as evidenced by a lower scale reading.

(4) Inspect the wiper blades and squeegees for any indications of damage, contamination, or rubber deterioration (Fig. 2). If the wiper blades or squeegees are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING). After cleaning the wiper blade and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or the squeegee rubber is damaged or deteriorated, replace the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.

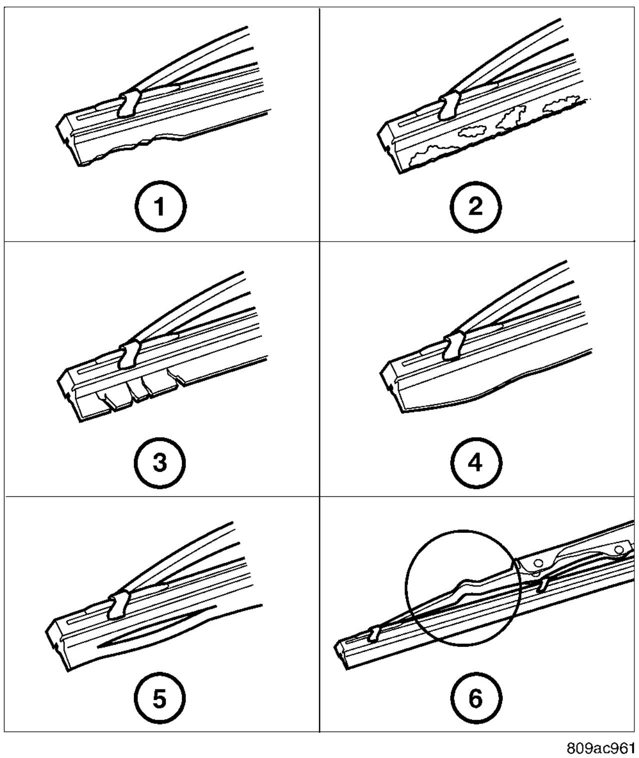


Fig. 2 Wiper Blade Inspection

1 - WORN OR UNEVEN EDGES
2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
3 - HARD, BRITTLE, OR CRACKED
4 - DEFORMED OR FATIGUED
5 - SPLIT
6 - DAMAGED SUPPORT COMPONENTS

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

FRONT CHECK VALVE

DESCRIPTION

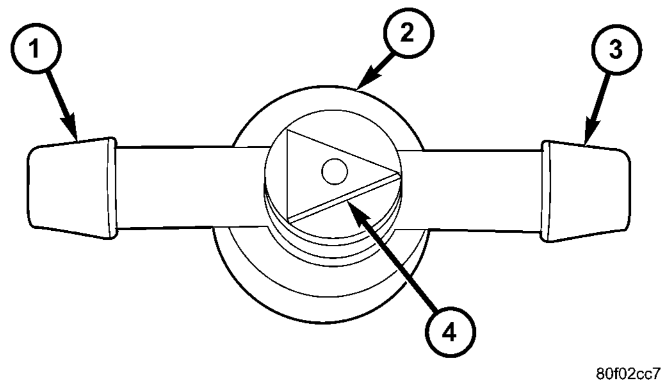


Fig. 3 Check Valve

1 - INLET NIPPLE
2 - CHECK VALVE
3 - OUTLET NIPPLE
4 - FLOW DIRECTION ARROW

A single front washer system check valve is standard equipment on this model, and is installed in the front washer system plumbing (Fig. 3). The front check valve is located in the engine compartment in the washer supply hose on the underside of the hood panel about 5 centimeters (2 inches) from the barbed nipple of the front washer nozzle. The check valve consists of a molded plastic valve body with a raised arrowhead molded into its center section that indicates the direction of the flow through the valve. A barbed hose nipple is formed on each side of the raised center section of the valve body. Within the check valve body, a small diaphragm is held against the lip of an integral sump well by a small plastic piston and a coiled spring. The front check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

FRONT CHECK VALVE (Continued)

OPERATION

The front check valve provides more than one function in this application. It prevents washer fluid from draining out of the front washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the front washer switch is actuated until washer fluid was dispensed through the front washer nozzle, because the front washer pump would have to refill the front washer plumbing from the reservoir to the nozzle. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the front check valve prevents washer fluid from siphoning out through the front washer nozzle after the front washer system is turned Off.

When the front washer pump pressurizes and pumps washer fluid from the reservoir through the front washer plumbing, the fluid pressure unseats a diaphragm from over a sump well within the valve by overriding the spring pressure applied to it by a piston (Fig. 4). With the diaphragm unseated, washer fluid is allowed to flow toward the front washer nozzle. When the front washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the front washer plumbing is prevented. The front check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Unlatch, open and support the hood.

(2) Locate the front check valve in the washer supply hose for the front washer nozzle. The check valve is installed in the washer supply hose about 5 centimeters (2 inches) from the front washer nozzle nipple near the rear hood panel reinforcement (Fig. 5).

(3) Disconnect the washer supply hose for the front washer nozzle from the barbed outlet nipple on the front washer system check valve. A small quantity of washer fluid may drain from the disconnected hose.

(4) Disconnect the washer supply hose for the reservoir from the barbed inlet nipple of the front check valve. Either install a temporary plug in the washer supply hose for the reservoir or secure the loose end of this hose at a point higher than the washer reservoir to prevent the contents of the washer reservoir from draining through this hose.

(5) Remove the front check valve from the engine compartment.

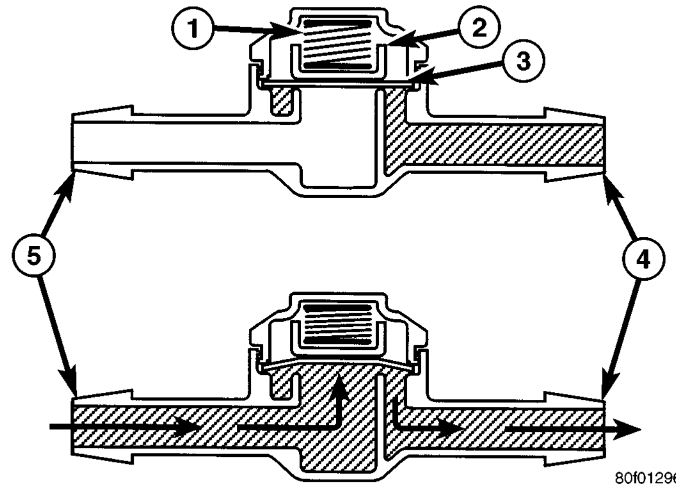


Fig. 4 Front Check Valve

1 - SPRING
2 - PISTON
3 - DIAPHRAGM
4 - TO WASHER NOZZLE
5 - FROM WASHER PUMP

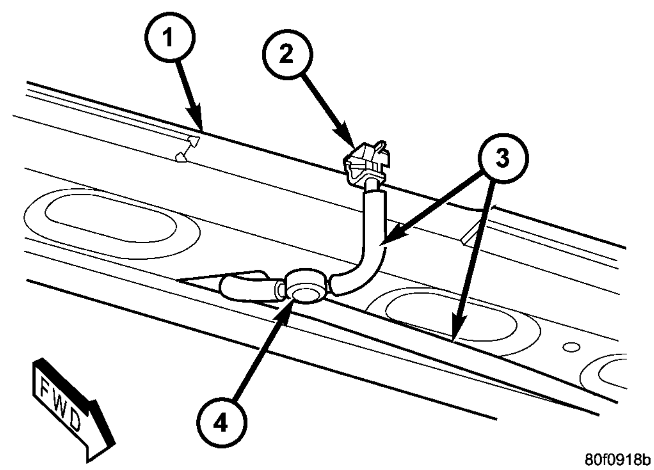


Fig. 5 Front Check Valve Remove/Install

1 - HOOD REAR REINFORCEMENT
2 - FRONT WASHER NOZZLE
3 - WASHER HOSE
4 - FRONT CHECK VALVE

FRONT CHECK VALVE (Continued)

INSTALLATION

(1) Position the front check valve in the engine compartment.

(2) With the directional arrow on the check valve pointed in the direction of the system flow, reconnect the washer supply hose from the reservoir to the barbed inlet nipple of the front check valve (Fig. 6).

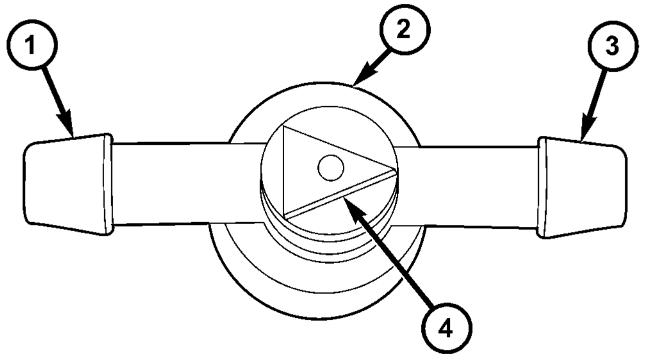


Fig. 6 Check Valve

1 - INLET NIPPLE
2 - CHECK VALVE
3 - OUTLET NIPPLE
4 - FLOW DIRECTION ARROW

(3) Reconnect the washer supply hose from the front washer nozzle to the barbed outlet nipple of the front check valve.

(4) Check that the washer supply hoses are properly routed and are not pinched.

(5) Close and latch the hood.

FRONT WASHER HOSES/ TUBES

DESCRIPTION

The front washer plumbing consists of a small diameter rubber front washer hose that is routed from the barbed outlet nipple of the electric front washer pump/motor unit on the washer reservoir around the front of the reservoir to the top of the left front fender wheel house. The hose is secured by six plastic tie wraps to the headlamp and dash wire harness and routed with the harness to the top dash panel near the center of the engine compartment (Fig. 7).

Near the center of the dash panel the front washer hose is routed to the inner rear hood panel reinforcement. Two molded plastic routing clips secure the front washer hose to the underside of the hood panel reinforcement. The front washer hose is connected to the barbed inlet nipple of the front washer check valve near the inner center hood panel reinforcement. A short piece of washer hose then connects the barbed outlet nipple of the front washer check valve to the barbed nipple of the front washer nozzle on the underside of the hood panel.

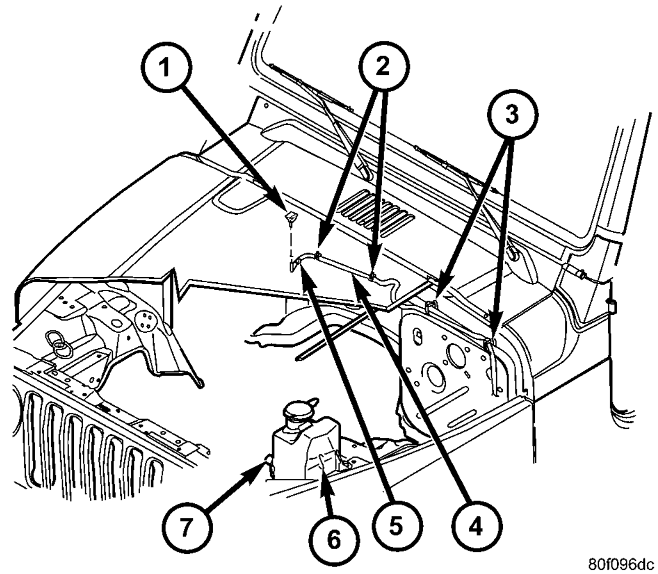


Fig. 7 Front Washer Plumbing

1 - FRONT WASHER NOZZLE
2 - CLIP (2)
3 - HARNESS CLIP (2)
4 - WASHER SUPPLY HOSE
5 - FRONT CHECK VALVE
6 - WASHER RESERVOIR
7 - FRONT WASHER PUMP/MOTOR

Washer hose is available for service only as roll stock, which must then be cut to length. Molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the front washer pump/motor through the front washer system plumbing and fittings to the front washer check valve and the front washer nozzle. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

FRONT WASHER NOZZLE

DESCRIPTION

The molded black plastic front washer nozzle has an integral latch feature that secures it in a dedicated mounting hole located at the center near the rear edge of the hood panel (Fig. 8). The washer nozzle is constructed in two pieces. The nozzle housing includes the domed hood that is visible on the outer surface of the hood panel, and the integral latch and

FRONT WASHER NOZZLE (Continued)

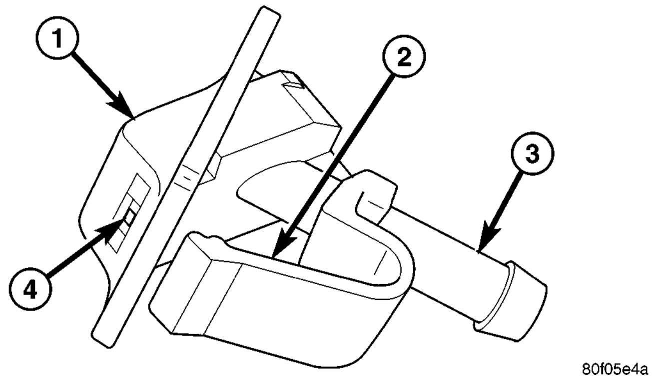


Fig. 8 Front Washer Nozzle

1 - HOOD
2 - LATCH
3 - ORIFICE (FLUIDIC INSERT)
4 - NIPPLE

barbed inlet nipple which are concealed below the hood panel.

A rectangular opening in the rearward facing surface of the nozzle hood accepts the fluidic insert of the nozzle. The fluidic insert is a one-piece unit that incorporates the various chambers, passages, deflectors and the single orifice through which the washer fluid stream is directed into the wipe pattern on the windshield glass. The nozzle is accessed for service from the underside of the hood panel. The front washer nozzle cannot be adjusted or repaired. If faulty or damaged, it must be replaced.

OPERATION

The front washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the front washer pump/motor through a single hose, which is attached to a barbed nipple on the front washer nozzle below the hood panel. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as a fan-like stream to more effectively cover a larger area of the glass to be cleaned.

REMOVAL

(1) Unlatch, open and support the hood.

(2) From the underside of the rear of the hood panel near the center, disconnect the washer supply hose from the barbed nipple of the front washer nozzle (Fig. 9).

(3) From the underside of the rear of the hood panel near the center, gently squeeze the latch feature of the front washer nozzle and push the nozzle out through the mounting hole towards the outside of the hood panel.

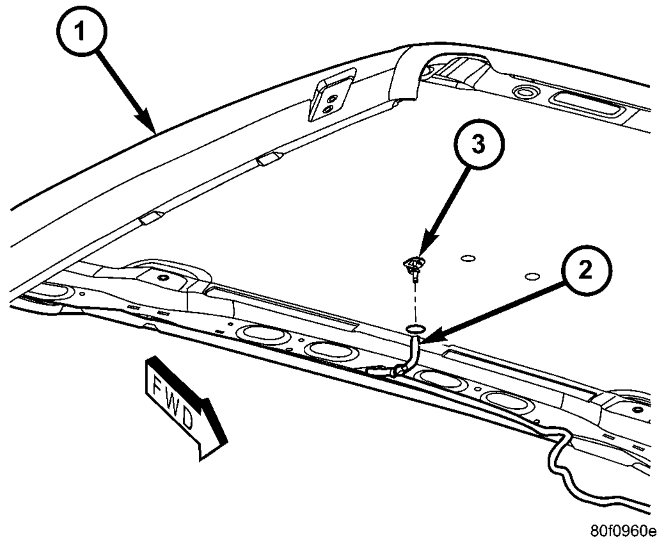


Fig. 9 Front Washer Nozzle Remove/Install

1 - HOOD PANEL
2 - WASHER SUPPLY HOSE
3 - FRONT WASHER NOZZLE

(4) Remove the front washer nozzle from the top of the hood panel.

INSTALLATION

(1) Lower the hood panel.

(2) From the top of the hood panel, position the nipple end of the front washer nozzle through the mounting hole. Be certain the nozzle orifice is oriented towards the windshield, then engage the notched forward-facing end of the nozzle housing to the forward edge of the mounting hole (Fig. 9).

(3) Using hand pressure, press firmly and evenly on the top of the front washer nozzle until the integral latch feature locks into place on the underside of the hood panel.

(4) Open and support the hood.

(5) From the underside of the rear of the hood panel near the center, reconnect the washer supply hose to the barbed nipple of the front washer nozzle.

(6) Close and latch the hood.

FRONT WASHER PUMP MOTOR

DESCRIPTION

The front washer pump/motor unit is located on the inboard side near the front and the bottom of the washer reservoir (Fig. 10). The washer reservoir is located on the top of the left front fender wheel house in the engine compartment. A small permanently lubricated and sealed electric motor is coupled to the

FRONT WASHER PUMP MOTOR (Continued)

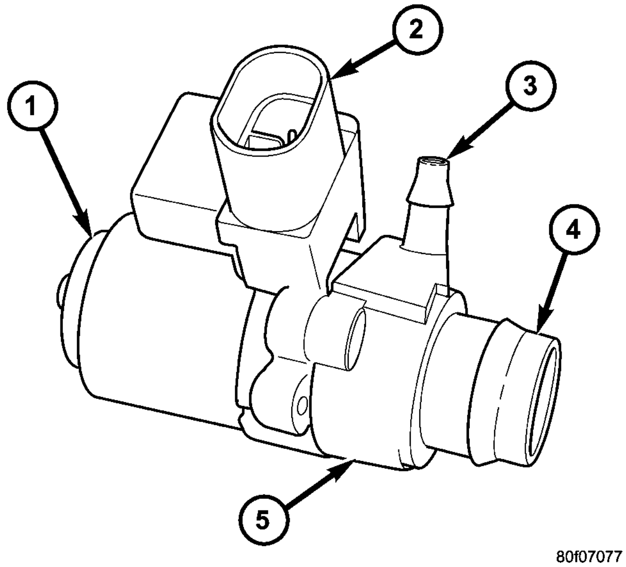


Fig. 10 Washer Pump/Motor

1 - MOTOR
2 - CONNECTOR RECEPTACLE
3 - OUTLET NIPPLE
4 - INLET NIPPLE
5 - PUMP

rotor-type washer pump. A seal flange with a barbed inlet nipple on the pump housing passes through a rubber grommet seal installed in a dedicated mounting hole in the sump area near the bottom of the washer reservoir. On vehicles with the optional rear washer system, the front washer pump/motor unit is always mounted in the forward-most, lowest pump mounting hole of the reservoir. An integral filter screen is located within the pump inlet nipple. When the pump is installed in the reservoir a barbed outlet nipple on the pump housing connects the unit to the washer system through the front washer supply hose.

The washer pump/motor unit is retained on the reservoir by the interference fit between the barbed pump inlet nipple and the grommet seal, which is a light press fit. An integral connector receptacle between the motor housing and the pump housing connects the unit to the vehicle electrical system. A small capacitor internal to the connector receptacle insulator is connected in parallel with the motor leads to control ElectroMagnetic Interference (EMI) created by washer motor operation. The front washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The front washer pump/motor unit features a small Direct Current (DC) electric motor. The motor is connected to the vehicle electrical system through a single take out and two-cavity connector of the headlamp and dash wire harness. The motor is grounded at all times through another take out of the headlamp and dash wire harness with a single eyelet terminal connector that is secured under a ground screw to the radiator closure panel behind the left headlamp in the engine compartment. The motor receives battery current through the closed contacts of the momentary front washer switch circuitry within the right multi-function switch only when the switch control stalk is pulled towards the steering wheel.

Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the motor spins the rotor within the rotor-type washer pump. The spinning pump rotor pressurizes the washer fluid and forces it through the pump outlet nipple, the front washer plumbing, and the front washer nozzle onto the windshield glass. The front washer pump/motor unit can be diagnosed using conventional diagnostic tools and methods.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the washer supply hose from the barbed outlet nipple of the front washer pump/motor and allow the washer fluid from the washer reservoir to drain into a clean container for reuse (Fig. 11).

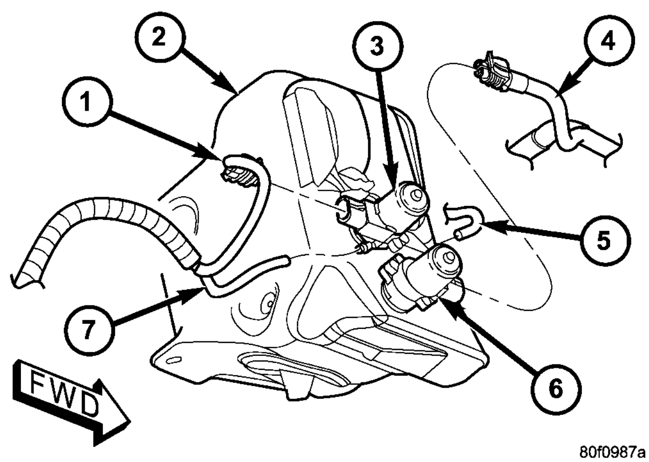


Fig. 11 Washer Pump/Motor Remove/Install

1 - REAR BODY WIRE HARNESS
2 - WASHER RESERVOIR
3 - REAR WASHER PUMP/MOTOR
4 - HEADLAMP & DASH WIRE HARNESS
5 - FRONT WASHER SUPPLY HOSE
6 - FRONT WASHER PUMP/MOTOR
7 - REAR WASHER SUPPLY HOSE

(3) Disconnect the headlamp and dash wire harness connector from the connector receptacle for the front washer pump/motor.

FRONT WASHER PUMP MOTOR (Continued)

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the front washer pump/motor out of the rubber grommet seal in the washer reservoir. Care must be taken not to damage the washer reservoir.

(5) Remove the front washer pump/motor from the washer reservoir.

(6) Remove the rubber grommet seal from the front washer pump/motor mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the front washer pump/motor mounting hole of the washer reservoir.

(2) Position the front washer pump/motor inlet nipple to the mounting hole in the washer reservoir (Fig. 11).

(3) Using hand pressure, firmly and evenly press on the front washer pump/motor to engage the inlet nipple through the rubber grommet seal and into the washer reservoir. Care must be taken not to damage the washer reservoir.

(4) Reconnect the headlamp and dash wire harness connector for the front washer pump/motor to the washer pump/motor connector receptacle.

(5) Reconnect the front washer supply hose to the barbed outlet nipple of the front washer pump/motor.

(6) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(7) Reconnect the battery negative cable.

FRONT WIPER ARM

DESCRIPTION

The front wiper arms are the rigid members located between the wiper pivots that protrude from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass. The wiper arm has a die cast metal pivot end (Fig. 12). On the underside of this pivot end is a large internally serrated socket formation with a small, movable, stamped steel latch plate that is secured loosely under a small strap that is staked to the pivot end.

The wide end of a tapered, stamped steel channel hinges on and is secured with a hinge pin to the pivot end of the wiper arm. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is hooked through a

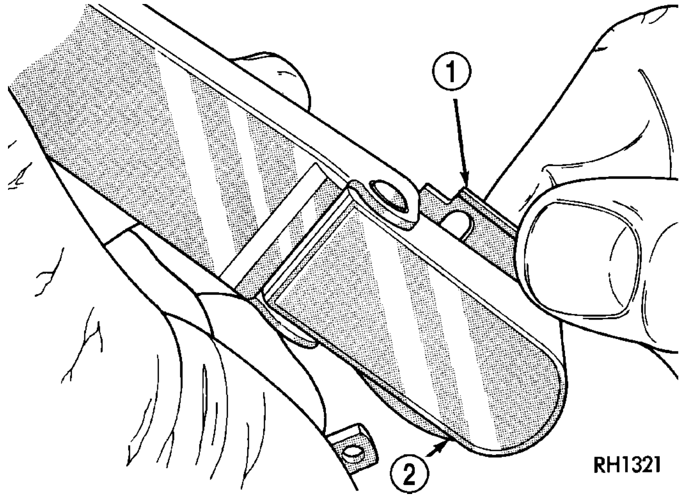


Fig. 12 Wiper Arm

1 - LATCH
2 - WIPER ARM PIVOT END

hole in a small stamped steel strap on the hinge pin within the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

The front wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The serrated socket formation in the wiper arm pivot end interlocks with the serrations on the outer circumference of the wiper pivot driver, providing positive engagement and finite adjustment of this connection. The latch plate on the underside of the wiper arm pivot end locks the wiper arm to the wiper pivot driver when in its installed position; and, when in its unlocked position, also serves as a blocker to hold the spring-loaded wiper arm off of the glass to facilitate removal and installation. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Lift the front wiper arm far enough to raise the wiper blade off of the glass and permit the wiper arm latch plate to be pulled out to its holding position, then release the arm (Fig. 13). The wiper arm and

FRONT WIPER ARM (Continued)

blade will remain off the glass with the latch in this position.

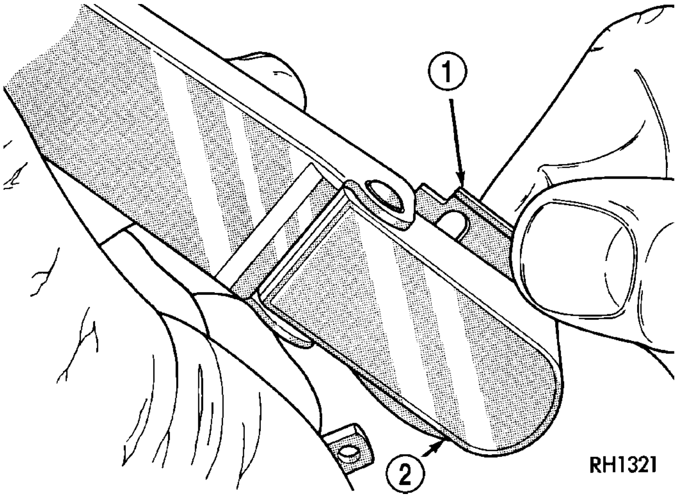


Fig. 13 Front Wiper Arm Remove/Install

1 - LATCH
2 - WIPER ARM PIVOT END

CAUTION: The use of a screwdriver or other prying tool to remove a wiper arm may distort it. This distortion could allow the arm to come off of the wiper pivot during wiper operation, regardless of how carefully it is reinstalled.

(2) Using a slight rocking motion, remove the front wiper arm pivot end from the wiper pivot driver.

INSTALLATION

NOTE: Be certain that the wiper motor is in the park position before attempting to install the wiper arms. Turn the ignition switch to the On position and move the right multi-function switch control stalk to its Off position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.

(1) The front wiper arms must be indexed to the wiper pivots with the wiper motor in the park position to be properly installed (Fig. 14). Position the front wiper arm pivot ends onto the wiper pivot drivers so that the tip of the wiper blade is on the upper edge of the lower windshield blackout area, + 15 millimeters/– 0 millimeter (+ 0.59 inch/– 0 inch).

(2) Once the wiper arm is indexed to the wiper pivot, lift the wiper arm away from the windshield slightly to relieve the spring tension on the latch plate, then push the latch into the locked position (Fig. 13). Gently lower the wiper arm until the wiper blade is in position on the windshield glass.

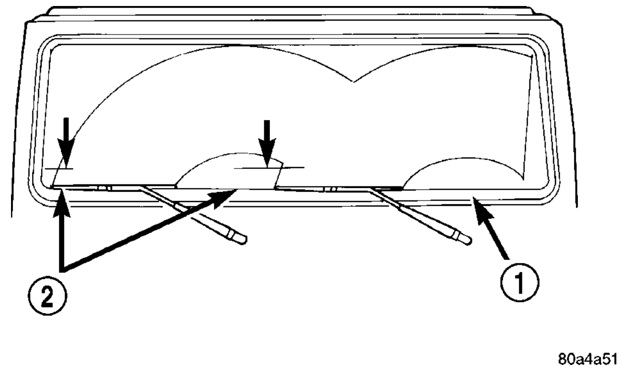


Fig. 14 Front Wiper Arm Installation

1 - WINDSHIELD BLACKOUT AREA
2 - PARK BLADE ON UPPER EDGE OF BLACKOUT AREA +15 mm – 0 mm (+0.59 in. – 0 in.)

(3) Wet the windshield glass, then operate the front wipers. Move the right multi-function switch control stalk to the Off position, then check for correct wiper arm position. Repeat the adjustment as required.

FRONT WIPER BLADE

DESCRIPTION

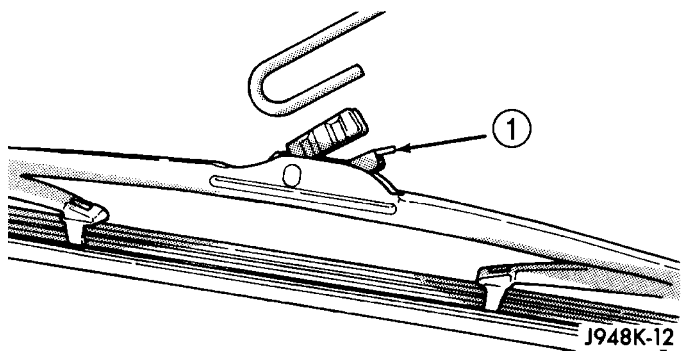


Fig. 15 Wiper Blade - Typical

1 - RELEASE TAB

Each front wiper blade is secured by an integral latching pivot block to the hook formation on the tip of each front wiper arm, and rests on the glass near the base of the windshield when the wipers are not in operation (Fig. 15). The wiper blade consists of the following components:

- **Superstructure** - The superstructure includes several stamped steel bridges and links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.

FRONT WIPER BLADE (Continued)

• **Element** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.

• **Flexor** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All models have two 33-centimeter (13-inch) long front wiper blades with non-replaceable rubber elements (squeegees). The wiper blades cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface. The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, yet resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REMOVAL

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Lift the front wiper arm to raise the wiper blade and element off of the glass.

(2) To remove the wiper blade from the wiper arm, depress the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook formation on the end of the arm (Fig. 16).

(3) Extract the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure just ahead of the wiper blade pivot block/latch unit.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

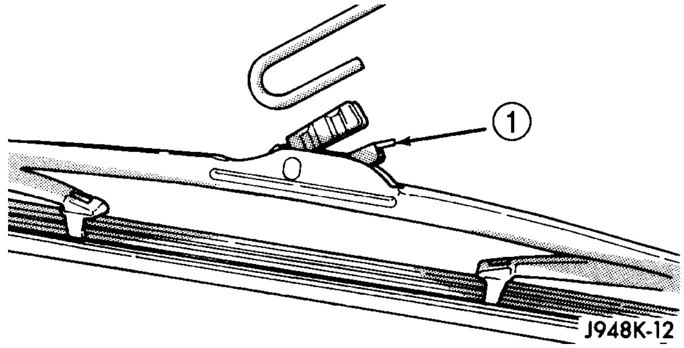


Fig. 16 Wiper Blade Remove/Install - Typical

1 - RELEASE TAB

(4) Gently lower the tip of the wiper arm onto the glass.

INSTALLATION

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Lift the front wiper arm off of the windshield glass.

(2) Position the front wiper blade near the hook formation on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the wiper pivot.

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/ latch unit far enough to engage the pivot block into the hook (Fig. 16).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position. Latch engagement will be accompanied by an audible click.

(5) Gently lower the wiper blade onto the glass.

FRONT WIPER MODULE

DESCRIPTION

The front wiper module is secured with three screws, one each at the motor bracket and the two pivot brackets through rubber insulators to the cowl top panel and concealed within the cowl plenum area beneath the cowl plenum cover/grille panel (Fig. 17). The driver ends of the wiper pivot shafts that protrude through dedicated openings in the cowl plenum cover/grille panel to drive the wiper arms and blades are the only visible components of the front wiper module. The front wiper module consists of the following major components:

FRONT WIPER MODULE (Continued)

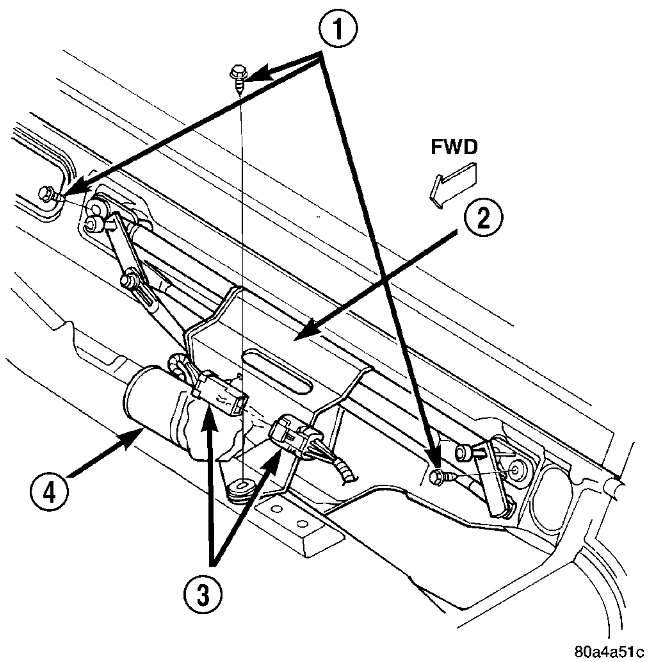


Fig. 17 Front Wiper Module

1 - SCREW (3)
2 - MODULE BRACKET
3 - WIRE HARNESS CONNECTOR
4 - WIPER MOTOR

• **Bracket** - The front wiper module bracket consists of a long tubular steel main member that has a stamped pivot bracket formation near each end where the two wiper pivots are secured. A stamped steel mounting plate for the wiper motor is secured with welds near the center of the main member. The bracket includes metal-sleeved rubber isolators at each of the three bracket mounting points.

• **Crank Arm** - The front wiper motor crank arm is a stamped steel unit with a slotted hole on the driven end that is secured to the wiper motor output shaft with a nut, and has a ball stud secured to the drive end.

• **Linkage** - The two front wiper linkage members are each constructed of stamped steel. A connecting link with a plastic socket-type bushing in each end is fit over the pivot ball studs to join the two pivots. The wiper drive link has a plastic socket-type bushing on each end. One end of the drive link is snap-fit over a second ball stud on the passenger side pivot crank arm, while the other end is snap-fit over the ball stud on the wiper motor crank arm.

• **Motor** - The front wiper motor is secured with three screws to the motor mounting plate near the center of the wiper module bracket and is protected by a rubber boot. The wiper motor output shaft passes through a hole in the module bracket, where a nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker.

• **Pivots** - The two front wiper pivots are secured to the ends of the wiper module bracket. A crank arm extends from the lower end of each pivot shaft. The driver side pivot crank arm has a single ball stud secured to it, while the passenger side crank arm has two ball studs. The upper end of each pivot shaft where the wiper arms will be fastened each has an externally serrated drum-like driver secured to it.

The front wiper module for this model is serviced only as a complete unit. If any linkage component or the mounting bracket of the module is faulty or damaged, the entire front wiper module unit must be replaced. The front wiper motor and boot are available for service replacement as a unit only.

OPERATION

The front wiper module operation is controlled by the battery current inputs received by the wiper motor through the right multi-function switch on the steering column. The wiper motor is connected to the vehicle electrical system through a dedicated take out and wire harness connector of the body wire harness. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes the wiper park switch sense circuit to ground or to battery current, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads. The wiper motor crank arm, the two wiper linkage members, and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

REMOVAL

(1) Remove the front wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - REMOVAL).

(2) Unlatch, open and support the hood.

(3) Disconnect and isolate the battery negative cable.

(4) Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL).

FRONT WIPER MODULE (Continued)

(5) Disconnect the body wire harness connector for the front wiper motor from the motor pigtail wire connector (Fig. 18).

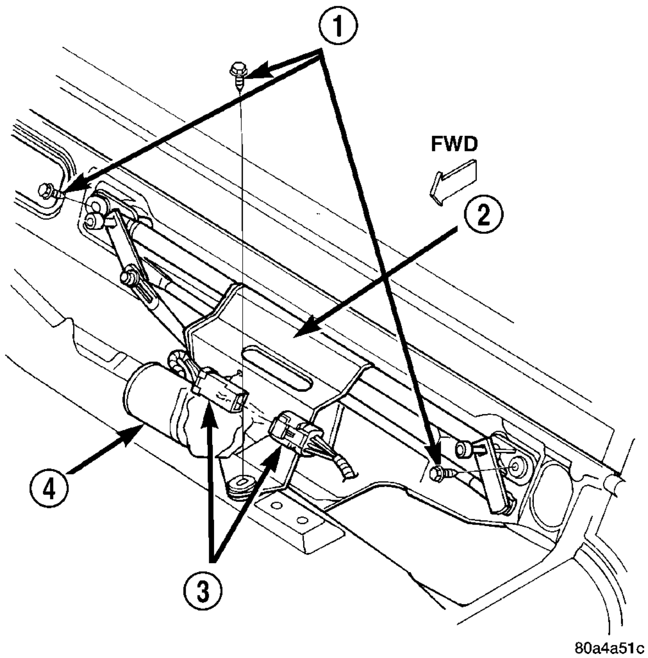


Fig. 18 Front Wiper Module Remove/Install

1 - SCREW (3)
2 - MODULE BRACKET
3 - WIRE HARNESS CONNECTOR
4 - WIPER MOTOR

(6) Remove the three screws that secure the front wiper module mounting bracket to the cowl plenum panel.

(7) Remove the front wiper module from the cowl plenum panel as a unit.

DISASSEMBLY

The front wiper motor and its rubber boot are available for service replacement. Following are the procedures for disassembling these components from the front wiper module unit.

(1) Remove the front wiper module from the cowl plenum. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER MODULE - REMOVAL).

(2) Release the retainer that secures the wiper motor pigtail wire connector to the front wiper module bracket.

(3) Turn the front wiper module over and remove the nut that secures the wiper motor crank arm to the wiper motor output shaft.

(4) Remove the three screws that secure the wiper motor to the front wiper module mounting bracket.

(5) Remove the wiper motor from the front wiper module bracket.

ASSEMBLY

The front wiper motor and its rubber boot are available for service replacement. Following are the procedures for reassembling these components onto the front wiper module unit.

(1) Position the wiper motor onto the front wiper module bracket.

(2) Install and tighten the three screws that secure the wiper motor to the front wiper module bracket. Tighten the screws to 8 N·m (70 in. lbs.).

(3) Position the wiper motor crank arm onto the front wiper motor output shaft.

(4) Install and tighten the nut that secures the wiper motor crank arm to the front wiper motor output shaft. Tighten the nut to 12 N·m (101 in. lbs.).

(5) Engage the wiper motor pigtail wire connector retainer in the locating hole on the front wiper module bracket.

(6) Reinstall the front wiper module into the cowl plenum. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER MODULE - INSTALLATION).

INSTALLATION

(1) Position the front wiper module into the cowl plenum as a unit (Fig. 18).

(2) Install and tighten the three screws that secure the front wiper module mounting bracket to the cowl plenum panel. Tighten the screws to 12 N·m (105 in. lbs.).

(3) Reconnect the body wire harness connector for the front wiper motor to the motor pigtail wire connector.

(4) Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - INSTALLATION).

(5) Reconnect the battery negative cable.

(6) Close and latch the hood.

(7) Reinstall the front wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS/FRONT WIPER ARM - INSTALLATION).

RIGHT MULTI-FUNCTION SWITCH

DESCRIPTION

The right multi-function switch is located on the right side of the steering column (Fig. 19). The only visible components of the right multi-function switch are the control stalk and control knob that extend through dedicated openings in the right side of the steering column shrouds, just below the steering wheel. The remainder of the switch, its mounting provisions, and its electrical connections are all concealed beneath the steering column shrouds. The switch housing and controls are constructed of molded black plastic. The right multi-function switch is secured by two screws to a mounting housing that is integral to the left multi-function switch.

The right multi-function switch control stalk has both white nomenclature and International Control and Display Symbols graphics applied to it, which clearly identify its many functions. On the end of the control stalk is a plastic control knob with a rounded end and a flattened face to allow it to be easily rotated. A single connector receptacle containing six terminal pins is integral to the back of the switch housing and connects the switch to the vehicle electrical system through a dedicated take out and connector of the body wire harness. The right multi-function switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

The right multi-function switch is the primary control for the front wiper and washer system, and contains switches, circuitry, an intermittent wipe logic circuit, and an internal wiper motor relay to provide the following functions and features:

- **Continuous Front Wipe Modes** - The internal circuitry and hardware of the right multi-function switch control stalk provide two continuous front wipe switch positions, low speed or high speed.
- **Front Washer Mode** - The internal circuitry and hardware of the right multi-function switch control stalk provide front washer system operation.
- **Front Wipe-After-Wash Mode** - The internal circuitry and hardware of the right multi-function switch control stalk provide a wipe-after-wash mode.
- **Front Wiper Mist Mode** - The internal circuitry and hardware of the right multi-function switch control stalk provide a front wiper system mist mode.
- **Intermittent Front Wipe Mode** - The internal circuitry and hardware of the right multi-function switch control stalk and control knob provide an intermittent front wipe mode with adjustable delay interval positions.

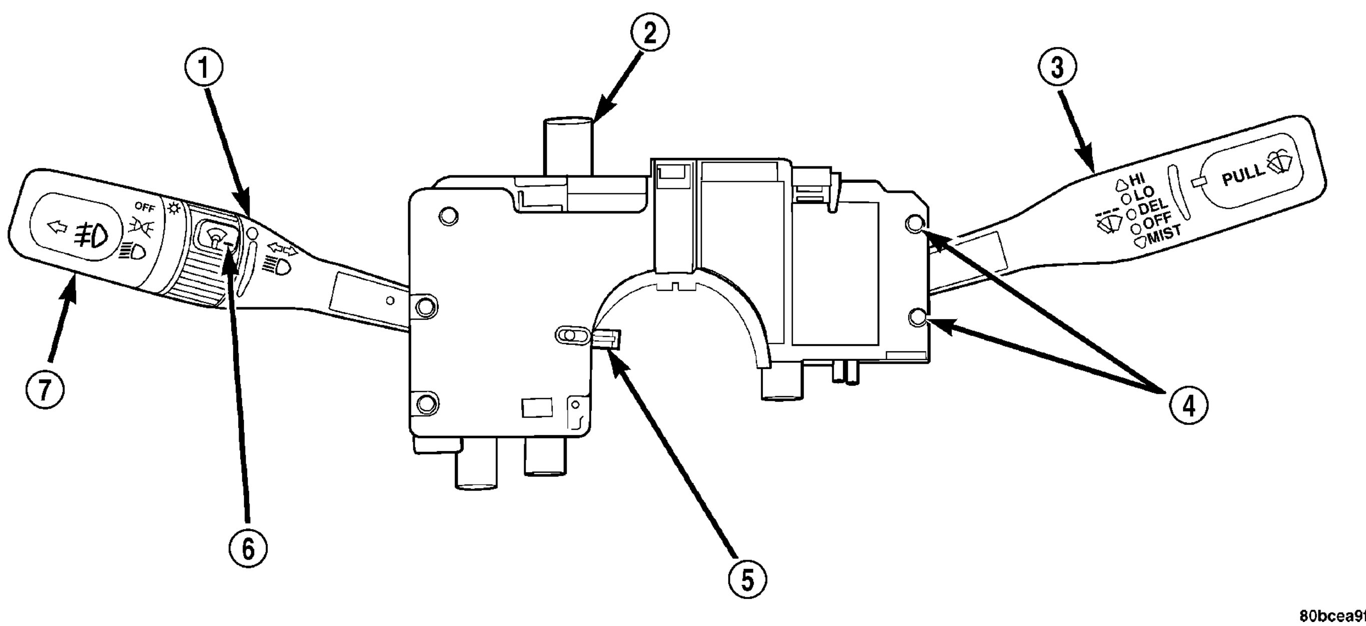


Fig. 19 Multi-Function Switch

1 - LEFT MULTI-FUNCTION SWITCH CONTROL STALK
2 - HAZARD WARNING SWITCH BUTTON
3 - RIGHT MULTI-FUNCTION SWITCH CONTROL STALK
4 - SCREW (2)
5 - TURN SIGNAL CANCEL ACTUATOR
6 - LEFT MULTI-FUNCTION SWITCH CONTROL RING
7 - LEFT MULTI-FUNCTION SWITCH CONTROL KNOB

RIGHT MULTI-FUNCTION SWITCH (Continued)

OPERATION

The right multi-function switch uses an internal logic circuit, an internal relay and conventionally switched outputs to control the many functions and features it provides. The switch receives battery current on a fused ignition switch output (run-acc) circuit from a fuse in the Power Distribution Center (PDC) and the wiper and washer system fuse in the fuse block whenever the ignition switch is in the On or Accessory positions. The electronic intermittent wipe logic circuit within the switch receives a logic ground at all times through the body wire harness from a take out with an eyelet terminal connector secured under a ground screw on the left inner cowl side panel, below the left end of the instrument panel.

Following are descriptions of how the right multi-function switch control stalk and control knob are operated to control the functions and features they provide. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the right multi-function switch.

- **Front Wash Mode** - Pulling the control stalk of the right multi-function switch towards the steering wheel actuates the momentary single pole, single throw front washer switch and operates the front washer pump/motor.
- **Front Wipe Modes** - Moving the control stalk of the right multi-function switch up or down to one of four detent positions actuates the triple pole, quadruple throw front wiper switch and selects the Off, Low, High, or Delay front wiper operating mode. Moving the control stalk downward from the Off position actuates a momentary single pole, single throw switch that selects the Mist operating mode.
- **Intermittent Front Wipe Delay Intervals** - Rotating the control knob on the end of the control stalk actuates the front wiper delay variable resistor and selects the wiper delay interval when the Delay mode is selected with the front wiper switch control stalk.

The intermittent wipe logic circuit within the right multi-function switch monitors inputs from the front wiper switch circuitry, the front washer switch circuitry, the front wiper delay variable resistor, and the front wiper motor park switch. The programming of the logic circuit then determines the proper outputs to the front wiper motor. The low current logic circuit controls the high current front wiper motor by pulling the control coil of the integral wiper motor relay to ground. The wiper motor relay switches a circuit that feeds battery current to the low speed or high speed brush of the front wiper motor through the appropriate right multi-function switch circuits.

DIAGNOSIS AND TESTING - RIGHT MULTI-FUNCTION SWITCH

Be certain to perform the diagnosis for the front wiper system and/or front washer system before testing the right multi-function switch. (Refer to 8 - ELECTRICAL/FRONT WIPERS/WASHERS - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the right multi-function switch from the steering column and disconnect the body wire harness connector for the switch from the switch connector receptacle.

(3) Using an ohmmeter, check the right multi-function switch continuity at the terminals (Fig. 20) in the switch connector receptacle as shown in the Right Multi-Function Switch Tests table.

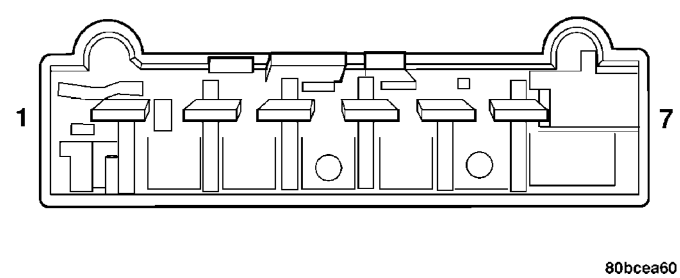


Fig. 20 Right Multi-Function Switch Connector Receptacle

RIGHT MULTI-FUNCTION SWITCH (Continued)

RIGHT MULTI-FUNCTION SWITCH TESTS	
SWITCH POSITION	CONTINUITY BETWEEN PINS
OFF	1 & 6
*LOW	4 & 6
*MIST	4 & 6
HIGH	4 & 5
WASH	3 & 4
*DELAY	1 & 6
*The intermittent wipe logic circuit within the right multi-function switch contains active electronic elements, which cannot be tested using conventional diagnostic tools. In addition, the function of the normally open contacts of the wiper relay internal to the switch cannot be tested properly unless the switch is connected to battery current (Pin 4) and ground (Pin 2). If all circuits and functions of the front wiper system and the right multi-function switch are operative except for the intermittent wipe, wipe-after-wash feature, and/or the front wipers will not park, replace the right multi-function switch with a known good unit and test system operation again.	

(4) If the right multi-function switch fails any of the continuity checks, replace the faulty switch. If the switch is OK, test and repair the front wiper and washer system circuits between the right multi-function switch and the front wiper motor or the front washer pump/motor as required.

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) From below the steering column, remove the two screws that secure the lower steering column shroud to the upper shroud (Fig. 21).

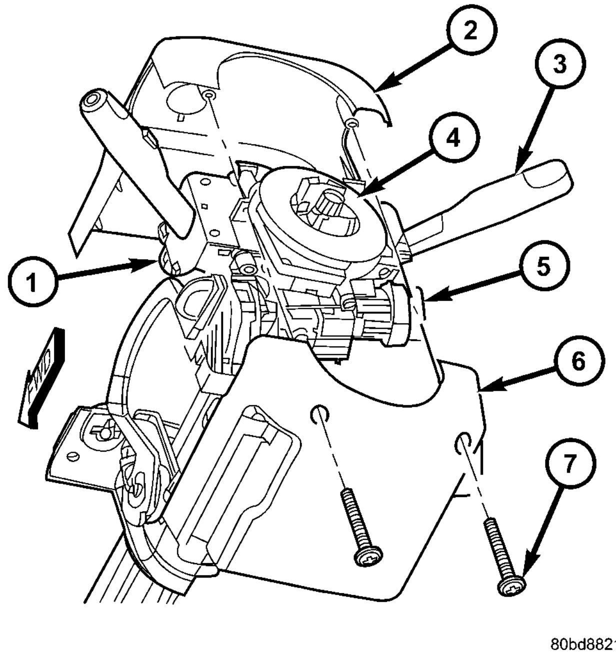


Fig. 21 Steering Column Shrouds Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - UPPER SHROUD
3 - RIGHT MULTI-FUNCTION SWITCH
4 - CLOCKSPRING
5 - IGNITION LOCK CYLINDER HOUSING
6 - LOWER SHROUD
7 - SCREW (2)

(4) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully lowered position and leave the tilt release lever in the released (down) position.

(5) Remove both the upper and lower shrouds from the steering column.

(6) Disconnect the body wire harness connector for the left multi-function switch from the connector receptacle on the back of the switch.

(7) Disconnect the body wire harness connector for the right multi-function switch from the connector receptacle on the back of the switch.

(8) Remove the two screws that secure the multi-function switch assembly to the upper steering column housing (Fig. 22).

(9) Remove the multi-function switch assembly from the upper steering column housing.

(10) Remove the two small screws that secure the right multi-function switch to the left multi-function switch mounting housing.

(11) Grasp the right multi-function switch control stalk firmly and pull the switch toward the right far enough to disengage the alignment pins on the top (1

RIGHT MULTI-FUNCTION SWITCH (Continued)

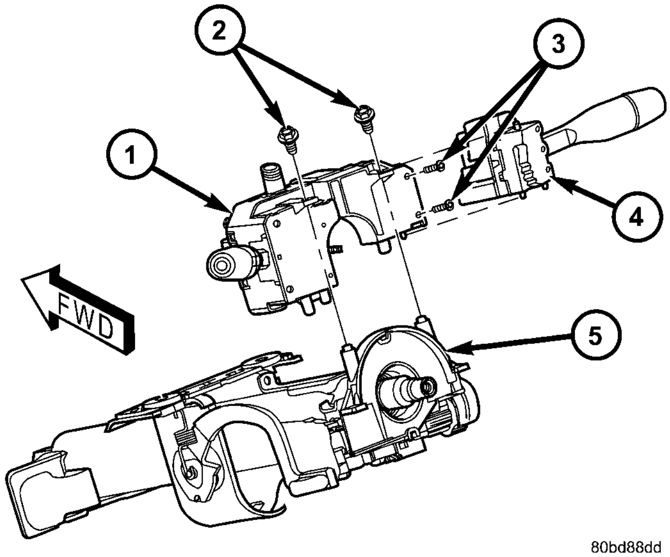


Fig. 22 Multi-Function Switch Remove/Install

1 - LEFT MULTI-FUNCTION SWITCH
2 - SCREW (2)
3 - SCREW (2)
4 - RIGHT MULTI-FUNCTION SWITCH
5 - UPPER STEERING COLUMN HOUSING

pin) and bottom (2 pins) of the right switch housing from the alignment ramps on the left switch mounting housing.

(12) Remove the right multi-function switch from the left multi-function switch mounting housing.

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Position the right multi-function switch to the mounting housing of the left multi-function switch.

(2) Grasp the right multi-function switch control stalk firmly and slide the switch to the left far enough to engage the alignment pins on the top (1 pin) and bottom (2 pins) of the right switch housing into the alignment ramps of the left multi-function switch mounting housing.

(3) Install and tighten the two small screws that secure the right multi-function switch to the left multi-function switch mounting housing (Fig. 22). Tighten the screws to 2 N·m (20 in. lbs.).

CAUTION: Before attempting to install the multi-function switch, be certain that the left switch control stalk is in the neutral turn signal position and the turn signal cancel actuator is in the retracted (neutral) position.

(4) Position the multi-function switch assembly onto the upper steering column housing.

(5) Install and tighten the two screws that secure the multi-function switch assembly to the upper steering column housing. Tighten the screws to 2 N·m (20 in. lbs.).

(6) Reconnect the body wire harness connector for the right multi-function switch to the connector receptacle on the back of the switch.

(7) Reconnect the body wire harness connector for the left multi-function switch to the connector receptacle on the back of the switch.

(8) Position both the upper and lower shrouds onto the steering column (Fig. 23). Be certain that the locating tabs for the left and right multi-function switch control stalk watershields are properly engaged in the openings of both the upper and lower shrouds.

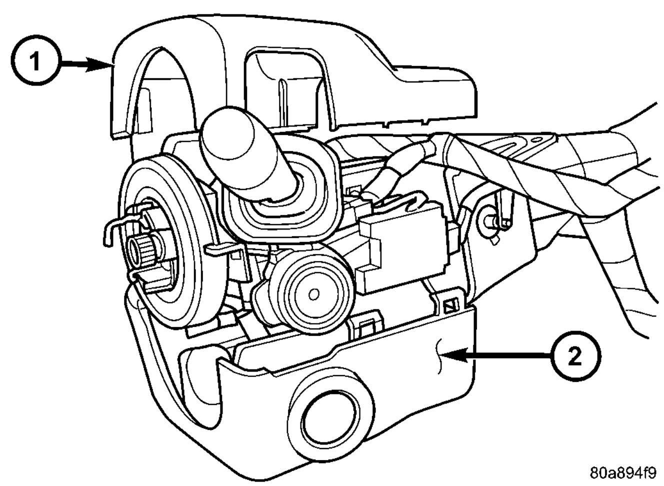


Fig. 23 Shroud Remove/Install

1 - UPPER SHROUD
2 - LOWER SHROUD

(9) From below the steering column, install and tighten the two screws that secure the lower steering column shroud to the upper shroud. Tighten the screws to 2 N·m (18 in. lbs.).

(10) If the vehicle is equipped with the optional tilt steering column, move the tilt steering column to the fully raised position and secure it in place by moving the tilt release lever back to the locked (up) position.

RIGHT MULTI-FUNCTION SWITCH (Continued)

(11) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(12) Reconnect the battery negative cable.

WASHER RESERVOIR

DESCRIPTION

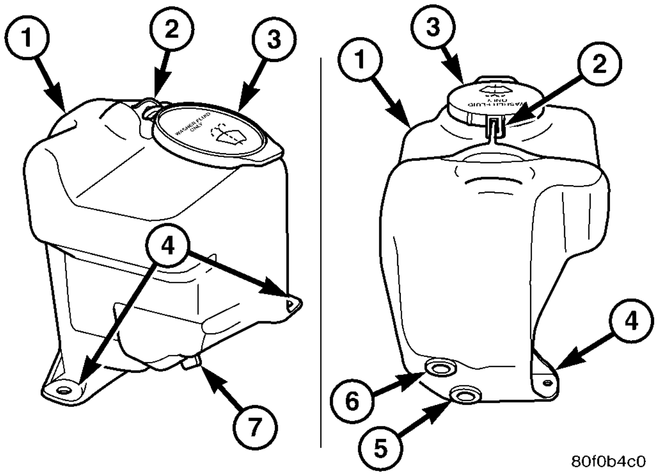


Fig. 24 Washer Reservoir

1 - WASHER RESERVOIR
2 - HOOK
3 - CAP
4 - MOUNTING TAB (2)
5 - FRONT WASHER PUMP/MOTOR HOLE
6 - REAR WASHER PUMP/MOTOR HOLE
7 - LOCATING TAB

A single washer fluid reservoir is used for both the standard front and optional rear washer systems (Fig. 24). The molded plastic washer fluid reservoir is secured to the left front fender wheel house in the engine compartment. A bright yellow plastic filler cap is labeled with the International Control and Display Symbol icon for “Windshield Washer” and the text “Washer Fluid Only” molded into it and highlighted in black. The cap hinges on a hinge molded into the cap and is secured to the reservoir by a hook molded into the top of the reservoir behind the filler neck. The cap snaps over the open end of the filler neck and is sealed with a rubber gasket.

There are separate, dedicated holes on the lower inboard side of the reservoir provided for the mounting of the front and rear washer/pump motor units. On models not equipped with the optional rear washer system, the rear washer pump/motor mounting hole in the washer reservoir is sealed with a plastic plug. The washer pump/motor units are secured and sealed to the reservoir by the interference fit between the barbed inlet nipple of each pump and a rubber grommet seal installed in each pump mounting hole. A locating tab on the bottom of the reservoir fits into a mating slot in the left front fender wheel house, and the reservoir is secured to the wheel house by two screws installed through two mounting tabs that are integral to the reservoir.

The washer reservoir cannot be repaired and, if faulty or damaged, it must be replaced. The reservoir filler cap is available for individual service replacement.

OPERATION

The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the standard front and optional rear washer systems. The washer reservoir filler cap provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The front and rear washer/pump motor units are located in a sump area on the inboard side of the reservoir to be certain that washer fluid will be available to the pumps as the fluid level in the reservoir becomes depleted. The front washer pump/motor unit is mounted in the lowest position in the sump so that the front washers will operate even after the rear washer system will no longer operate.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two screws that secure the washer reservoir to the left front fender wheel house (Fig. 25).

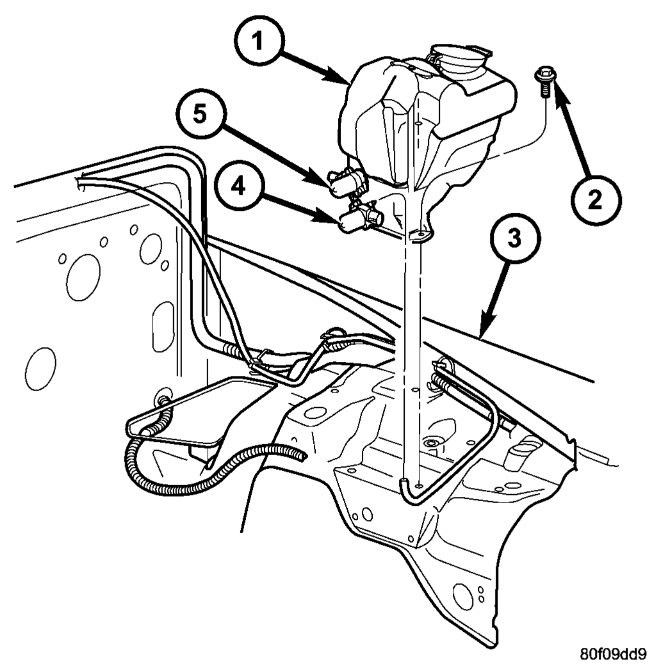


Fig. 25 Washer Reservoir Remove/Install

1 - WASHER RESERVOIR
2 - SCREW (2)
3 - LEFT FRONT FENDER
4 - FRONT WASHER PUMP/MOTOR
5 - REAR WASHER PUMP/MOTOR

WASHER RESERVOIR (Continued)

(3) Lift the reservoir far enough to access the washer pump/motor(s).

(4) Disconnect the washer supply hose(s) from the barbed outlet nipple(s) of the washer pump/motor unit(s) and allow the washer fluid from the washer reservoir to drain into a clean container for reuse.

(5) Disconnect the headlamp and dash wire harness connector for the front washer pump/motor from the connector receptacle on the motor.

(6) If the vehicle is so equipped, disconnect the rear body wire harness connector for the rear washer pump/motor from the connector receptacle on the motor.

(7) Remove the washer reservoir from the engine compartment.

INSTALLATION

(1) Position the washer reservoir into the engine compartment (Fig. 25).

(2) If the vehicle is so equipped, reconnect the rear body wire harness connector for the rear washer pump/motor to the connector receptacle on the motor.

(3) Reconnect the headlamp and dash wire harness connector for the front washer pump/motor to the connector receptacle on the motor.

(4) Reconnect the washer supply hose(s) to the barbed outlet nipple(s) of the washer pump/motor unit(s).

(5) Position the washer reservoir onto the left front fender wheel house. Be certain to insert the locating tab on the bottom of the reservoir into the locating slot in the wheel house panel.

(6) Install and tighten the two screws that secure the washer reservoir to the left front fender wheel house. Tighten the screws to 8 N·m (70 in. lbs.).

(7) Refill the washer reservoir with clean washer fluid.

(8) Reconnect the battery negative cable.

REAR WIPERS/WASHERS

TABLE OF CONTENTS

REAR WIPERS/WASHERS

DESCRIPTION

An electrically operated fixed speed rear wiper and washer system is optional factory-installed equipment on this model when it is also equipped with the optional hardtop roof (Fig. 1). The rear wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Rear Check Valve** - The rear washer system check valve is located near the belt line in the left rear corner of the passenger compartment in the vehicle. The rear check valve also serves as the in-line connector between the body wire harness half and the hardtop wire harness half of the rear washer hose plumbing.
- **Rear Washer Nozzle** - The rear washer nozzle is located in a mounting hole in the rear liftglass just below and inboard of the rear wiper motor output shaft. A plastic nut secures the threaded nipple on the back of the nozzle to the inside of the liftglass.
- **Rear Washer Plumbing** - The plumbing for the rear washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the left side of the vehicle with the body wire harness from the washer reservoir in the engine compartment, through the dash into the passenger compartment, and back to the left rear corner of the body. The rear check valve splices the body wire harness half of the washer hose to the hardtop wire harness half of the hose at the left rear corner of the body. The hardtop wire harness and washer hose are routed up the left rear corner of the hardtop and over the upper liftglass opening header to the rear washer nozzle in the upper right corner of the rear liftglass. A molded plastic washer hose cap is secured by an integral bail strap to the body wire harness half of the rear washer hose near the left rear corner of the body. This cap serves to plug the rear washer hose when the hardtop is removed from the vehicle.

REAR WIPERS/WASHERS (Continued)

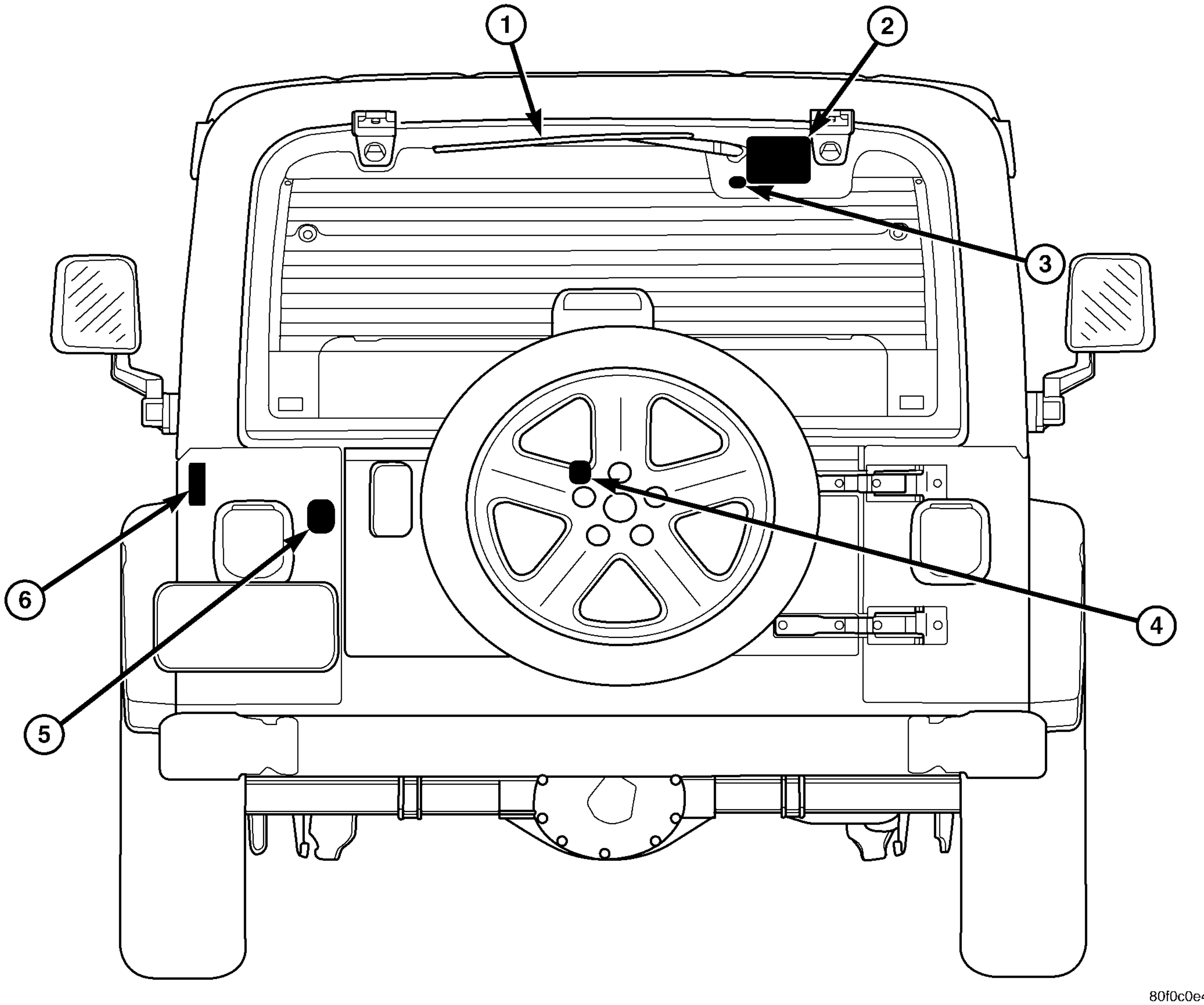


Fig. 1 Rear Wiper & Washer System

1 - WIPER ARM & BLADE
2 - WIPER MOTOR
3 - WASHER NOZZLE
4 - REAR WIPER/WASHER SWITCH
5 - REAR WASHER PUMP/MOTOR
6 - REAR WASHER HOSE CAP/CHECK VALVE

- **Rear Washer Pump/Motor** - The rear washer pump/motor unit is located in a dedicated hole on the lower inboard side of the washer reservoir, on the top of the left front fender wheel house in the engine compartment. The optional rear washer pump is located just behind and above the standard front washer pump/motor unit on the reservoir.
- **Rear Wiper and Washer Switch** - The rear wiper and washer switch is located in the accessory switch bezel near the bottom of the center stack area on the instrument panel. Only the switch rocker button is visible through the lower opening of the instrument panel center bezel, the remainder of the switch is concealed behind the accessory switch bezel within the instrument panel. The rear wiper and washer switch is dedicated to providing all of the driver controls for both the rear wiper and the rear washer systems.
- **Rear Wiper Arm** - The single rear wiper arm is secured by a nut directly to the rear wiper motor output shaft, which extends through a mounting hole in the liftglass inboard of the upper right liftglass hinge.
- **Rear Wiper Blade** - The single rear wiper blade is secured to the rear wiper arm with an integral latch, and is parked in a horizontal position near the top of the liftglass when the rear wiper system is not in operation.

REAR WIPERS/WASHERS (Continued)

- **Rear Wiper Motor** - The rear wiper motor output shaft is the only visible component of the rear wiper motor. The remainder of the motor is concealed behind a plastic trim cover on the inside of the liftglass near the upper right liftglass hinge. The rear wiper motor includes the motor bracket, the rear wiper motor, an internal automatic resetting circuit breaker, a diode, and the rear wiper motor park switch.
- **Washer Reservoir** - The rear washer system shares a single reservoir with the front washer system, but has its own dedicated washer pump/motor unit and unique plumbing provisions. The reservoir is secured to the top of the left front fender wheel house within the engine compartment of the vehicle.

Hard wired circuitry connects the rear wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the rear wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATING MODES

The components of the rear wiper and washer system are designed to work in concert to provide the following operating modes:

- **Continuous Wipe Mode** - When the rear wiper and washer switch rocker is moved to the Wipe position, the rear wiper will be operated in a continuous manner at a fixed wipe cycle speed until the switch is moved to the Off position. When the Off position is selected, the rear wiper motor will continue to operate until the current wipe cycle is complete, then park the wiper blade in a horizontal position near the top of the liftglass.
- **Washer Mode** - The rear wiper and washer switch rocker must first be moved to the Wipe detent in order to access the momentary Wash position and operate the rear washer system. When the Wash position is selected, the rear washer system will dispense washer fluid onto the liftglass and the rear wiper motor will operate in a continuous mode for as long as the switch is held closed. The rear wiper and washer switch rocker must be manually moved back to the Off position following rear washer operation in order to turn the rear wiper system off.

OPERATION

The rear wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the rear liftglass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blade to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris that might be encountered while driving the vehicle under numerous types of inclement operating conditions from the outside of the liftglass surface.

The vehicle operator initiates all rear wiper and washer system functions with the rear wiper and washer switch located in the accessory switch bezel, just below the heater and air conditioner controls in the center stack area of the instrument panel. Moving the switch rocker downward to a detent position selects the rear wiper system fixed cycle operating mode. Moving the switch rocker downward past the wipe mode detent actuates the momentary rear washer system switch.

The rear wiper and washer system will only operate when the ignition switch is in the On position. When the ignition switch is in the On position, battery current is directed from a fuse in the Power Distribution Center (PDC) to the rear wiper and washer system fuse in the fuse block. This fuse provides battery current through a fused ignition switch output (run) circuit to the rear wiper and washer switch, and to one fixed contact of the rear wiper motor park switch.

The hard wired circuits and components of the rear wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the rear wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the Wipe position of the rear wiper and washer switch rocker is selected, the Wipe mode circuitry within the switch directs battery current

REAR WIPERS/WASHERS (Continued)

through the rear wiper motor control circuit to the rear wiper motor, which causes the rear wiper to cycle continuously at a fixed speed.

When the Off position of the rear wiper and washer switch is selected, one of two events is possible. The event that will occur depends upon the position of the wiper blade on the liftglass at the moment that the Off position is selected. If the wiper blade is in the up position on the glass when the Off position is selected, the park switch in the rear wiper motor is closed to ground through the rear wiper motor control circuit input and the wiper motor ceases to operate. If the wiper blade is not in the up position on the glass when the Off position is selected, the park switch is closed to battery current through the fused ignition switch output (run) circuit. The park switch directs this battery current to the rear wiper motor brush causing the motor to continue running until the wiper blade is in the up position on the glass, at which time the park switch opens the battery current feed to the rear wiper motor brush and is again closed to ground through the rear wiper motor control circuit input and the wiper motor ceases to operate.

WASH MODE

When the momentary Wash position of the rear wiper and washer switch rocker is selected, the Wash position circuitry within the switch directs battery current to the rear washer pump and to the rear washer motor control circuit input of the rear wiper motor, which causes both the rear washer pump and the rear wiper motor to operate for as long as the rear wiper and washer switch rocker is held in the momentary Wash position.

DIAGNOSIS AND TESTING - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The diagnosis found here addresses an electrically inoperative rear wiper system. If the rear wiper motor operates, but the wiper does not move on the liftglass, inspect the mechanical connection between the rear wiper arm and the rear wiper motor output shaft. If OK, replace the faulty rear wiper motor. If the wiper operates, but chatters, lifts, or does not clear the glass, clean and inspect the rear wiper system components as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - INSPECTION) and (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Check the rear wiper and washer fuse (Fuse 6 - 20 ampere) in the fuse block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at rear wiper and washer fuse (Fuse 6 - 20 ampere) in the fuse block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run) circuit between the fuse block and the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the rear wiper and washer switch from the switch connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the instrument panel wire harness connector for the rear wiper and washer switch. If OK, go to Step 4. If not OK, repair the open fused ignition switch output (run) circuit between the rear wiper and washer switch and the fuse block as required.

(4) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the rear wiper and washer switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground (G200) as required.

(5) Test the rear wiper and washer switch continuity. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER/WASHER SWITCH - DIAGNOSIS AND TESTING). If OK, go to Step 6. If not OK, replace the faulty rear wiper and washer switch.

REAR WIPERS/WASHERS (Continued)

(6) Disconnect the hardtop wire harness connector for the rear wiper motor from the motor pigtail wire connector. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the hardtop wire harness connector for the rear wiper motor. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run) circuit between the rear wiper motor and the fuse block as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the hardtop wire harness connector for the rear wiper motor and a good ground. There should be continuity. If OK, go to Step 8. If not OK, repair the open ground circuit to ground (G302) as required.

(8) Check for continuity between the rear wiper motor control circuit cavity of the hardtop wire harness connector for the rear wiper motor and a good ground. There should be no continuity. If OK, go to Step 9. If not OK, repair the shorted rear wiper motor control circuit between the rear wiper motor and the rear wiper and washer switch as required.

(9) Check for continuity between the rear wiper motor control circuit cavities of the hardtop wire harness connector for the rear wiper motor and the instrument panel wire harness connector for the rear wiper and washer switch. There should be continuity. If OK, replace the faulty rear wiper motor. If not OK, repair the open rear wiper motor control circuit between the rear wiper motor and the rear wiper and washer switch as required.

WASHER SYSTEM

The diagnosis found here addresses an electrically inoperative rear washer system. If the rear washer pump/motor operates, but no washer fluid is emitted from the rear washer nozzle, be certain to check the fluid level in the reservoir. Also inspect the rear washer system components as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - INSPECTION). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Turn the ignition switch to the On position. Place the rear wiper and washer switch rocker in the Wipe position. Check whether the rear wiper is operating. If OK, go to Step 2. If not OK, repair the wiper system as required before you proceed with washer system diagnosis. Refer to WIPER SYSTEM.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the body wire harness connector for the rear washer pump/motor from the pump/motor connector receptacle. Check for continuity between the ground circuit cavity of the body wire harness connector for the rear washer pump/motor and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground (G302) as required.

(3) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the rear washer motor control circuit cavity of the body wire harness connector for the rear washer pump/motor while the rear wiper and washer switch rocker is actuated to the Wash position. If OK, replace the faulty rear washer pump/motor unit. If not OK, go to Step 4.

(4) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector for the rear wiper and washer switch from the switch connector receptacle. Check for continuity between the rear washer motor control circuit cavities of the body wire harness connector for the rear washer pump/motor and the instrument panel wire harness connector for the rear wiper and washer switch. There should be continuity. If OK, go to Step 5. If not OK, repair the open rear washer motor control circuit between the rear wiper and washer switch and the rear washer pump/motor as required.

(5) Test the rear wiper and washer switch continuity. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER/WASHER SWITCH - DIAGNOSIS AND TESTING). If not OK, replace the faulty rear wiper and washer switch.

CLEANING - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The squeegee of a wiper blade exposed to the elements for a long time tends to lose its wiping effectiveness. Periodic cleaning of the squeegee is

REAR WIPERS/WASHERS (Continued)

suggested to remove any deposits of salt or road film. The wiper blade, arm, and liftglass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blade continues to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegee of the wiper blade from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegee.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the front washer pump/motor from the reservoir. Clean foreign material from the inside of both washer pump/motor inlet filter screens and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the rear washer supply hose from the rear washer nozzle, then running the rear washer pump/motor to run clean washer fluid or water through the system. A plugged or restricted washer nozzle should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegee of the wiper blade.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

INSPECTION - REAR WIPER & WASHER SYSTEM

WIPER SYSTEM

The rear wiper blade and wiper arm should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arm for any indications of damage, or contamination. If the wiper arm is contaminated with any foreign material, clean as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

(2) Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. The spring tension of the wiper arm should be sufficient to cause the rubber squeegee to conform to the curvature of the glass. Replace a wiper arm if it has low or no spring tension.

(4) Inspect the wiper blade and squeegee for any indications of damage, contamination, or rubber deterioration (Fig. 2). If the wiper blade or squeegee is contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING). If after cleaning the wiper blade and the glass, the wiper blade fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or if the squeegee rubber is damaged or deteriorated, replace the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connec-

REAR WIPERS/WASHERS (Continued)

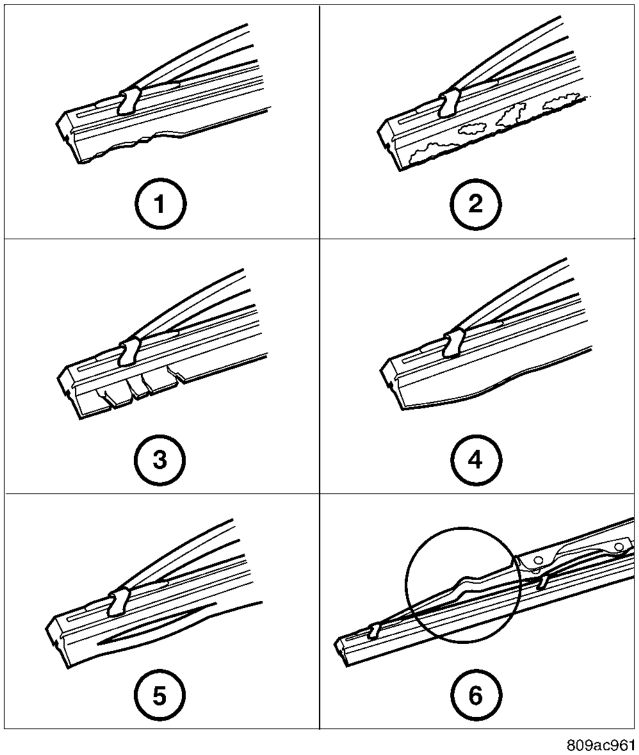


Fig. 2 Wiper Blade Inspection

1 - WORN OR UNEVEN EDGES
2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
3 - HARD, BRITTLE, OR CRACKED
4 - DEFORMED OR FATIGUED
5 - SPLIT
6 - DAMAGED SUPPORT COMPONENTS

tor fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

REAR CHECK VALVE

DESCRIPTION

Models equipped with the optional rear wiper and washer system have a rear check valve (Fig. 3). The rear check valve is located in the rear washer plumbing connection between the rear washer supply hose in the body wire harness and the rear washer supply hose in the hardtop wire harness, near the belt line in the left rear corner of the vehicle. The check valve consists of a molded plastic valve body with a raised center section that is tapered in the direction of the flow through the valve. A barbed hose nipple is formed on each side of the raised center section of the valve body. Within the check valve body, a small check ball is held against an integral valve seat by a small coiled spring. The rear check valve cannot be

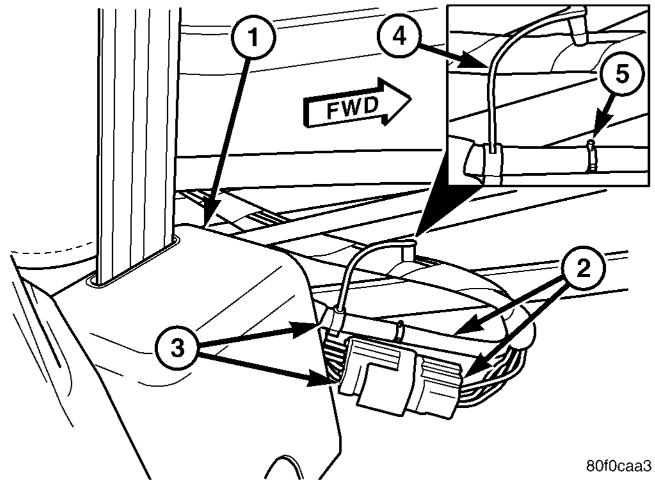


Fig. 3 Rear Check Valve

1 - LEFT REAR SEAT BELT RETRACTOR TRIM COVER
2 - HARDTOP WIRE HARNESS
3 - BODY WIRE HARNESS
4 - REAR WASHER HOSE CAP
5 - REAR CHECK VALVE

adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The rear check valve provides more than one function in this application. It serves as an in-line connector fitting between the body and hardtop sections of the rear washer supply hose. It prevents washer fluid from draining out of the rear washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the rear washer switch is actuated until washer fluid was dispensed through the rear washer nozzle, because the rear washer pump would have to refill the rear washer plumbing from the reservoir to the nozzle. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the rear check valve prevents washer fluid from siphoning out through the rear washer nozzle after the rear washer system is turned Off.

When the rear washer pump pressurizes and pumps washer fluid from the reservoir through the rear washer plumbing, the fluid pressure unseats a check ball from a seat within the valve by overriding the pressure applied to the ball within the valve by a small coiled spring (Fig. 4). With the check ball unseated, washer fluid is allowed to flow toward the rear washer nozzle. When the washer pump stops operating, the spring pressure on the check ball seats

REAR CHECK VALVE (Continued)

the ball in the valve and fluid flow in either direction within the rear washer plumbing is prevented. The rear check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

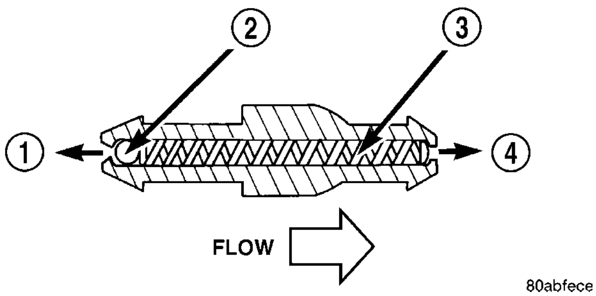


Fig. 4 Rear Check Valve

1 - TO RESERVOIR
2 - CHECK BALL
3 - SPRING
4 - TO REAR NOZZLE

REMOVAL

(1) Disconnect the hardtop wire harness half of the washer supply hose from the barbed nipple of the rear check valve (Fig. 5).

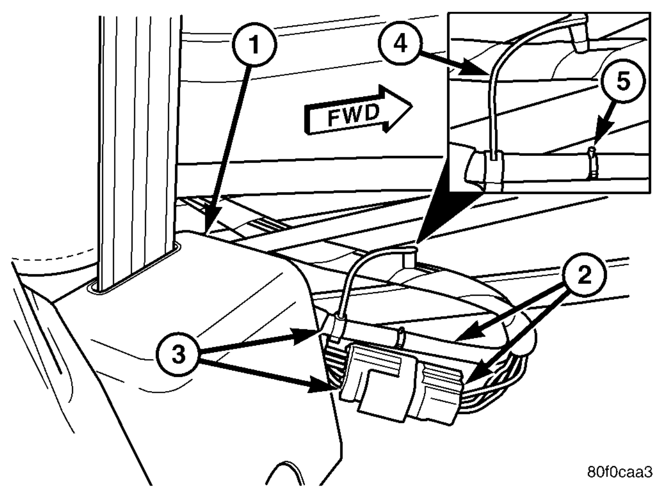


Fig. 5 Rear Check Valve Remove/Install

1 - LEFT REAR SEAT BELT RETRACTOR TRIM COVER
2 - HARDTOP WIRE HARNESS
3 - BODY WIRE HARNESS
4 - REAR WASHER HOSE CAP
5 - REAR CHECK VALVE

(2) Disconnect the body wire harness half of the washer supply hose from the other barbed nipple of the rear check valve.

(3) Remove the rear check valve from the left rear corner of the vehicle near the belt line.

INSTALLATION

(1) Position the rear check valve into the left rear corner of the vehicle near the belt line.

(2) With the tapered end of the check valve pointed in the direction of the system flow (Fig. 6), reconnect the body wire harness half of the washer supply hose to the barbed nipple of the rear check valve.

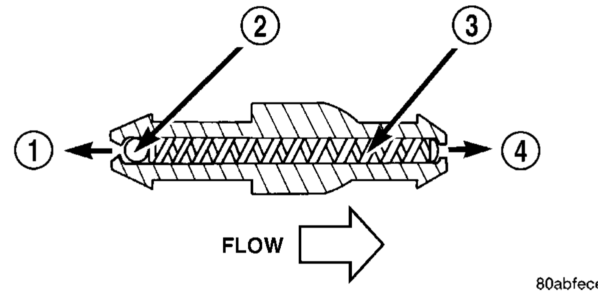


Fig. 6 Rear Washer System Check Valve

1 - TO RESERVOIR
2 - CHECK BALL
3 - SPRING
4 - TO REAR NOZZLE

(3) Reconnect the hardtop wire harness half of the washer supply hose to the other barbed nipple of the rear check valve.

REAR WASHER HOSES/TUBES

DESCRIPTION

The rear washer plumbing consists of small diameter rubber hose that is integral to and routed with the body wire harness from the barbed outlet nipple of the rear washer pump/motor on the washer reservoir through the dash panel to the left cowl side inner panel under the instrument panel. The washer hose and wire harness pass from the engine compartment into the passenger compartment through a rubber grommet in a dedicated hole near the left side of the lower dash panel.

The body wire harness and washer hose are routed from the left cowl side inner panel, along the left door opening sill, then up the B-pillar and along the upper inner edge of the left rear fender panel to the left rear corner of the passenger compartment. At the left rear corner of the passenger compartment the hose connects to the rear check valve, which also serves as an in-line connector between the body and hardtop halves of the rear washer supply hose.

There is also a washer hose cap attached by an integral clip and bail strap to the body half of the washer supply hose just below the rear check valve (Fig. 7). When the hardtop is removed from the vehicle the body half of the washer hose must be disconnected from the rear check valve. The washer hose cap is used to plug the body half of the washer hose after it is disconnected from the check valve.

REAR WASHER HOSES/TUBES (Continued)

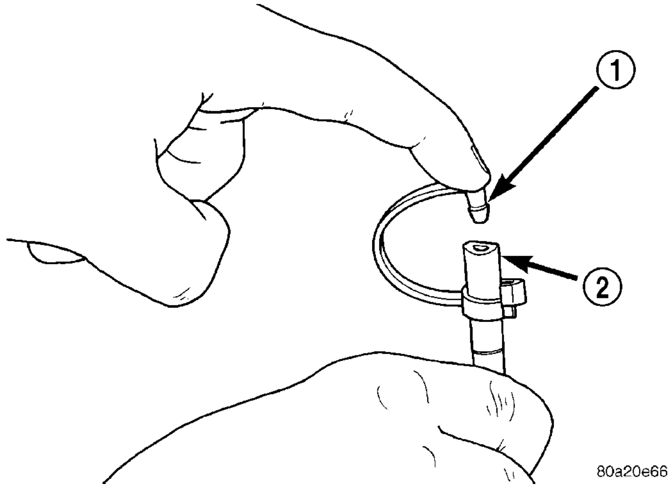


Fig. 7 Rear Washer Hose Cap

1 - WASHER HOSE CAP
2 - REAR WASHER SUPPLY HOSE - BODY HALF

The hardtop half of the rear washer supply hose is routed with the hardtop wire harness through the left rear pillar and across the upper liftglass opening reinforcement to the rear washer nozzle located near the right liftglass hinge. The hardtop washer hose is connected directly to the barbed nipple of the rear washer nozzle on the inside of the liftglass.

Washer hose is available for service only as roll stock, which must then be cut to length. For service replacement of the hose that is integral to the hardtop or body wire harnesses, it is suggested that a suitable length of washer hose be carefully routed along and secured to the outside of the harness. The molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the rear washer pump/motor through the rear washer system plumbing and fittings to the rear washer nozzle located near the rear wiper motor output shaft on the outside of the hardtop liftglass. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

REAR WASHER NOZZLE

DESCRIPTION

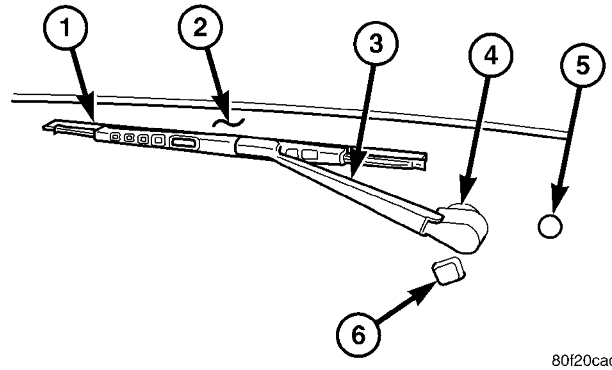


Fig. 8 Rear Washer Nozzle

1 - REAR WIPER BLADE
2 - LIFTGLASS
3 - REAR WIPER ARM
4 - REAR WIPER MOTOR OUTPUT SHAFT
5 - MOUNTING STUD
6 - REAR WASHER NOZZLE

The rear washer nozzle is a fluidic-type unit constructed of molded plastic. The molded hood of the washer nozzle is visible on the outside of the liftglass just below and inboard of the rear wiper motor output shaft (Fig. 8). The remainder of the rear washer nozzle and its plumbing connection are concealed behind the rear wiper motor trim cover secured to the rear wiper motor bracket on the inside of the liftglass. On the back of the nozzle is an externally threaded and barbed nipple that is inserted through a rubber gasket and a mounting hole from the outside of the liftglass, and is secured to the inside of the liftglass with a plastic nut. The rear washer nozzle cannot be adjusted or repaired. If faulty or damaged, the entire nozzle unit must be replaced.

OPERATION

The rear washer nozzle is designed to dispense washer fluid into the wiper pattern area on the outside of the liftglass. Pressurized washer fluid is fed to the nozzle from the washer reservoir by the rear washer pump/motor through a single hose, which is attached to a barbed nipple on the back of the rear washer nozzle behind the rear wiper motor trim cover on the inside of the liftglass. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as a fan-like stream to more effectively cover a larger area of the glass to be cleaned.

REAR WASHER NOZZLE (Continued)

REMOVAL

(1) Remove the trim cover from the rear wiper motor on the inside of the liftglass. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - REMOVAL).

(2) From the inside of the liftglass, disconnect the rear washer supply hose from the barbed nipple on the back of the rear washer nozzle (Fig. 9).

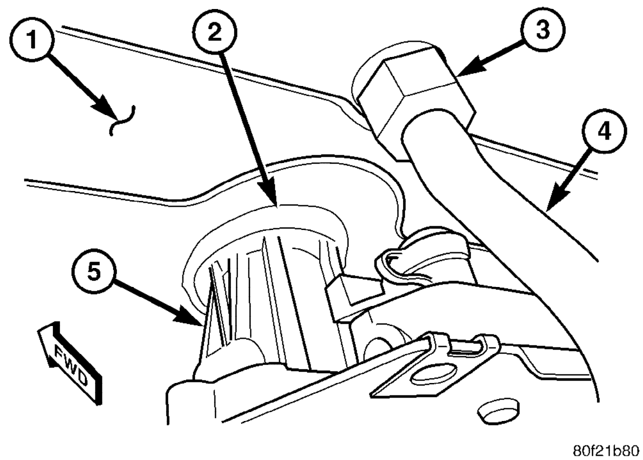


Fig. 9 Rear Washer Nozzle Remove/Install

1 - LIFTGLASS (INSIDE)
2 - GROMMET
3 - PLASTIC NUT
4 - REAR WASHER SUPPLY HOSE
5 - REAR WIPER MOTOR

(3) While holding the hood of the rear washer nozzle securely from the outside of the liftglass, remove the plastic nut that secures the threaded nipple of the rear washer nozzle to the inside of the liftglass.

(4) From the inside of the liftglass, push the nipple of the rear washer nozzle out through the mounting hole in the liftglass.

(5) Remove the rear washer nozzle and rubber gasket from the outside of the liftglass.

INSTALLATION

(1) Position the rear washer nozzle and rubber gasket to the outside of the liftglass with the orifice of the nozzle aimed at the nozzle alignment arrowhead visible on the outside of the glass.

(2) From the inside of the liftglass, install and tighten the plastic nut that secures the threaded nipple on the back of the rear washer nozzle to the inside of the liftglass (Fig. 9). Tighten the nut to 1 N·m (8 in. lbs.).

(3) Reconnect the rear washer supply hose to the barbed nipple of the rear washer nozzle.

(4) Reinstall the trim cover onto the rear wiper motor on the inside of the liftglass. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - INSTALLATION).

REAR WASHER PUMP MOTOR

DESCRIPTION

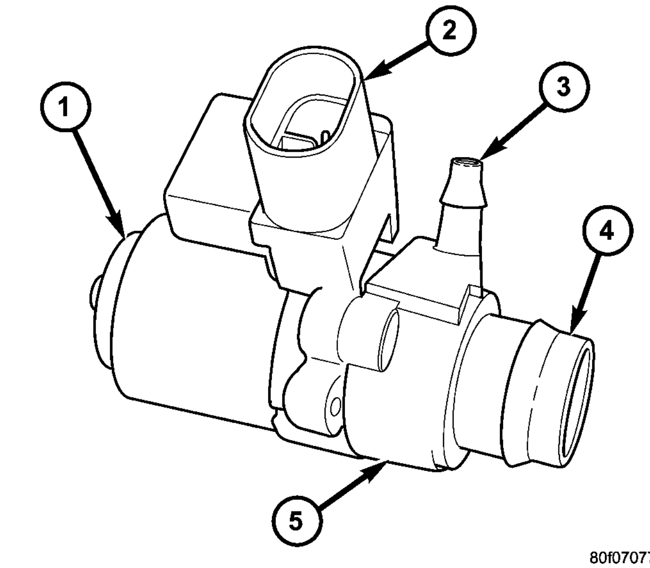


Fig. 10 Washer Pump/Motor

1 - MOTOR
2 - CONNECTOR RECEPTACLE
3 - OUTLET NIPPLE
4 - INLET NIPPLE
5 - PUMP

The rear washer pump/motor unit is located on the inboard side just behind and above the front washer pump/motor on the washer reservoir (Fig. 10). The washer reservoir is located on the top of the left front fender wheel house in the engine compartment. A small permanently lubricated and sealed electric motor is coupled to the rotor-type washer pump. A seal flange with a barbed inlet nipple on the pump housing passes through a rubber grommet seal installed in a dedicated mounting hole in the sump area near the bottom of the washer reservoir. The rear washer pump/motor unit is always mounted in the rearward-most upper mounting hole of the reservoir. An integral filter screen is located within the pump inlet nipple. When the pump is installed in the reservoir a barbed outlet nipple on the pump housing connects the unit to the washer system through the front washer supply hose.

The washer pump/motor unit is retained on the reservoir by the interference fit between the barbed pump inlet nipple and the grommet seal, which is a light press fit. An integral connector receptacle between the motor housing and the pump housing connects the unit to the vehicle electrical system. A small capacitor internal to the connector receptacle insulator is connected in parallel with the motor leads to control ElectroMagnetic Interference (EMI)

REAR WASHER PUMP MOTOR (Continued)

created by washer motor operation. The rear washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The rear washer pump/motor unit features a small Direct Current (DC) electric motor. The motor is connected to the vehicle electrical system through a single take out and two-cavity connector of the body wire harness. The motor is grounded at all times through a take out of the body wire harness with a single eyelet terminal connector that is secured under a ground screw to the left cowl side inner panel below the instrument panel in the passenger compartment. The motor receives battery current through the closed contacts of the momentary rear washer switch circuitry within the rear wiper and washer switch unit only when the bottom of the switch rocker is pushed towards the instrument panel.

Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the motor spins the rotor within the rotor-type washer pump. The spinning pump rotor pressurizes the washer fluid and forces it through the pump outlet nipple, the rear washer plumbing, and the rear washer nozzle onto the liftglass. The rear washer pump/motor unit can be diagnosed using conventional diagnostic tools and methods.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the washer supply hose from the barbed outlet nipple of the rear washer pump/motor and allow the washer fluid from the washer reservoir to drain into a clean container for reuse (Fig. 11).

(3) Disconnect the body wire harness connector from the connector receptacle for the rear washer pump/motor.

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the rear washer pump/motor unit out of the rubber grommet seal in the washer reservoir. Care must be taken not to damage the washer reservoir.

(5) Remove the rear washer pump/motor unit from the washer reservoir.

(6) Remove the rubber grommet seal from the rear washer pump/motor mounting hole in the washer reservoir and discard.

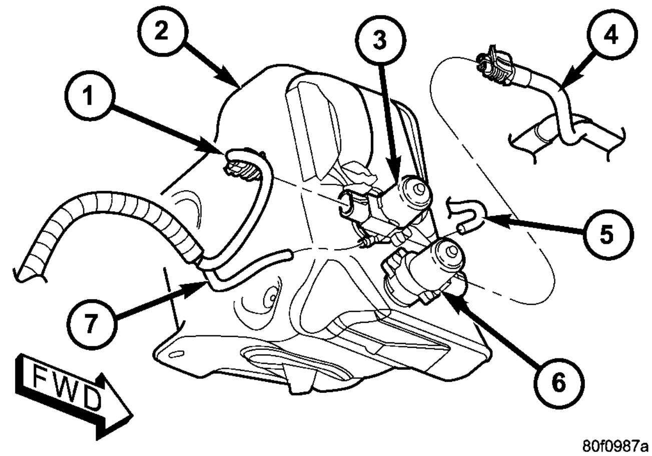


Fig. 11 Washer Pump/Motor Remove/Install

1 - REAR BODY WIRE HARNESS
2 - WASHER RESERVOIR
3 - REAR WASHER PUMP/MOTOR
4 - HEADLAMP & DASH WIRE HARNESS
5 - FRONT WASHER SUPPLY HOSE
6 - FRONT WASHER PUMP/MOTOR
7 - REAR WASHER SUPPLY HOSE

INSTALLATION

(1) Install a new rubber grommet seal into the rear washer pump/motor mounting hole of the washer reservoir.

(2) Position the rear washer pump/motor inlet nipple to the mounting hole in the washer reservoir (Fig. 11).

(3) Using hand pressure, firmly and evenly press on the rear washer pump/motor to engage the inlet nipple through the rubber grommet seal into the washer reservoir. Care must be taken not to damage the washer reservoir.

(4) Reconnect the body wire harness connector for the rear washer pump/motor to the washer pump/motor connector receptacle.

(5) Reconnect the rear washer supply hose to the barbed outlet nipple of the rear washer pump/motor.

(6) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(7) Reconnect the battery negative cable.

REAR WIPER ARM

DESCRIPTION

The rear wiper arm is the rigid member located between the rear wiper motor output shaft that protrudes from the outside of the liftglass near the right liftglass hinge and the rear wiper blade (Fig. 12). This wiper arm features an over-center hinge that allows easy access to the liftglass for cleaning. The wiper arm has a die cast metal pivot end with a

REAR WIPER ARM (Continued)

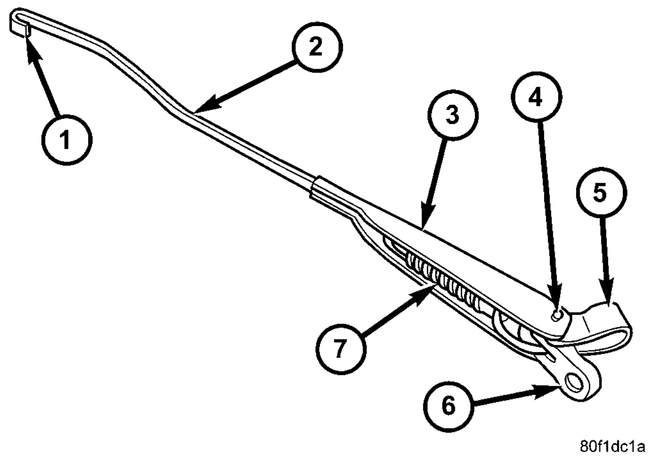


Fig. 12 Rear Wiper Arm

1 - HOOK
2 - STRAP
3 - CHANNEL
4 - HINGE PIN
5 - COVER
6 - PIVOT END
7 - TENSION SPRING

large tapered mounting hole at one end. A molded plastic pivot cover is secured loosely to and pivots on the wiper arm hinge pin to conceal the wiper arm retaining nut.

The wide end of a tapered, stamped steel channel is secured with a hinge pin to the pivot end of the wiper arm. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

The rear wiper arm is designed to mechanically transmit the motion from the rear wiper motor output shaft to the rear wiper blade. The wiper arm must be properly indexed to the motor output shaft in order to maintain the proper wiper blade travel on the glass. The tapered hole in the wiper arm pivot end interlocks with the serrations on the outer circumference of the tapered motor output shaft, allowing positive engagement and finite adjustment of this connection. A hex nut secures the wiper arm pivot end to the threads on the rear wiper motor output shaft and the pivot cover hinges and snaps over this connection for a neat appearance. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Lift the rear wiper arm pivot cover by lifting it at the rear wiper motor output shaft end of the arm (Fig. 13).

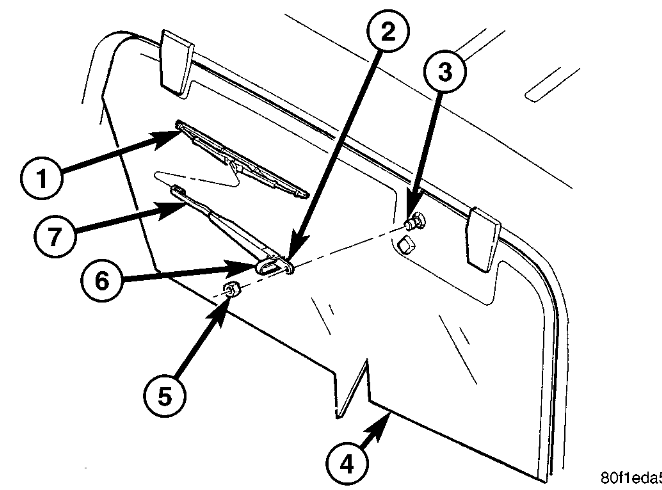


Fig. 13 Rear Wiper Arm Remove/Install

1 - LATCH
2 - WIPER ARM PIVOT END

(2) Remove the nut that secures the rear wiper arm to the rear wiper motor output shaft.

(3) Lift the rear wiper arm to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to rear wiper motor output shaft connection.

(4) If necessary, use a battery terminal puller to disengage the wiper arm from the rear wiper motor output shaft splines (Fig. 14).

(5) Remove the rear wiper arm pivot end from the motor output shaft.

INSTALLATION

NOTE: Be certain that the rear wiper motor is in the park position before attempting to install the wiper arm. Turn the ignition switch to the On position and move the rear wiper and washer switch rocker to its Off position. If the wiper motor output shaft moves, wait until it stops moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.

REAR WIPER ARM (Continued)

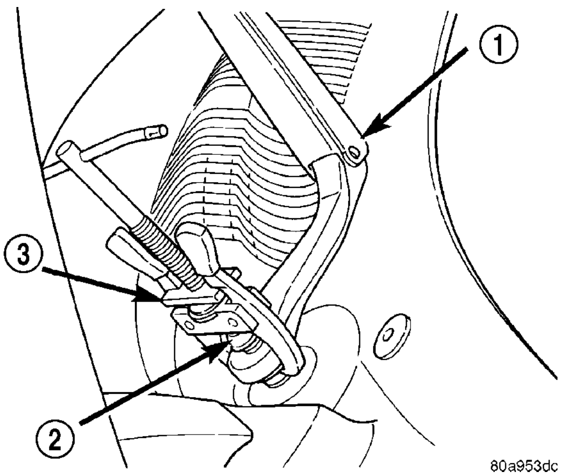


Fig. 14 Wiper Arm Puller - Typical

1 - WIPER ARM
2 - WIPER PIVOT
3 - BATTERY TERMINAL PULLER

(1) The rear wiper arm must be indexed to the rear wiper motor output shaft with the motor in the park position to be properly installed. Position the rear wiper arm pivot end onto the motor output shaft so that the wiper blade is parallel to the lower edge of the upper liftglass blackout area (Fig. 15).

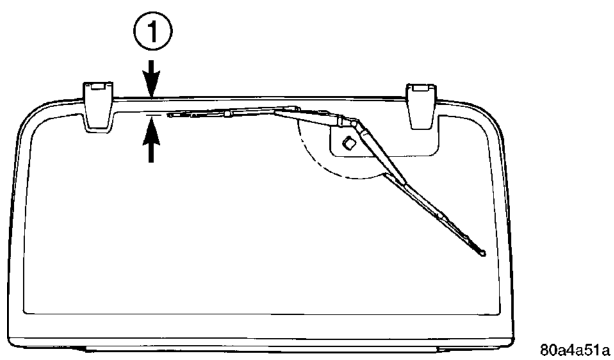


Fig. 15 Rear Wiper Arm Installation

1 - LIFTGLASS BLACKOUT AREA

(2) Once the wiper blade is indexed to the rear wiper motor output shaft, lift the rear wiper arm to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to rear wiper motor output shaft connection. Using hand pressure, push the tapered hole in the pivot end of the wiper arm down firmly and evenly over the rear wiper motor output shaft (Fig. 13).

(3) Install and tighten the nut that secures the wiper arm to the rear wiper motor output shaft. Tighten the nut to 12 N·m (9 ft. lbs.). **Do not over-tighten.**

(4) Gently lower the wiper arm until the wiper blade rests on the glass.

(5) Wet the liftglass, then operate the rear wiper. Turn the wiper switch to the Off position, then check for the correct wiper arm position and readjust as required.

REAR WIPER BLADE

DESCRIPTION

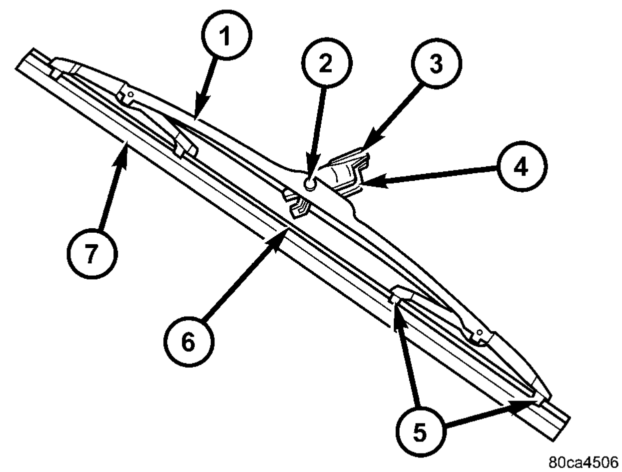


Fig. 16 Rear Wiper Blade

1 - SUPERSTRUCTURE
2 - PIVOT PIN
3 - LATCH RELEASE
4 - PIVOT BLOCK
5 - CLAW
6 - FLEXOR
7 - ELEMENT

The rear wiper blade is secured by an integral latching pivot block to the hook formation on the tip of the rear wiper arm, and rests in a horizontal position on the glass near the top of the liftglass when the wiper is not in operation (Fig. 16). The wiper blade consists of the following components:

- **Superstructure** - The superstructure includes a stamped steel bridge and plastic links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.
- **Element** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All models with the optional rear wiper and washer system have a single 46.00 centimeter (18.00 inch) rear wiper blade with a non-replaceable rubber element (squeegee). The wiper blade cannot be

REAR WIPER BLADE (Continued)

adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The rear wiper blade is moved back and forth across the glass by the wiper arm when the rear wiper system is in operation. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the liftglass, even as the blade is moved over the varied curvature found across the glass surface.

The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

REMOVAL

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the rear wiper motor output shaft.

(1) Lift the rear wiper arm to raise the wiper blade and element off of the liftglass.

(2) To remove the wiper blade from the wiper arm, push the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the rear wiper motor output shaft end of the arm (Fig. 17).

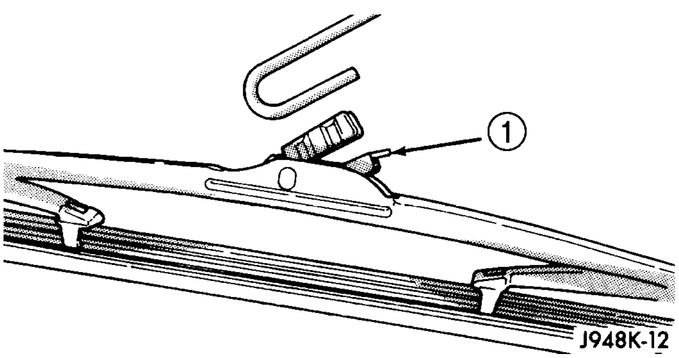


Fig. 17 Wiper Blade Remove/Install - Typical

1 - RELEASE TAB

(3) Slide the rear wiper blade away from the tip of the arm towards the pivot end of the arm far enough to disengage the pivot block from the hook formation on the end of the arm.

(4) Extract the hook formation on the tip of the wiper arm from the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit.

CAUTION: Do not allow the wiper arm to spring back against the liftglass without the wiper blade in place or the glass may be damaged.

(5) Gently lower the wiper arm tip onto the glass.

INSTALLATION

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the rear wiper motor output shaft.

(1) Lift the rear wiper arm off of the liftglass.

(2) Position the rear wiper blade near the hook formation on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the rear wiper motor output shaft.

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block with the hook (Fig. 17).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position.

(5) Gently lower the wiper blade onto the liftglass.

REAR WIPER MOTOR

DESCRIPTION

The rear wiper motor is concealed behind a molded plastic trim cover on the inside of the liftglass near the right liftglass hinge at the top of the glass. A large blackout area of the liftglass conceals the unit from the exterior of the vehicle. The end of the motor output shaft that protrudes through a large rubber grommet in the liftglass to drive the rear wiper arm and blade is the only visible component of the rear wiper motor (Fig. 18). A large flat washer and a nut secure and seal the motor output shaft to the outside of the liftglass, while a rubber insulator in a slot on the outboard upper corner of the motor bracket is secured by a stud and nut to the inside of the liftglass near the right liftglass hinge. The connector of a short pigtail harness is secured to a tab on the back of the motor bracket, and connects the rear wiper motor to the vehicle electrical system through a dedicated take out and connector of the hardtop

REAR WIPER MOTOR (Continued)

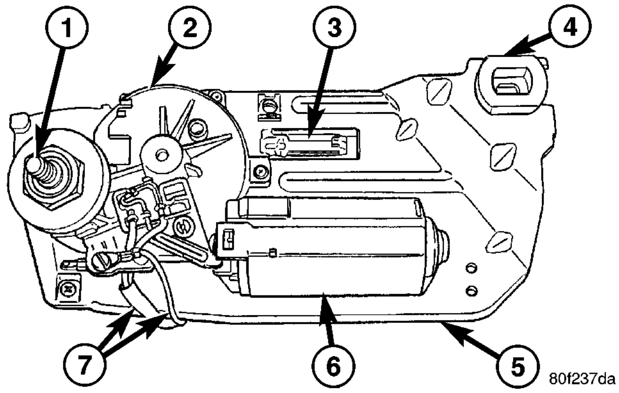


Fig. 18 Rear Wiper Motor

1 - OUTPUT SHAFT
2 - TRANSMISSION
3 - PIGTAIL CONNECTOR (ON BACK)
4 - INSULATOR
5 - BRACKET
6 - MOTOR
7 - PIGTAIL WIRES

wire harness. The rear wiper motor consists of the following major components:

- **Bracket -** The rear wiper motor bracket consists of a stamped steel mounting plate that is secured with screws to the wiper motor and transmission. A rubber insulator in a slot on the upper outboard corner of the bracket is secured by a nut and washer to a stud on the inside surface of the liftglass. An integral tab on the back of the bracket supports the wiper motor pigtail wire connector.
- **Motor** - The single-speed permanent magnet rear wiper motor is secured with screws to the rear wiper motor bracket. The wiper motor includes an integral transmission, a motor output shaft, a diode, and the rear wiper motor park switch.

The rear wiper motor cannot be adjusted or repaired. If any component of the motor is faulty or damaged, the entire rear wiper motor unit must be replaced. The motor output shaft grommet, washer and nut are available for individual service replacement.

OPERATION

The rear wiper motor operation is controlled by the vehicle operator through battery current inputs received by the rear wiper motor from the rear wiper and washer switch on the instrument panel, and the rear wiper motor park switch, which control current flow to the wiper motor brushes. An internal diode protects the motor from feedback through the park switch when the switch is closed to the fused ignition switch output (run) circuit. An internal circuit breaker protects the motor from overloads.

The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately closes the wiper motor brush to the rear wiper and washer switch output or to a fused ignition switch output (run) circuit, depending upon the position of the wiper on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blade in the uppermost portion of the wipe pattern.

The wiper motor transmission converts the rotary output of the wiper motor to the back and forth wiping motion of the rear wiper arm and blade on the liftglass. The rear wiper motor may be diagnosed using conventional diagnostic tools and methods.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear wiper arm from the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER ARM - REMOVAL).

(3) Remove the nut that secures the threaded sleeve of the rear wiper motor output shaft to the outside of the liftglass (Fig. 19).

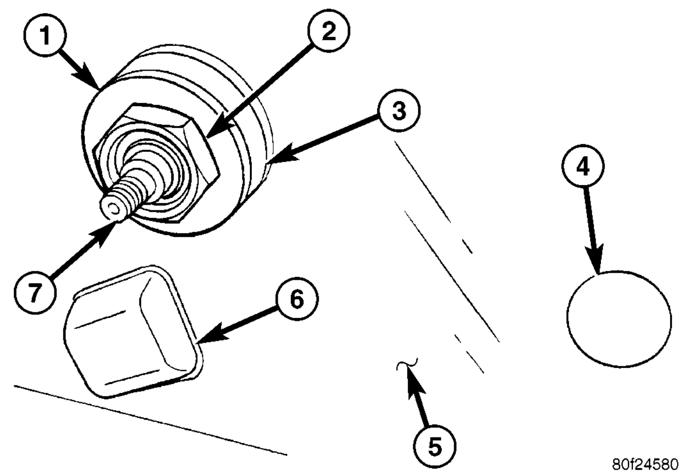


Fig. 19 Rear Wiper Motor Output Shaft

1 - WASHER
2 - NUT
3 - GROMMET
4 - STUD
5 - LIFTGLASS
6 - REAR WASHER NOZZLE
7 - REAR WIPER MOTOR OUTPUT SHAFT

(4) Remove the washer from the rear wiper motor output shaft sleeve.

(5) Remove the trim cover from the rear wiper motor on the inside of the liftglass. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - REMOVAL).

REAR WIPER MOTOR (Continued)

(6) Disconnect the hardtop wire harness connector for the rear wiper motor from the motor pigtail wire connector.

(7) Remove the nut and washer that secures the rear wiper motor bracket insulator to the stud on the liftglass (Fig. 20).

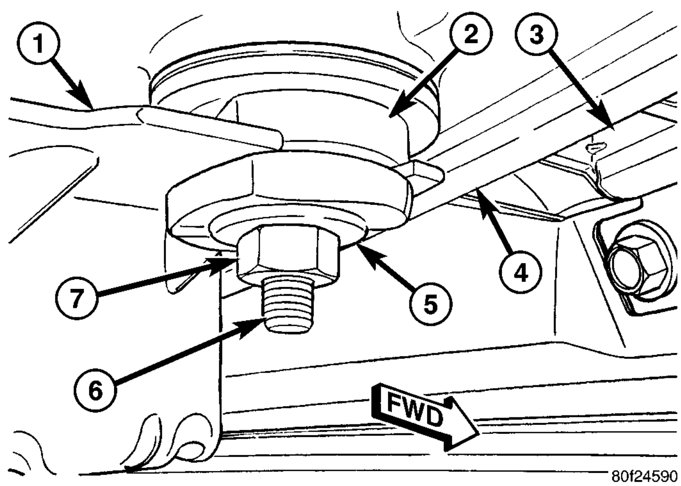


Fig. 20 Rear Wiper Motor Bracket

1 - BRACKET
2 - INSULATOR
3 - RIGHT LIFTGLASS HINGE
4 - LIFTGLASS
5 - WASHER
6 - STUD
7 - NUT

(8) Remove the washer from the stud that secures the rear wiper motor bracket insulator to the liftglass.

(9) From the inside of the liftglass, gently pull the rear wiper motor away from the liftglass until the output shaft clears the rubber grommet in the liftglass output shaft hole.

(10) Remove the rear wiper motor and mounting bracket from the liftglass as a unit.

(11) Remove the rubber grommet from the outside of the liftglass output shaft hole.

INSTALLATION

(1) Install the rubber grommet from the outside of the liftglass output shaft hole. Be certain that the alignment arrow molded into the outer flange of the grommet is aligned with the arrowhead imprinted on the glass below the output shaft hole.

(2) Position the rear wiper motor to the inside of the liftglass with the output shaft inserted through the rubber grommet and the mounting bracket insulator installed over the stud on the inside of the liftglass (Fig. 20).

(3) Reinstall the washer onto the stud that secures the rear wiper motor bracket insulator to the liftglass.

(4) Install and tighten the nut and washer that secures the rear wiper motor bracket insulator to the stud on the liftglass. Tighten the nut to 6 N·m (54 in. lbs.).

(5) From the outside of the liftglass, reinstall the washer over the rear wiper motor output shaft sleeve (Fig. 19).

(6) Install and tighten the nut that secures the threaded sleeve of the rear wiper motor output shaft to the outside of the liftglass. Tighten the nut to 5 N·m (44 in. lbs.).

(7) Reconnect the hardtop wire harness connector for the rear wiper motor to the motor pigtail wire connector.

(8) Reinstall the trim cover over the rear wiper motor on the inside of the liftglass. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - INSTALLATION).

(9) Reinstall the rear wiper arm onto the rear wiper motor output shaft. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER ARM - INSTALLATION).

(10) Reconnect the battery negative cable.

REAR WIPER MOTOR TRIM COVER

REMOVAL

(1) From the inside of the liftglass, remove the three screws that secure the rear wiper motor trim cover to the motor mounting bracket (Fig. 21).

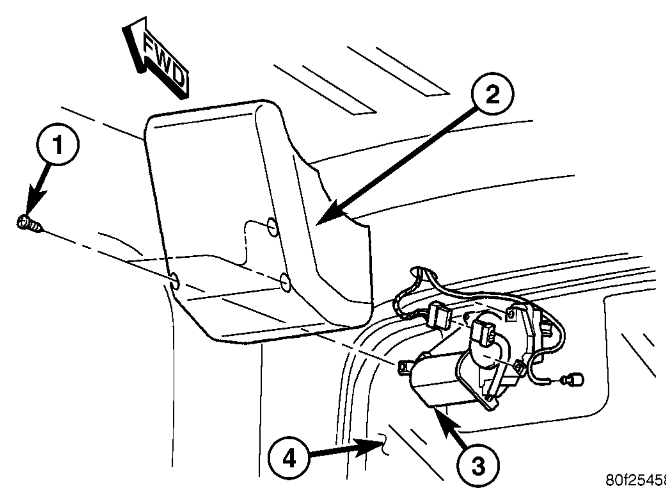


Fig. 21 Rear Wiper Motor Trim Cover Remove/Install

1 - SCREW (3)
2 - TRIM COVER
3 - REAR WIPER MOTOR
4 - LIFTGLASS

(2) Remove the trim cover from the rear wiper motor mounting bracket.

REAR WIPER MOTOR TRIM COVER (Continued)

INSTALLATION

(1) From the inside of the liftglass, position the trim cover onto the rear wiper motor mounting bracket (Fig. 21).

(2) Install and tighten the three screws that secure the trim cover to the rear wiper motor mounting bracket. Tighten the screws to 1 N·m (10 in. lbs.).

REAR WIPER/WASHER SWITCH

DESCRIPTION

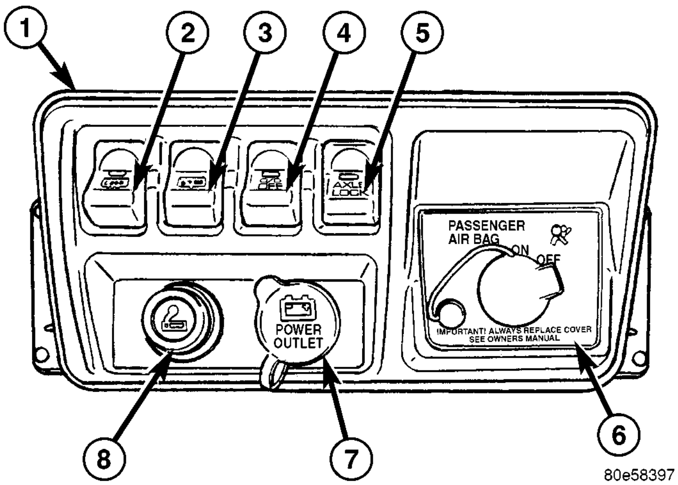


Fig. 22 Accessory Switch Bezel

1 - ACCESSORY SWITCH BEZEL
2 - REAR WINDOW DEFOGGER SWITCH (HARDTOP ONLY)
3 - REAR WIPER/WASHER SWITCH (HARDTOP ONLY)
4 - OVERDRIVE-OFF SWITCH (AUTOMATIC TRANSMISSION ONLY)
5 - AXLE LOCK SWITCH (OFF ROAD PACKAGE ONLY)
6 - PASSENGER AIRBAG ON/OFF SWITCH (WITHOUT REAR SEAT ONLY)
7 - ACCESSORY POWER OUTLET
8 - CIGAR LIGHTER

The rear wiper and washer switch is located in the accessory switch bezel near the bottom of the instrument panel center stack area on the instrument panel (Fig. 22). Only the single switch toggle button is visible through the opening of the accessory switch bezel (Fig. 23). The remainder of the switch is concealed behind the accessory switch bezel within the instrument panel. The single two-function switch housing and switch toggle button are molded from black plastic. The switch toggle button is clearly identified by a white graphic of the International Control and Display Symbol icon for “Rear Wiper and Washer,” making it clearly visible in daylight. When illuminated from behind by an integral panel lamps dimmer controlled illumination lamp with the exterior lamps turned On, the white graphic appears blue-green.

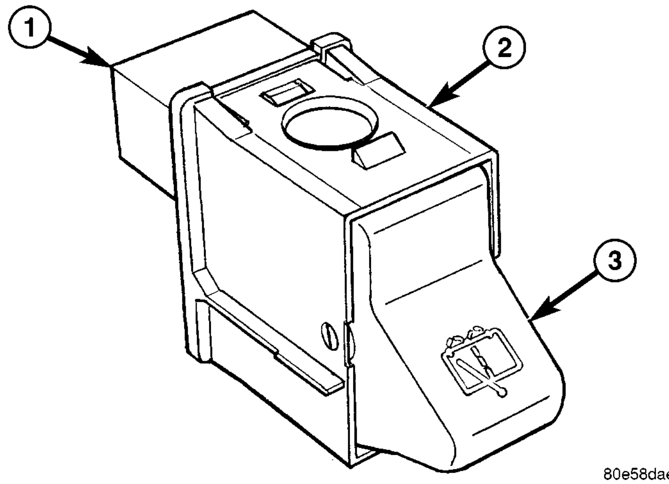


Fig. 23 Rear Wiper/Washer Switch

1 - CONNECTOR RECEPTACLE
2 - HOUSING
3 - TOGGLE BUTTON

The rear wiper and washer switch is secured by a snap fit within a dedicated receptacle molded into the back of the accessory switch bezel. A single six pin connector receptacle is molded into the back of the switch housing. A dedicated take out and connector of the instrument panel wire harness connects the switch to the vehicle electrical system. The rear wiper and washer switch contains switches and circuitry to control both the rear wiper and the rear washer functions. The rear wiper and washer switch cannot be repaired and, if faulty or damaged, the entire switch unit must be replaced. The incandescent switch illumination bulb and bulb holder unit is available for individual service replacement.

OPERATION

The rear wiper and washer switch uses conventionally switched outputs to control the functions and features of the rear wiper and washer system. The switch receives battery current on a fused ignition switch output (run) circuit from a fuse in the Power Distribution Center (PDC) through the rear wiper and washer system fuse in the fuse block whenever the ignition switch is in the On position. The switch receives a path to ground at all times through a through a take out of the instrument panel wire harness with an eyelet terminal connector that is secured by a ground screw to the support structure near the driver side end of the instrument panel.

The rear wiper and washer switch features detents in the Off and Wipe positions, and a momentary Wash position. When the switch toggle button is in the Off position it provides a ground path to the park switch within the rear wiper motor. The park switch uses this ground path to operate the rear wiper motor until the wiper blade is in its parked position, REAR WIPER/WASHER SWITCH (Continued)

or until the ignition switch is turned to the Off position, whichever occurs first. When the switch toggle button is depressed downward to its Wipe detent position, the switch provides ignition switched battery current to the rear wiper motor and the rear wiper system operates. When the switch toggle button is depressed downward to the momentary Wash position, the switch provides ignition switched battery current to both the rear wiper motor and the rear washer pump motor for as long as the switch is held depressed. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the rear wiper and washer switch.

The incandescent switch illumination lamp is controlled by a lamp driver output from the instrument cluster based upon the panel lamps dimmer input to the cluster from the left multi-function switch. The rear wiper and washer switch can be diagnosed using conventional diagnostic tools and methods.

DIAGNOSIS AND TESTING - REAR WIPER & WASHER SWITCH

Be certain to perform the diagnosis for the rear wiper system and/or rear washer system before testing the rear wiper and washer switch. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Disconnect and isolate the battery negative cable. Remove the accessory switch bezel from the instrument panel and disconnect the instrument panel wire harness connector for the rear wiper and washer switch from the switch connector receptacle.

(2) Using an ohmmeter, check the rear wiper and washer switch continuity at the switch terminals as shown in the Rear Wiper & Washer Switch Continuity chart (Fig. 24).

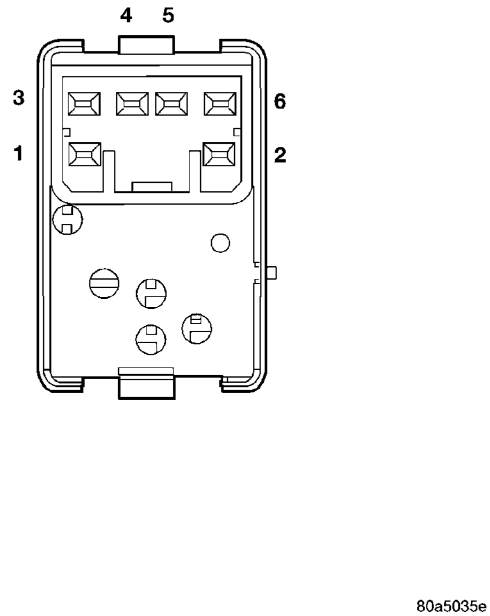


Fig. 24 Rear Wiper & Washer Switch Continuity

SWITCH POSITION	CONTINUITY BETWEEN
OFF	1 & 4
WIPE	4 & 5
WASH	2 & 5, 4 & 5
LAMP	1 & 3

(3) If the switch fails any of the continuity checks, replace the faulty switch. If the switch checks OK, repair the open or shorted rear wiper and/or rear washer system circuits as required.

REMOVAL

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

REAR WIPER/WASHER SWITCH (Continued)

(1) Disconnect and isolate the battery negative cable.

(2) Remove the accessory switch bezel from the instrument panel center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL).

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the latch tabs at the top and bottom of the rear wiper and washer switch receptacle on the back of the accessory switch bezel far enough to disengage the snap features on the top and bottom of the switch housing then pull the switch out of the receptacle (Fig. 25).

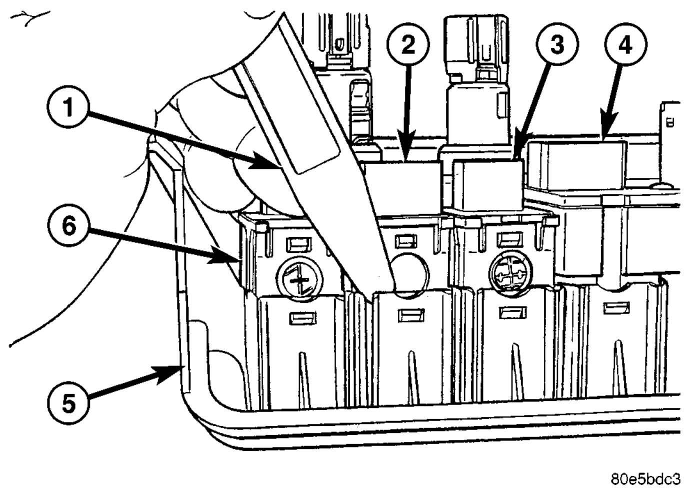


Fig. 25 Rear Wiper/Washer Switch Remove

1 - TRIM STICK
2 - REAR WIPER/WASHER SWITCH
3 - OVERDRIVE-OFF SWITCH
4 - AXLE LOCKER SWITCH
5 - ACCESSORY SWITCH BEZEL
6 - REAR WINDOW DEFOGGER SWITCH

INSTALLATION

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT.

(1) Position the rear wiper and washer switch over the proper receptacle on the back of the accessory switch bezel (Fig. 25).

(2) Gently and evenly push the rear wiper and washer switch into the receptacle until the snap features on the top and bottom of the switch housing are fully engaged by the latch tabs at the top and bottom of the receptacle.

(3) Reinstall the accessory switch bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION).

(4) Reconnect the battery negative cable.

WIRING

TABLE OF CONTENTS

8W-01 WIRING DIAGRAM INFORMATION

TABLE OF CONTENTS

WIRING DIAGRAM INFORMATION

DESCRIPTION

DESCRIPTION - HOW TO USE WIRING DIAGRAMS

DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, it is important to understand all of their features and characteristics.

Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page (Fig. 1).

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition (Fig. 2).

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world (Fig. 3).

WIRING DIAGRAM INFORMATION (Continued)

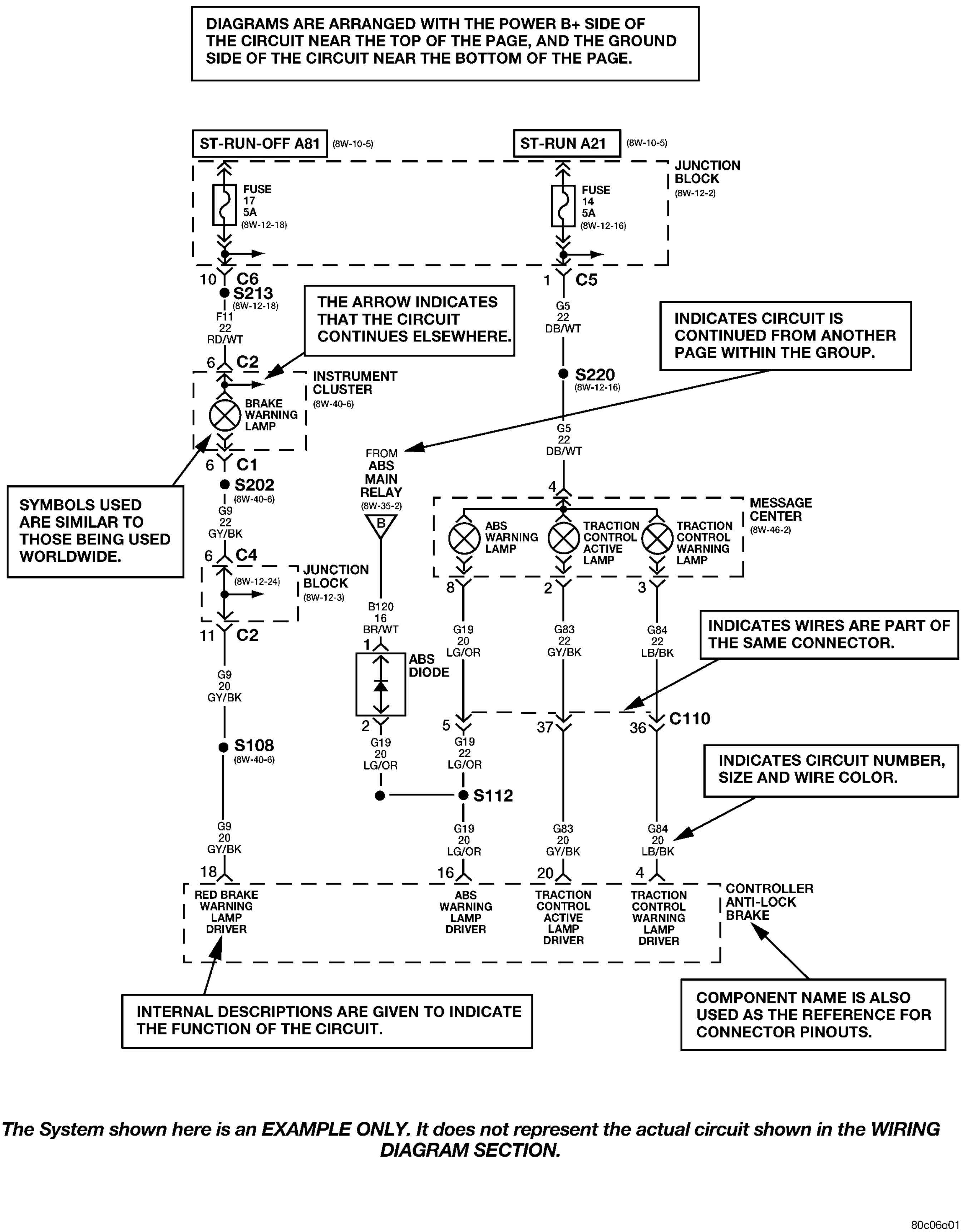


Fig. 1 WIRING DIAGRAM EXAMPLE 1

WIRING DIAGRAM INFORMATION (Continued)

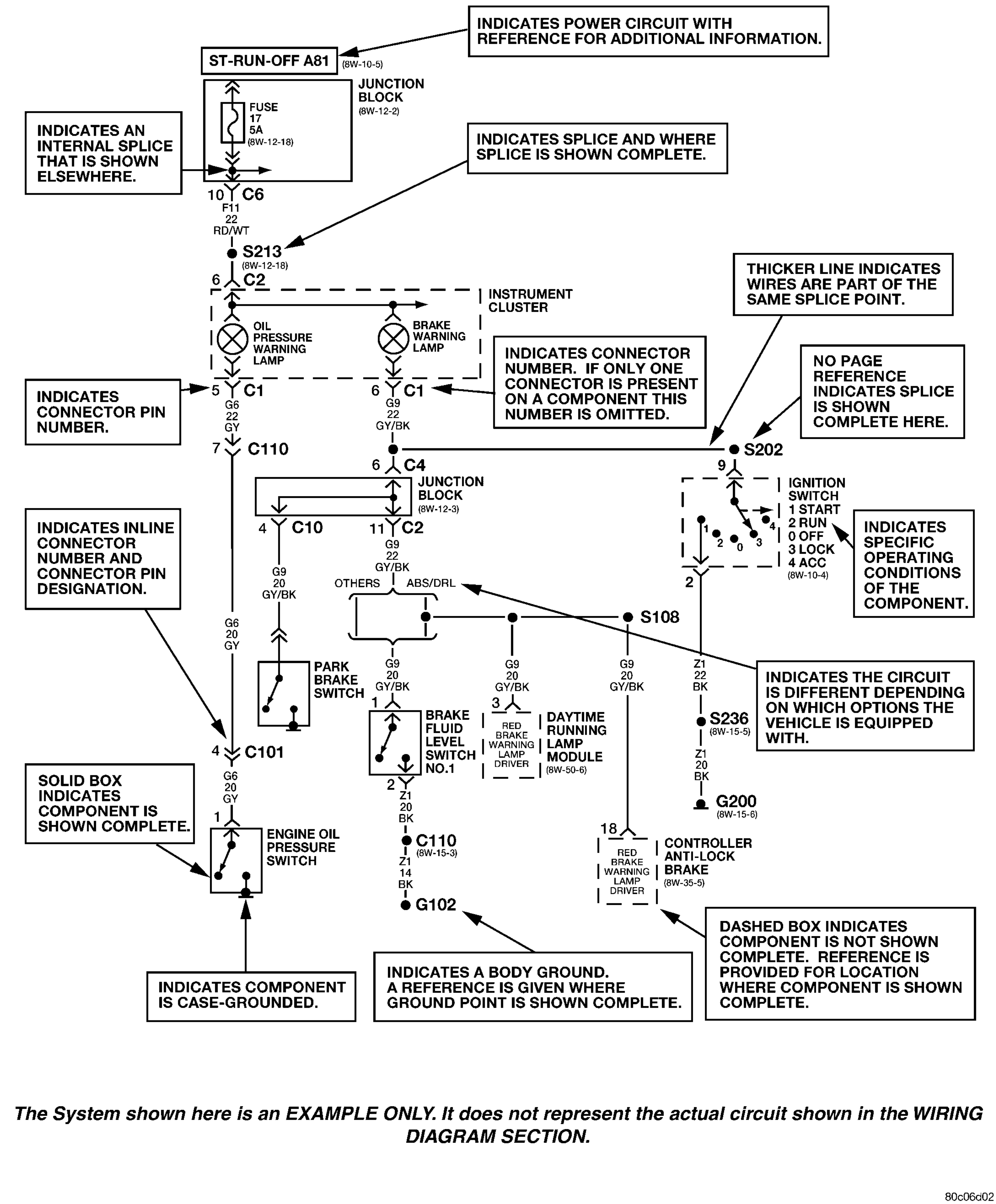


Fig. 2 WIRING DIAGRAM EXAMPLE 2

WIRING DIAGRAM INFORMATION (Continued)

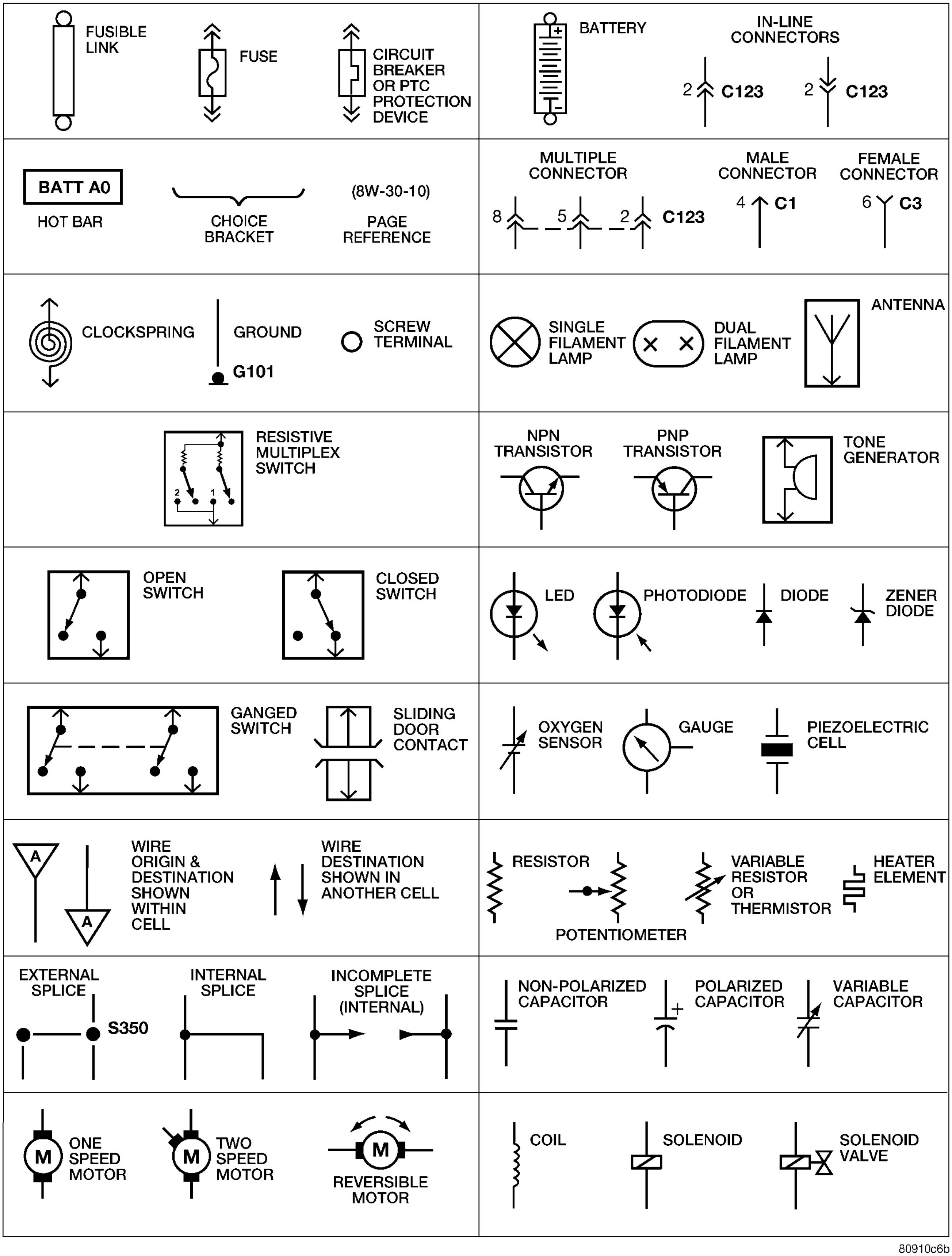


Fig. 3 WIRING DIAGRAM SYMBOLS

WIRING DIAGRAM INFORMATION (Continued)

TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD . . . . Left Hand Drive Vehicles
RHD . . . . Right Hand Drive Vehicles
ATX . . Automatic Transmissions-Front Wheel Drive
MTX . . . Manual Transmissions-Front Wheel Drive
AT . . . . Automatic Transmissions-Rear Wheel Drive
MT . . . . . Manual Transmissions-Rear Wheel Drive
SOHC . . . . Single Over Head Cam Engine
DOHC . . . . Double Over Head Cam Engine
Built-Up-Export . . . . Vehicles Built For Sale In Markets Other Than North America
Except Built-Up-Export . . . . Vehicles Built For Sale In North America

DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 4).

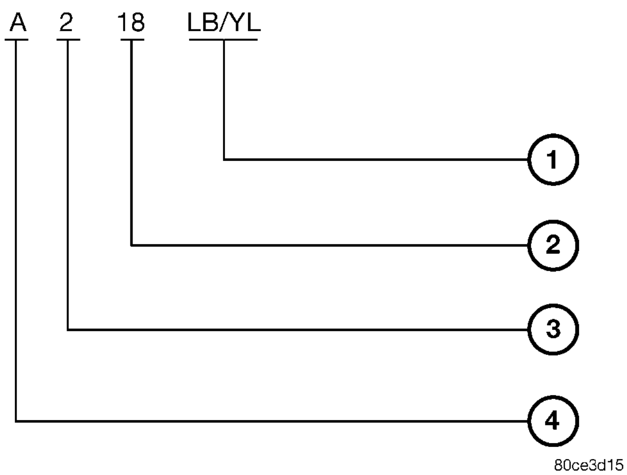


Fig. 4 WIRE CODE IDENTIFICATION

1 - COLOR OF WIRE (LIGHT BLUE WITH YELLOW TRACER
2 - GAGE OF WIRE (18 GAGE)
3 - PART OF MAIN CIRCUIT (VARIES DEPENDING ON EQUIPMENT)
4 - MAIN CIRCUIT IDENTIFICATION

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE
DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED
TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

WIRING DIAGRAM INFORMATION (Continued)

DESCRIPTION - CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and it's function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/ WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUNDS

DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the diagram pages.

WIRING SECTION CHART

GROUP	TOPIC
8W-01 thru 8W-09	General information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-91	Connector, Ground and Splice Locations

WIRING DIAGRAM INFORMATION (Continued)

DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located in the engine compartment are C100 series numbers
- In-line connectors located in the Instrument Panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.
- Grounds and ground connectors are identified with a "G" and follow the same series numbering as the in-line connectors.
- Splices are identified with an "S" and follow the same series numbering as the in-line connectors.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component. The abbreviation N/S means Not Shown in the illustrations

WARNING

WARNINGS - GENERAL

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY AND AVOID LOOSE CLOTHING.

DIAGNOSIS AND TESTING - WIRING HARNESS

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

- Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking voltages in these circuits, use a meter with a 10 - megohm or greater impedance rating.

WIRING DIAGRAM INFORMATION (Continued)

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: Most of the electrical components used in today's vehicles are Solid State. When checking resistance in these circuits use a meter with a 10 - megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle's electrical system can cause damage to the equipment and provide false readings.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 5). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

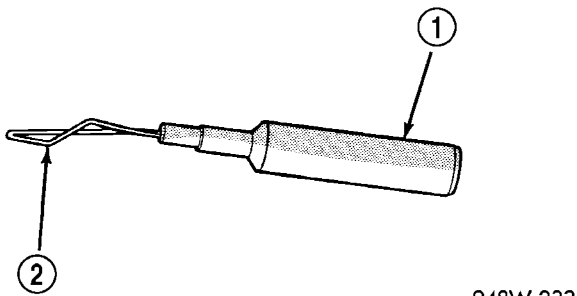


Fig. 5 PROBING TOOL

1 - SPECIAL TOOL 6801
2 - PROBING END

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly, check the following items.

• Connectors are fully seated
• Spread terminals, or terminal push out
• Terminals in the wiring assembly are fully seated into the connector/component and locked into position
• Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
• Damaged connector/component casing exposing the item to dirt or moisture
• Wire insulation that has rubbed through causing a short to ground
• Some or all of the wiring strands broken inside of the insulation
• Wiring broken inside of the insulation

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.
(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.
(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.
(4) Isolate the problem area.
(5) Repair the problem area.
(6) Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

STANDARD PROCEDURE

STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 6) is used to indicate this. When handling any component with this symbol, comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.
(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.
(3) When using a voltmeter, be sure to connect the ground lead first.
(4) Do not remove the part form it's protective packing until it is time to install the part.
(5) Before removing the part from it's pakage, ground the pakage to a known good ground on the vehicle.

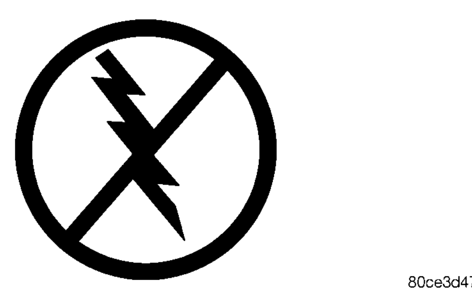


Fig. 6 ELECTROSTATIC DISCHARGE SYMBOL

WIRING DIAGRAM INFORMATION (Continued)

STANDARD PROCEDURE - TESTING OF VOLTAGE POTENTIAL

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 7).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

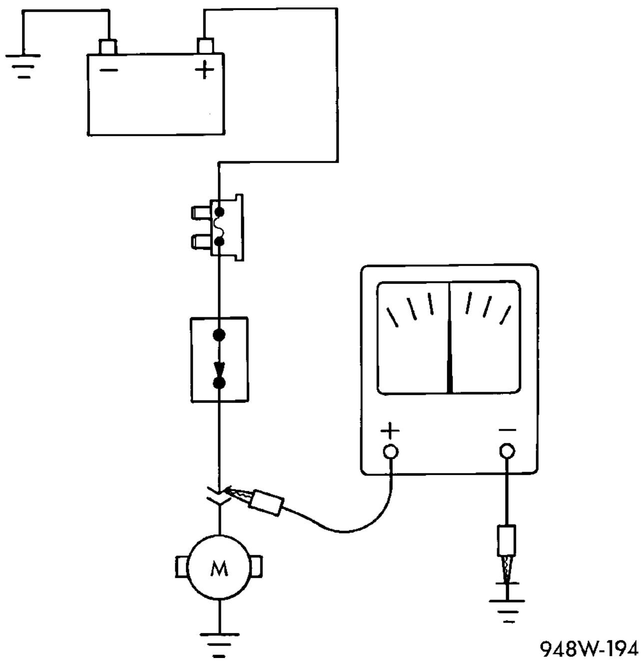


Fig. 7 TESTING FOR VOLTAGE POTENTIAL

STANDARD PROCEDURE - TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 8).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

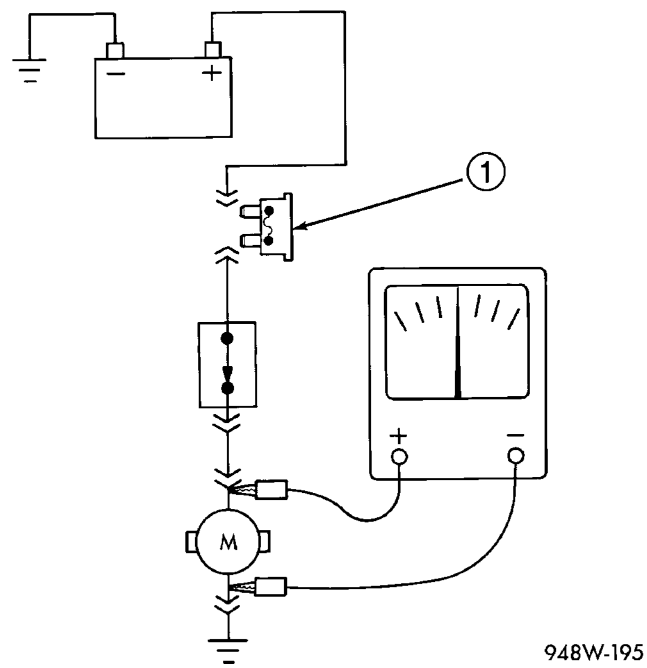


Fig. 8 TESTING FOR CONTINUITY

1 - FUSE REMOVED FROM CIRCUIT

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

WIRING DIAGRAM INFORMATION (Continued)

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 9).

(2) Connect the other lead of the voltmeter to the other side of the switch, component or circuit.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

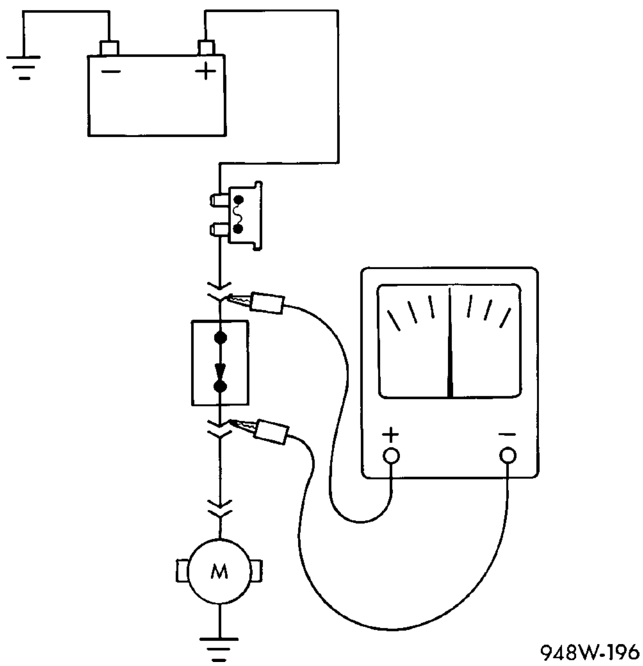
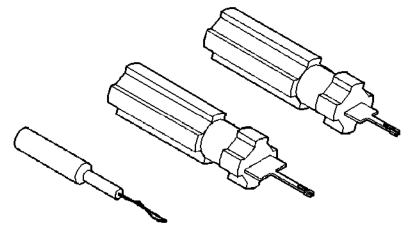


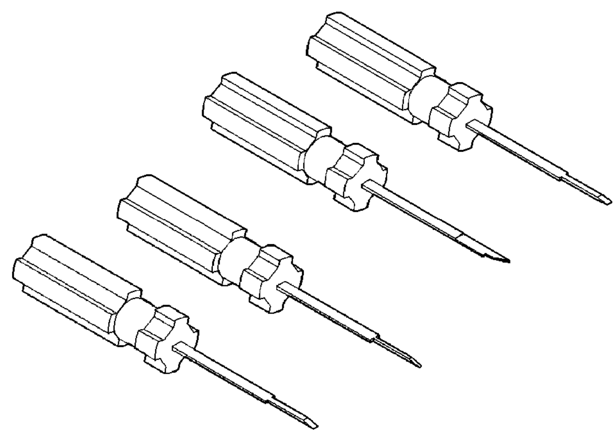
Fig. 9 TESTING FOR VOLTAGE DROP

SPECIAL TOOLS

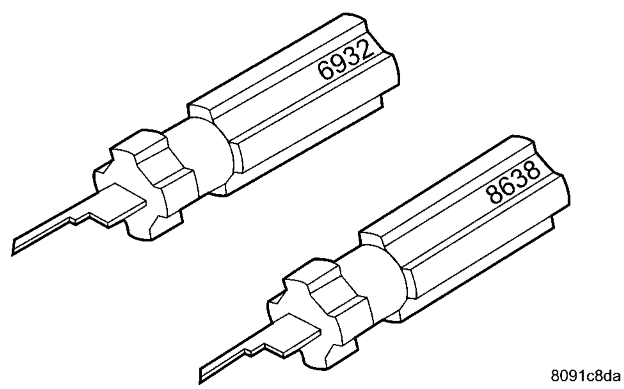
WIRING/TERMINAL



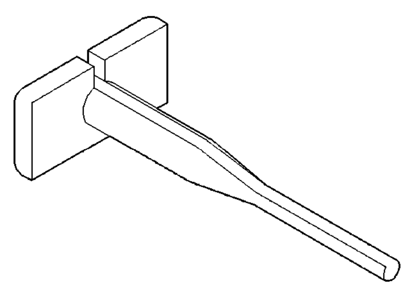
PROBING TOOL PACKAGE 6807



TERMINAL PICK TOOL SET 6680



TERMINAL REMOVING TOOLS 6932 AND 8638



TERMINAL REMOVING TOOL 6934

CONNECTOR

REMOVAL

(1) Disconnect battery.

(2) Release Connector Lock (Fig. 10).

(3) Disconnect the connector being repaired from its mating half/component.

(4) Remove the dress cover (if applicable) (Fig. 10).

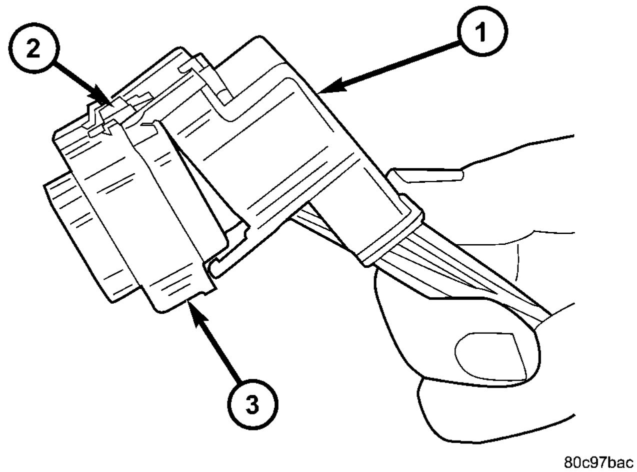


Fig. 10 REMOVAL OF DRESS COVER

1 - DRESS COVER
2 - CONNECTOR LOCK
3 - CONNECTOR

(5) Release the Secondary Terminal Lock, if required (Fig. 11).

(6) Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector (Fig. 12).

INSTALLATION

(1) Insert the removed terminal in the same cavity on the repair connector.

(2) Repeat steps for each terminal in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

(3) When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.

(4) Replace dress cover (if applicable).

(5) Connect connector to its mating half/component.

(6) Connect battery and test all affected systems.

CONNECTOR (Continued)

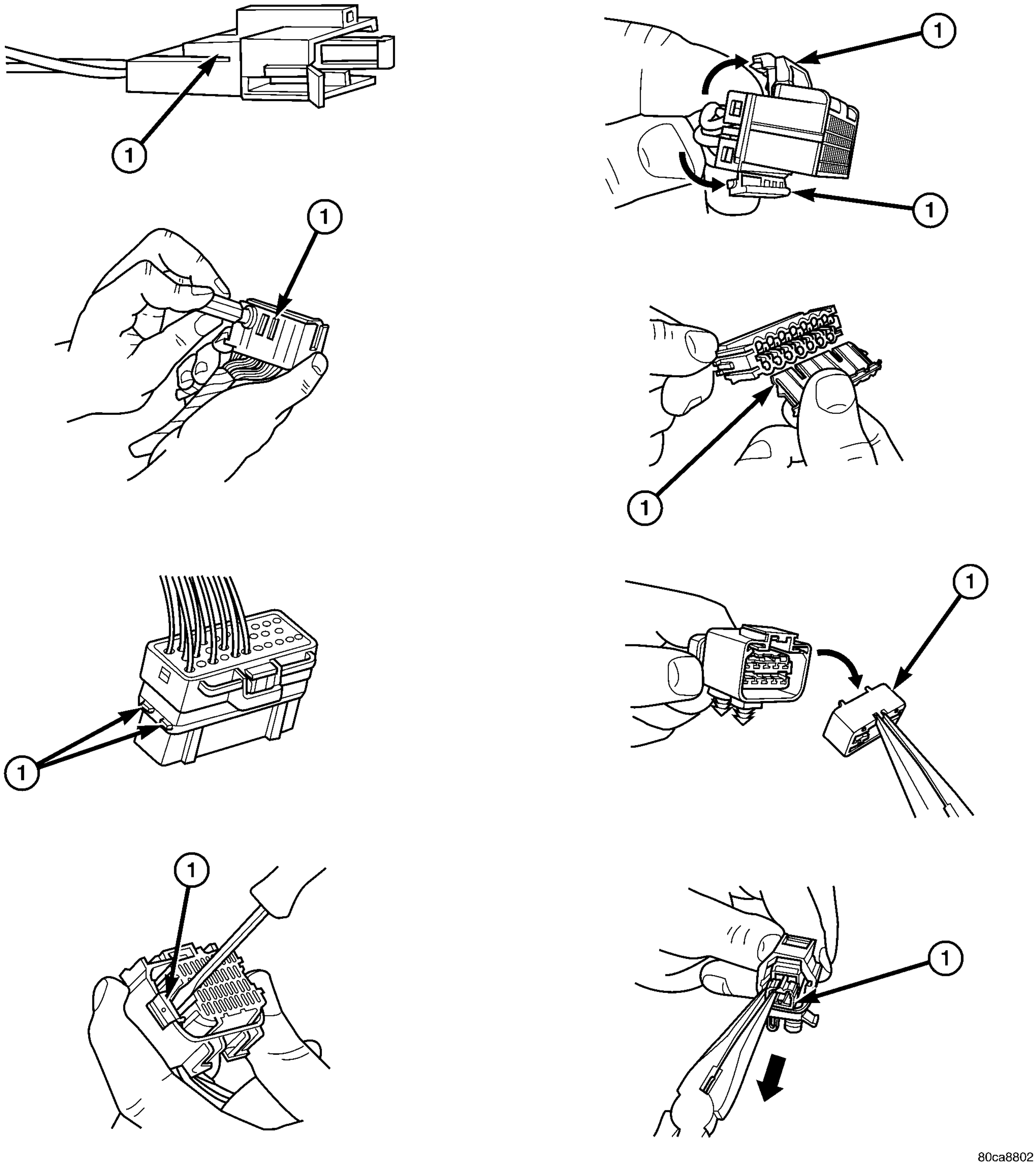


Fig. 11 EXAMPLES OF CONNECTOR SECONDARY TERMINAL LOCKS

1 - Secondary Terminal Lock

CONNECTOR (Continued)

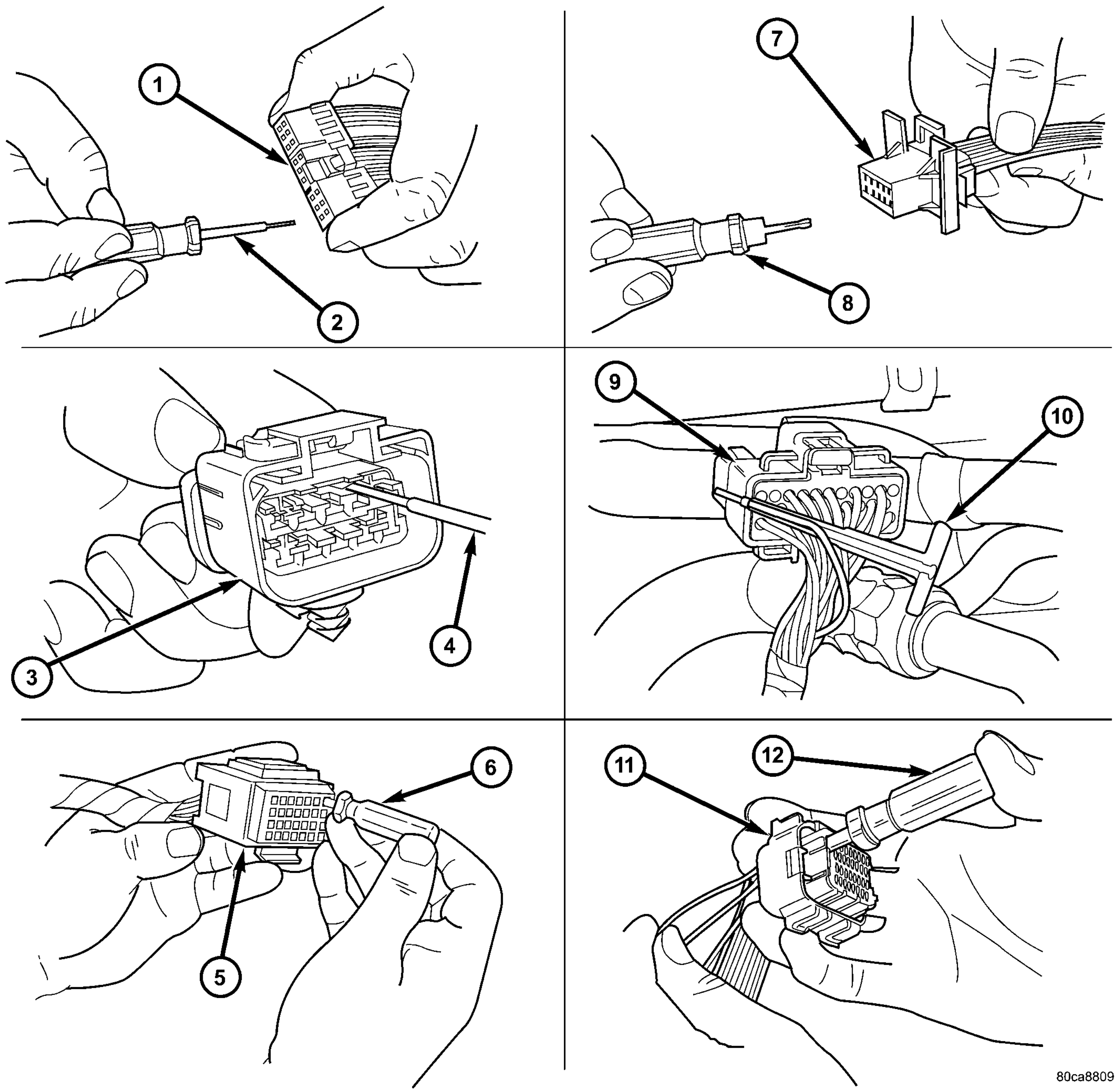


Fig. 12 TERMINAL REMOVAL

1 - TYPICAL CONNECTOR
2 - PICK FROM SPECIAL TOOL KIT 6680
3 - APEX CONNECTOR
4 - PICK FROM SPECIAL TOOL KIT 6680
5 - AUGAT CONNECTOR
6 - SPECIAL TOOL 6932
7 - MOLEX CONNECTOR
8 - SPECIAL TOOL 6742
9 - THOMAS AND BETTS CONNECTOR
10 - SPECIAL TOOL 6934
11 - TYCO CONNECTOR
12 - SPECIAL TOOL 8638

DIODE

REMOVAL

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 13).

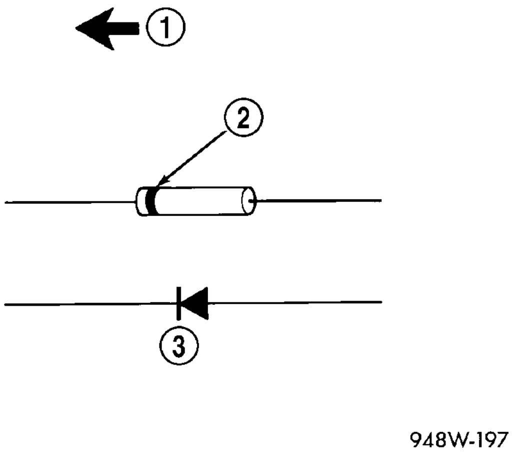


Fig. 13 DIODE IDENTIFICATION

1 - CURRENT FLOW
2 - BAND AROUND DIODE INDICATES CURRENT FLOW
3 - DIODE AS SHOWN IN THE DIAGRAMS

INSTALLATION

(1) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(2) Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow (Fig. 13).

(3) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(4) Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the elements.

(5) Re-connect the battery and test affected systems.

TERMINAL

REMOVAL

(1) Follow steps for removing terminals described in the connector removal section.

(2) Cut the wire 6 inches from the back of the connector.

INSTALLATION

(1) Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.

(2) Cut the repair wire to the proper length and remove one–half (1/2) inch of insulation.

(3) Splice the repair wire to the wire harness (see wire splicing procedure).

(4) Insert the repaired wire into the connector.

(5) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(6) Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.

(7) Connect battery and test all affected systems.

WIRE

STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

(1) Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.

(2) Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(3) Place the strands of wire overlapping each other inside of the splice clip (Fig. 14).

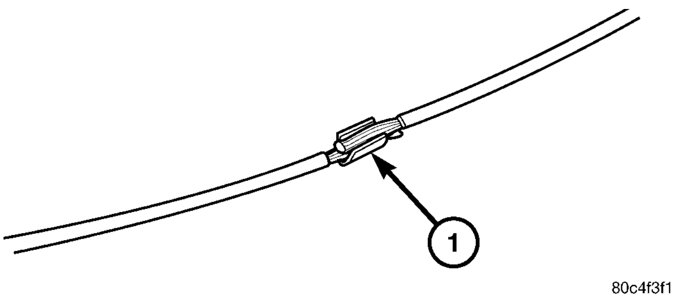


Fig. 14 SPLICE BAND

1 - SPLICE BAND

(4) Using crimping tool, Mopar p/n 05019912AA, crimp the splice clip and wires together (Fig. 15).

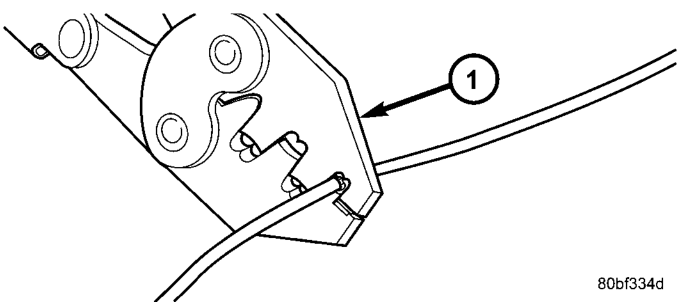


Fig. 15 CRIMPING TOOL

1 - CRIMPING TOOL

(5) Solder the connection together using rosin core type solder only (Fig. 16).

CAUTION: DO NOT USE ACID CORE SOLDER.

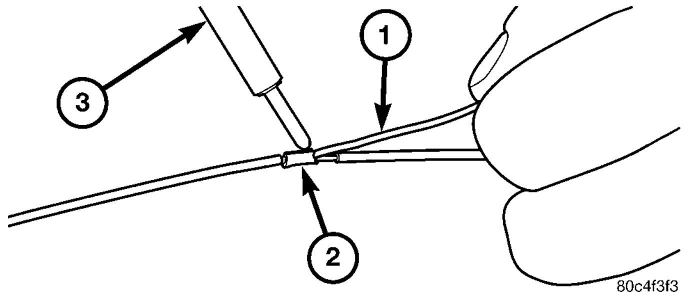


Fig. 16 SOLDER SPLICE

1 - SOLDER
2 - SPLICE BAND
3 - SOLDERING IRON

(6) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing (Fig. 17).

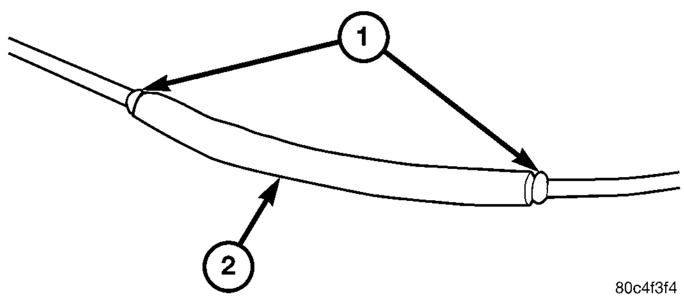


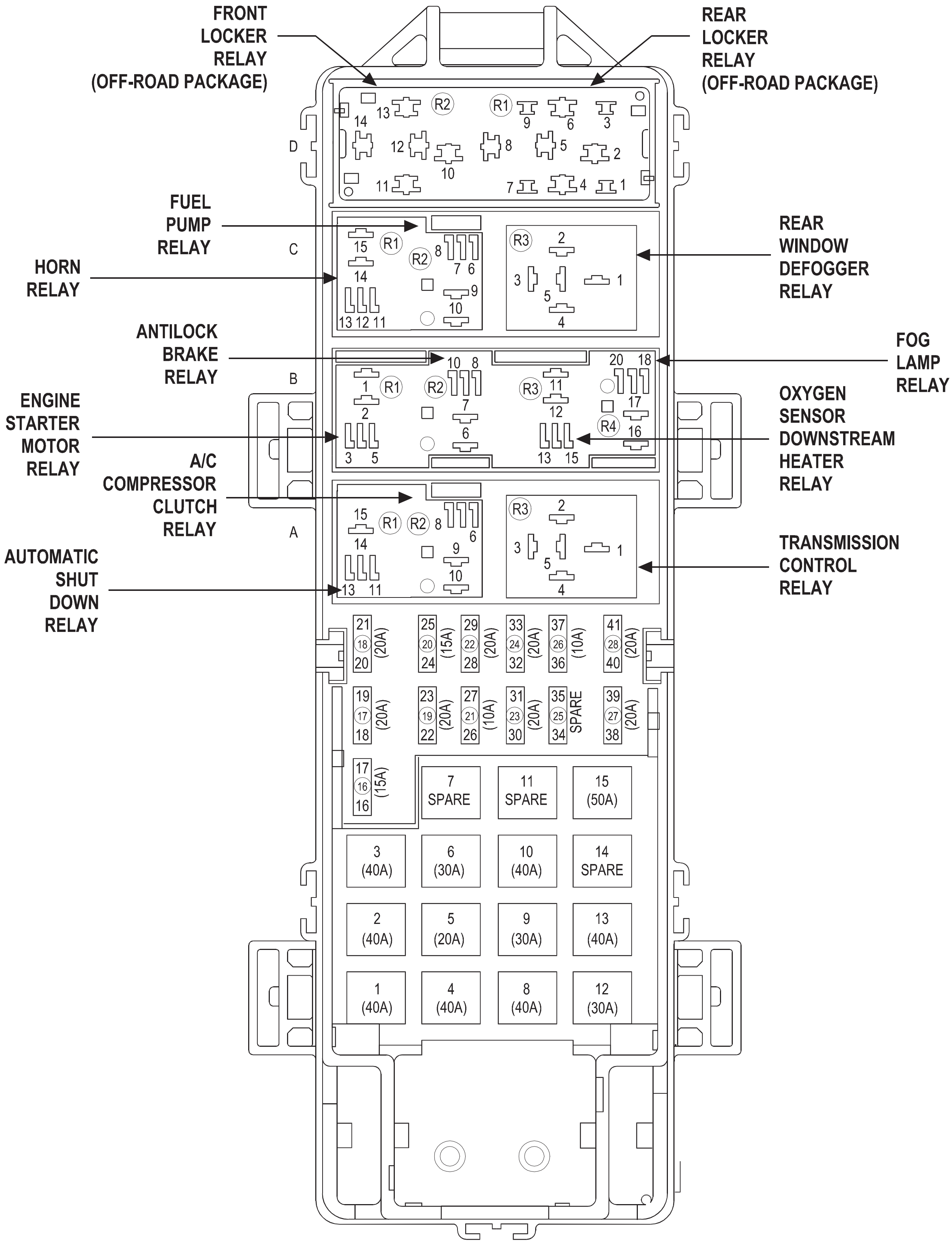
Fig. 17 HEAT SHRINK TUBE

1 - SEALANT
2 - HEAT SHRINK TUBE

8W-02 COMPONENT INDEX

8W-10 POWER DISTRIBUTION

POWER DISTRIBUTION CENTER



FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	A111 12RD/LB	FUSED B(+)
2	40A	INTERNAL	FUSED B(+)
3	40A	A6 12RD/BK	FUSED B(+)
4	40A	A16 12GY ✳	FUSED B(+)
5	20A	INTERNAL	FUSED B(+)
6	30A	A2 14PK/BK	FUSED B(+)
7	-	SPARE	-
8	40A	A10 12RD/DG ◇◇◇	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
		INTERNAL	FUSED B(+)
10	40A	A3 12RD/WT	FUSED B(+)
11	-	SPARE	-
12	30A	A20 12RD/DB	FUSED B(+)
13	40A	F30 12RD/PK	FUSED B(+)
14	-	SPARE	-
15	50A	M1 16PK/WT	FUSED B(+)
		M1 20PK/WT ◇◇◇	FUSED B(+)
16	15A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
		F142 18OR/DG	AUTOMATIC SHUT DOWN RELAY OUTPUT
17	20A	F70 16PK/BK	FUSED B(+)
18	20A	INTERNAL	FUSED B(+)
		INTERNAL	
19	20A	F39 16PK/LG □□□	FUSED B(+)
20	15A	F60 16RD/WT	FUSED B(+)
21	10A	INTERNAL	FUSED B(+)
22	20A	A1 18RD	FUSED B(+)
23	20A	INTERNAL	FUSED B(+)
24	20A	INTERNAL □	FUSED B(+)
25	-	SPARE	-
26	10A	M1 20PK/WT	FUSED B(+)
27	20A	L9 18BK/WT	FUSED B(+)
28	20A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
		F42 18DG/LG	AUTOMATIC SHUT DOWN RELAY OUTPUT

□□□ FRONT FOG LAMPS

◇◇◇ ABS

□ OFF-ROAD PACKAGE

✳ 2.4L

A/C COMPRESSOR CLUTCH RELAY

CAVITY	CIRCUIT	FUNCTION
A6	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
A7	-	-
A8	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
A9	C3 20DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
A10	A17 20RD/GY	FUSED B(+)

ANTILOCK BRAKE RELAY

CAVITY	CIRCUIT	FUNCTION
B6	G19 20LG/OR	ABS WARNING INDICATOR DRIVER
B7	-	-
B8	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
B9	Z1 18BK	GROUND
B10	G83 18GY/BK	ABS SYSTEM RELAY CONTROL

AUTOMATIC SHUT DOWN RELAY

CAVITY	CIRCUIT	FUNCTION
A11	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
A12	-	-
A13	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
A14	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
A15	A14 14RD/WT	FUSED B(+)

ENGINE STARTER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
B1	A2 14PK/BK	FUSED B(+)
B2	T40 12BR ◇◇◇	ENGINE STARTER MOTOR RELAY OUTPUT
B2	T40 14BR ◇◇◇◇	ENGINE STARTER MOTOR RELAY OUTPUT
B3	T41 20BR/LB	PARK/NEUTRAL POSITION SWITCH SENSE
B4	-	-
B5	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)

FOG LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
B16	F61 16WT/OR	FUSED B(+)
B17	-	-
B18	G34 14RD/GY △	HIGH BEAM INDICATOR
B18	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
B19	L39 16LB	FOG LAMP NO. 1 OUTPUT
B20	Z1 18BK	GROUND
B20	Z1 18BK ■■	GROUND

FRONT LOCKER RELAY (OFF-ROAD PACKAGE)

CAVITY	CIRCUIT	FUNCTION
D10	A88 18RD/DB	FUSED B(+)
D11	G304 20VT/DB	FRONT LOCKER REQUEST
D12	-	-
D13	A88 18RD/DB	FUSED B(+)
D14	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT

△ DRL
◇◇◇ ABS
◇◇◇◇ EXCEPT ABS
■■ A/T

FUEL PUMP RELAY

CAVITY	CIRCUIT	FUNCTION
C6	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
C7	-	-
C8	K31 18BR	FUEL PUMP RELAY CONTROL
C9	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
C10	A61 18DG/BK	FUSED B(+)

HORN RELAY

CAVITY	CIRCUIT	FUNCTION
C11	F31 18VT	FUSED B(+)
C12	-	-
C13	X3 20RD/YL	HORN RELAY CONTROL
C14	X2 18WT/RD	HORN RELAY OUTPUT
C15	F31 18VT	FUSED B(+)

OXYGEN SENSOR DOWNSTREAM HEATER RELAY

CAVITY	CIRCUIT	FUNCTION
B11	F142 18OR/DG	FUSED ASD RELAY OUTPUT
	F142 18OR/DG	FUSED ASD RELAY OUTPUT
B12	A242 18VT/OR	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
B13	F142 18 OR/DG	FUSED ASD RELAY OUTPUT
	F142 18 OR/DG	FUSED ASD RELAY OUTPUT
B14	-	-
B15	K512 18RD/YL	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT

REAR LOCKER RELAY (OFF-ROAD PACKAGE)

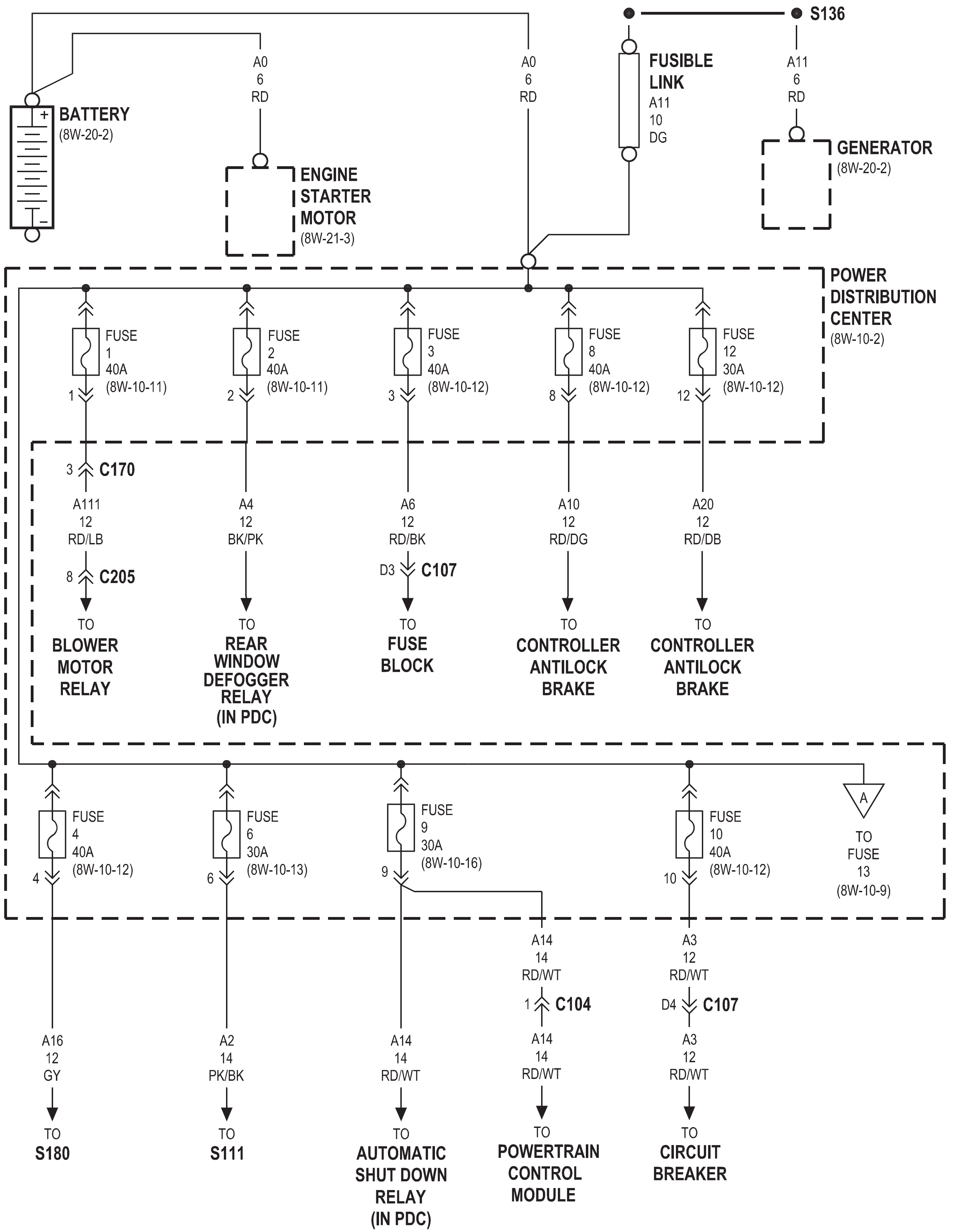
CAVITY	CIRCUIT	FUNCTION
D2	A88 18RD/DB	FUSED B(+)
D4	A88 18RD/DB	FUSED B(+)
D5	-	-
D6	G305 20VT/LG	REAR LOCKER REQUEST
D8	A850 18RD/WT	REAR LOCKER RELAY OUTPUT

REAR WINDOW DEFOGGER RELAY

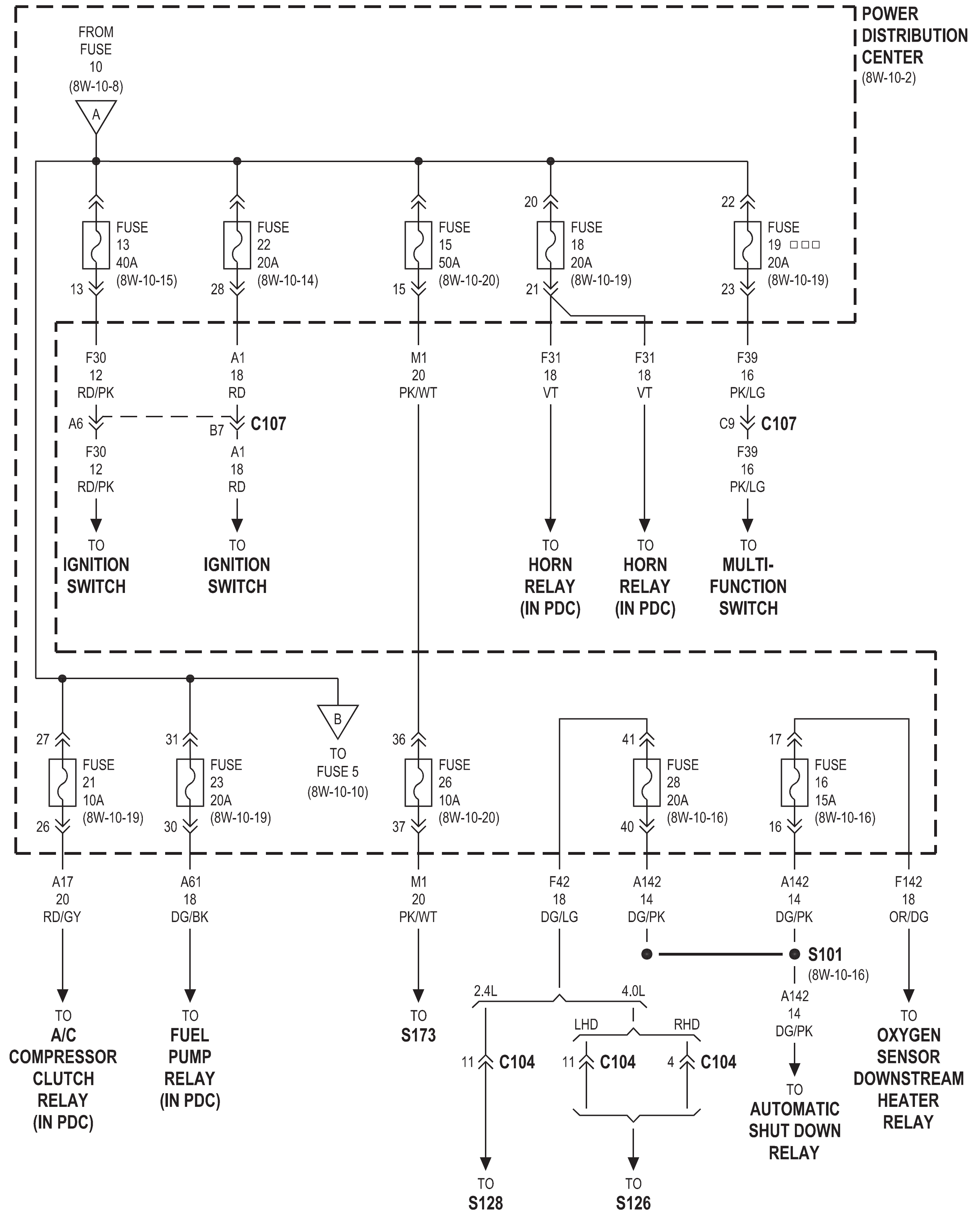
CAVITY	CIRCUIT	FUNCTION
C1	A4 12BK/PK	FUSED B(+)
C2	C81 20LB/WT	REAR WINDOW DEFOGGER RELAY CONTROL
C3	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
C4	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
C5	-	-

TRANSMISSION CONTROL RELAY

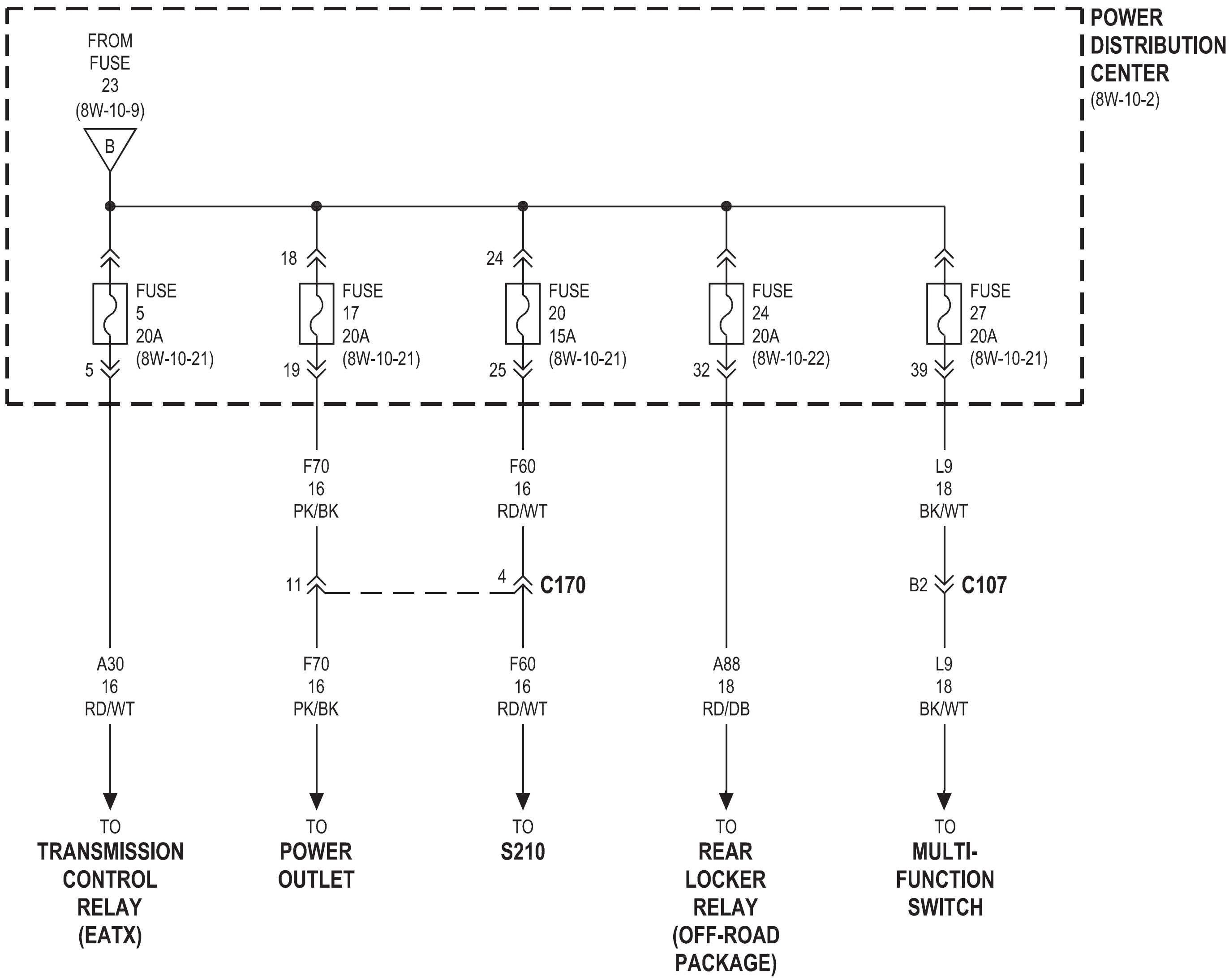
CAVITY	CIRCUIT	FUNCTION
A1	A30 16RD/WT	FUSED B(+)
	INTERNAL	FUSED B(+)
A2	K30 18PK	FUSED B(+)
A3	T16 16RD	FUSED B(+)
A4	Z1 18BK	FUSED B(+)
A5	-	-

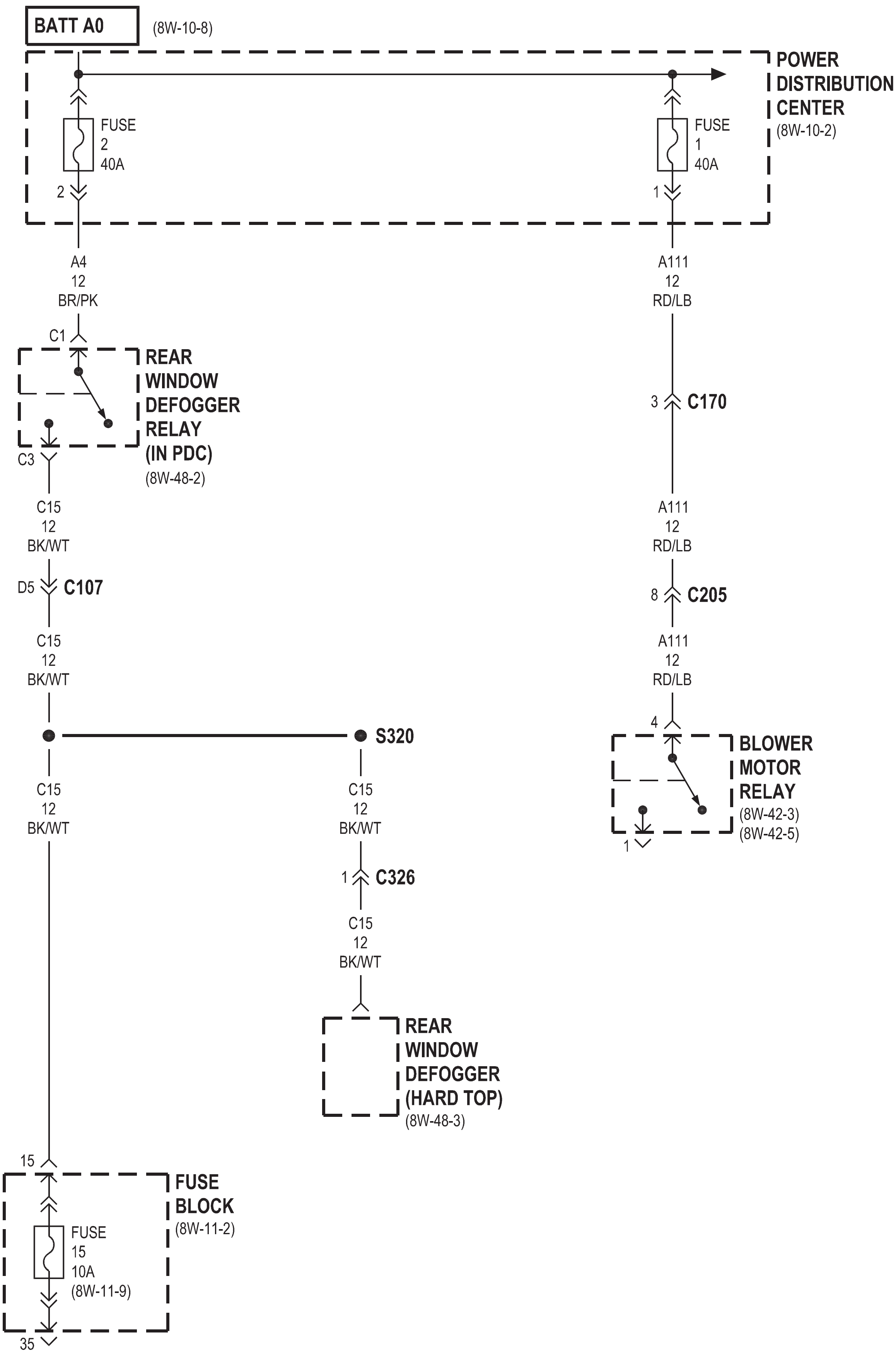


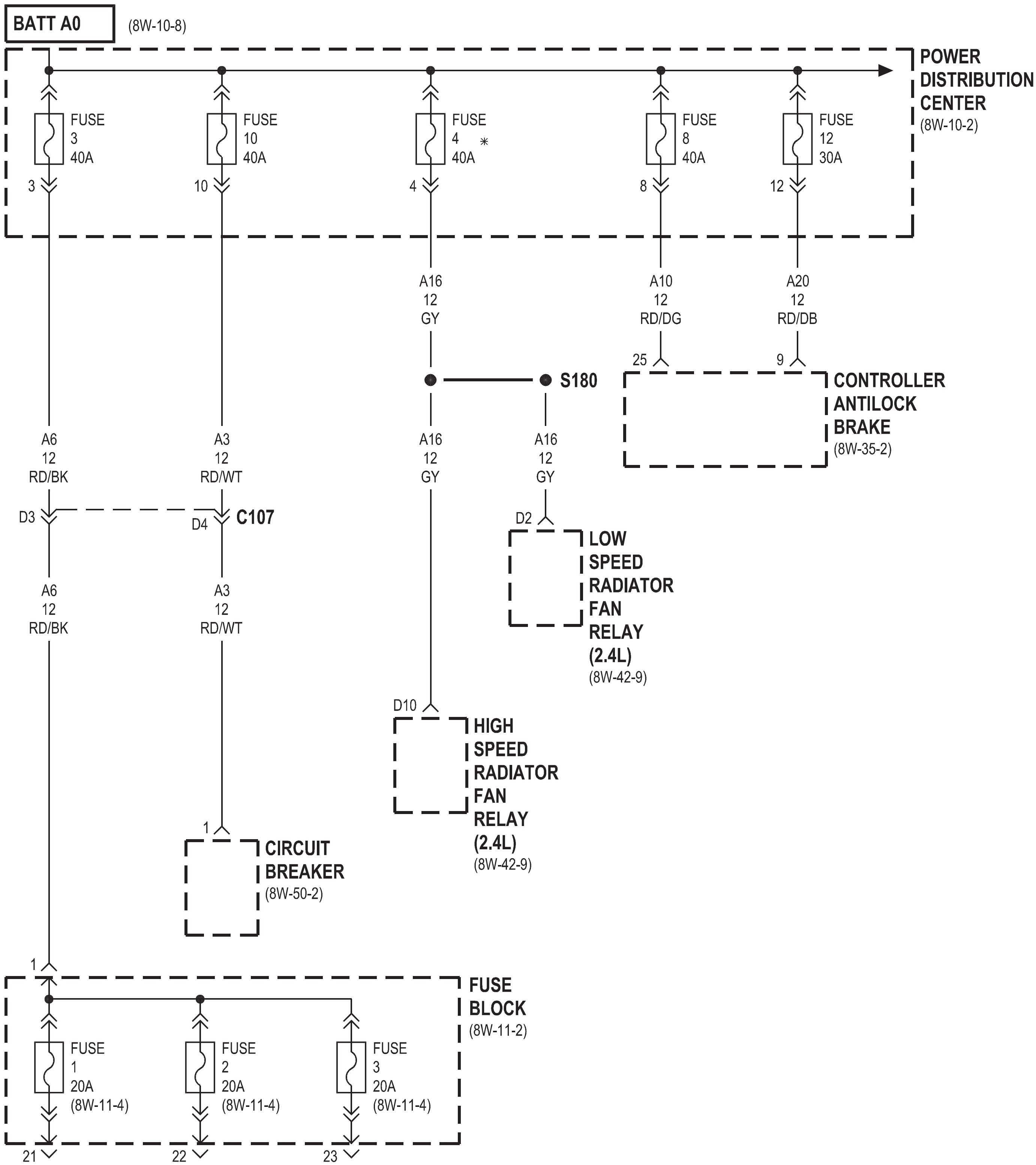
S136
FUSIBLE LINK
A11
10
DG
A0
6
RD
A0
6
RD
A11
6
RD
BATTERY
(8W-20-2)
ENGINE STARTER MOTOR
(8W-21-3)
GENERATOR
(8W-20-2)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 1 40A (8W-10-11)
FUSE 2 40A (8W-10-11)
FUSE 3 40A (8W-10-12)
FUSE 8 40A (8W-10-12)
FUSE 12 30A (8W-10-12)
C170
A111 12 RD/LB
A4 12 BK/PK
A6 12 RD/BK
A10 12 RD/DG
A20 12 RD/DB
C205
C107
TO BLOWER MOTOR RELAY
TO REAR WINDOW DEFOGGER RELAY (IN PDC)
TO FUSE BLOCK
TO CONTROLLER ANTILOCK BRAKE
TO CONTROLLER ANTILOCK BRAKE
FUSE 4 40A (8W-10-12)
FUSE 6 30A (8W-10-13)
FUSE 9 30A (8W-10-16)
FUSE 10 40A (8W-10-12)
A
TO FUSE 13 (8W-10-9)
A14 14 RD/WT
A3 12 RD/WT
C104
C107
A14 14 RD/WT
A3 12 RD/WT
A16 12 GY
A2 14 PK/BK
A14 14 RD/WT
TO S180
TO S111
TO AUTOMATIC SHUT DOWN RELAY (IN PDC)
TO POWERTRAIN CONTROL MODULE
TO CIRCUIT BREAKER



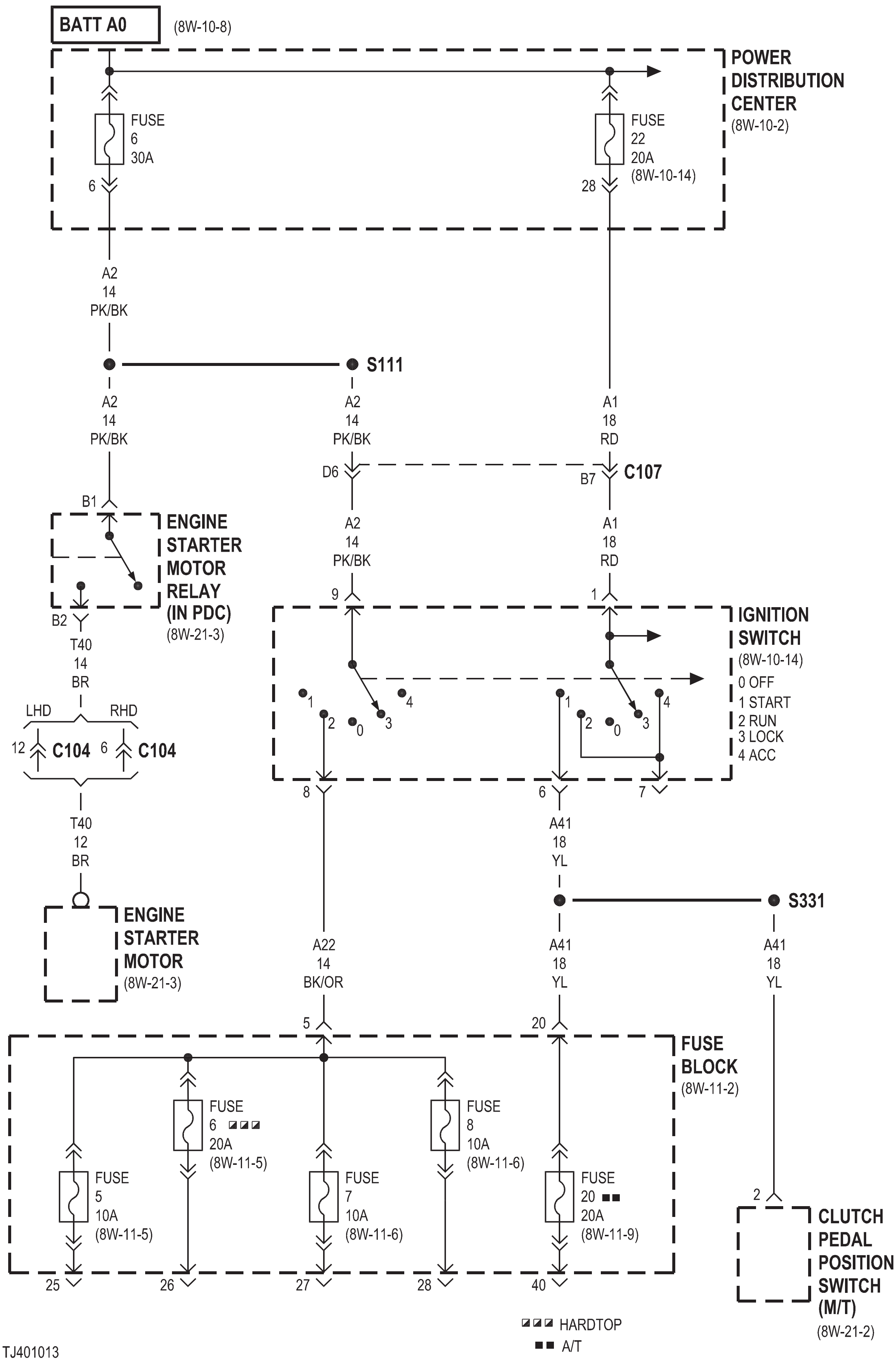
□□□ FRONT FOG LAMPS

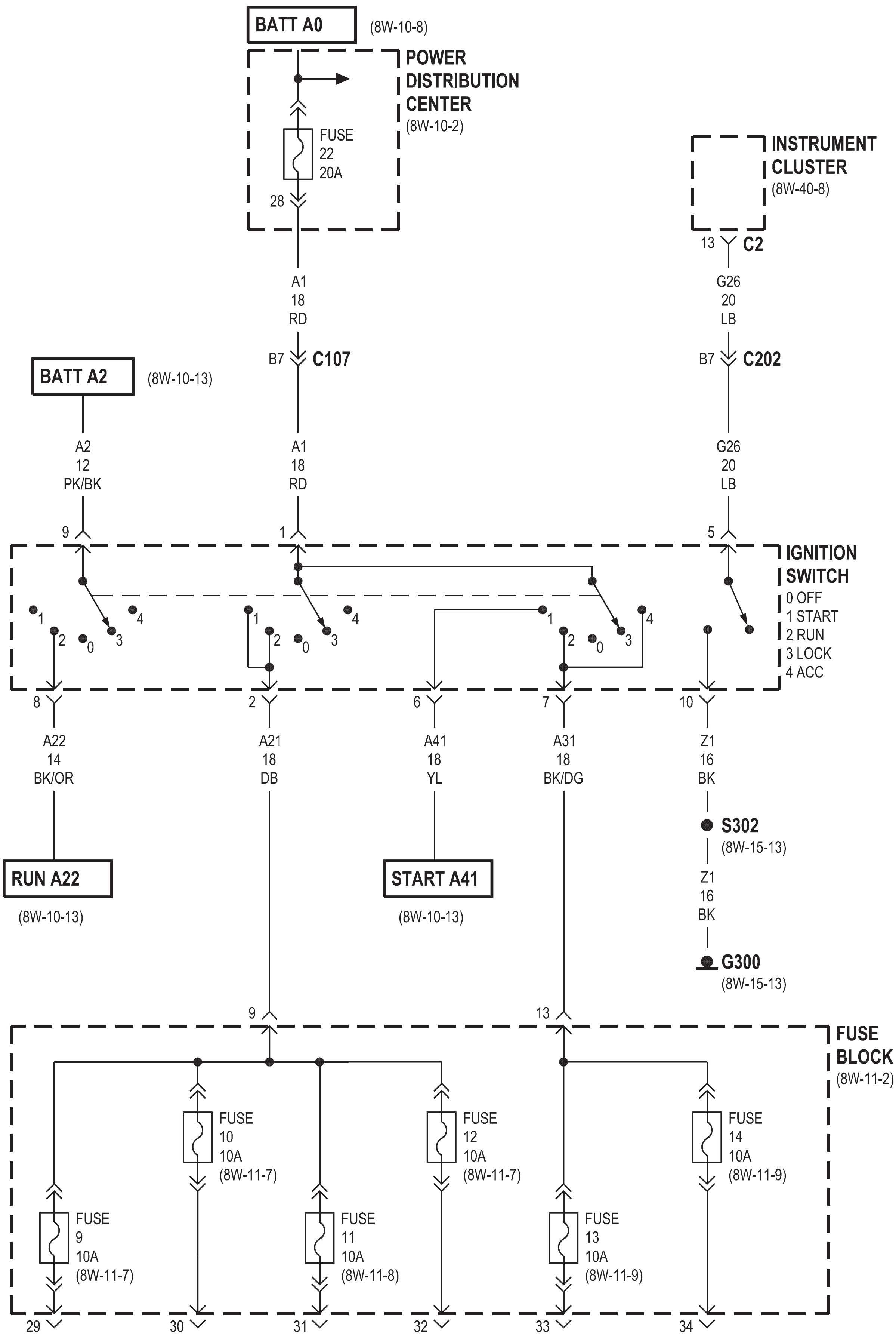

POWER
DISTRIBUTION
CENTER
(8W-10-2)
FROM
FUSE
23
(8W-10-9)
B
FUSE
5
20A
(8W-10-21)
5
18
FUSE
17
20A
(8W-10-21)
19
24
FUSE
20
15A
(8W-10-21)
25
FUSE
24
20A
(8W-10-22)
32
FUSE
27
20A
(8W-10-21)
39
F70
16
PK/BK
F60
16
RD/WT
L9
18
BK/WT
11
4
C170
B2
C107
A30
16
RD/WT
F70
16
PK/BK
F60
16
RD/WT
A88
18
RD/DB
L9
18
BK/WT
TO
TRANSMISSION
CONTROL
RELAY
(EATX)
TO
POWER
OUTLET
TO
S210
TO
REAR
LOCKER
RELAY
(OFF-ROAD
PACKAGE)
TO
MULTI-
FUNCTION
SWITCH

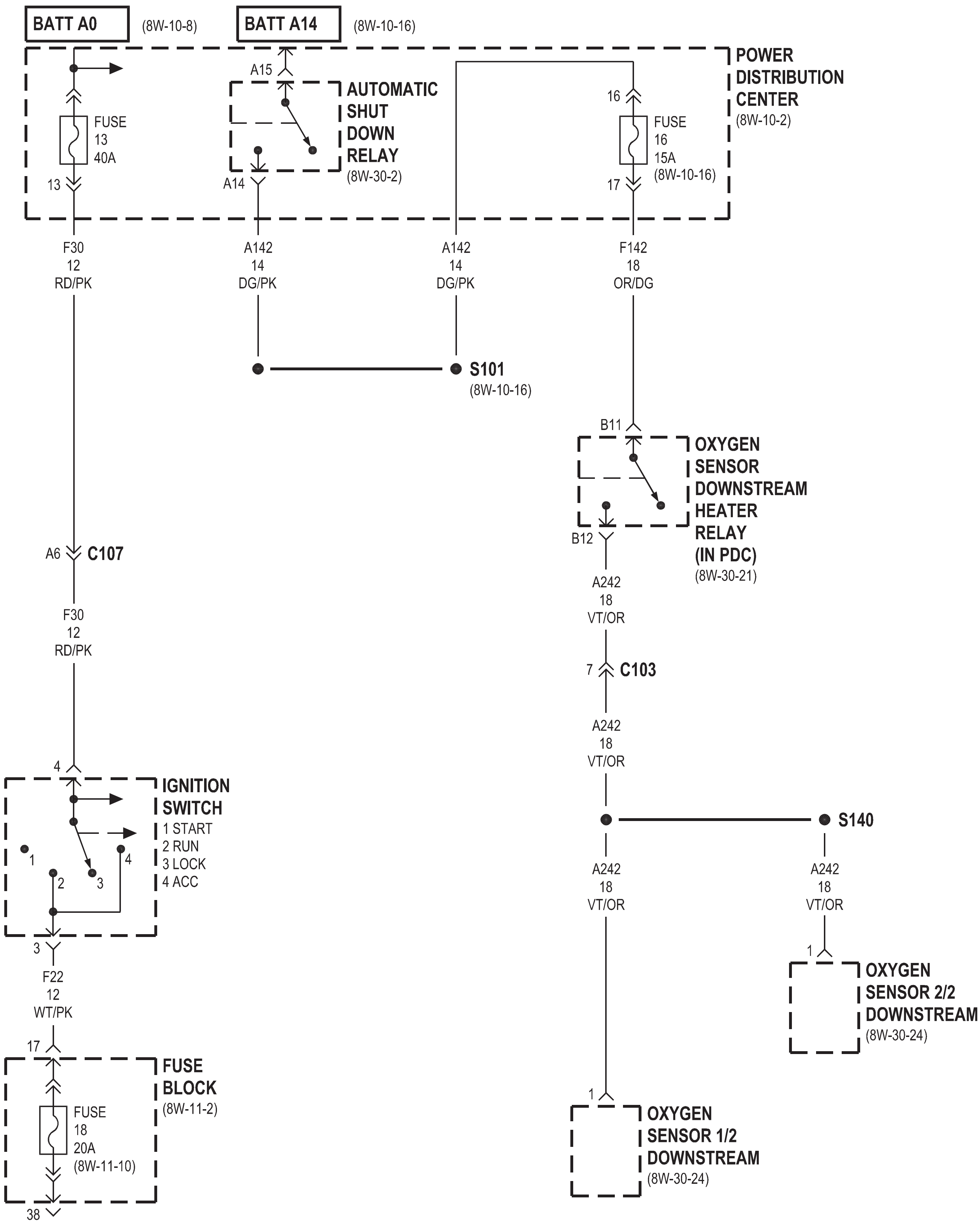

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
2
40A
2
FUSE
1
40A
1
A4
12
BR/PK
A111
12
RD/LB
C1
REAR
WINDOW
DEFOGGER
RELAY
(IN PDC)
(8W-48-2)
C3
3
C170
C15
12
BK/WT
A111
12
RD/LB
D5
C107
8
C205
C15
12
BK/WT
A111
12
RD/LB
4
S320
BLOWER
MOTOR
RELAY
(8W-42-3)
(8W-42-5)
1
C15
12
BK/WT
C15
12
BK/WT
1
C326
C15
12
BK/WT
REAR
WINDOW
DEFOGGER
(HARD TOP)
(8W-48-3)
15
FUSE
BLOCK
(8W-11-2)
FUSE
15
10A
(8W-11-9)
35

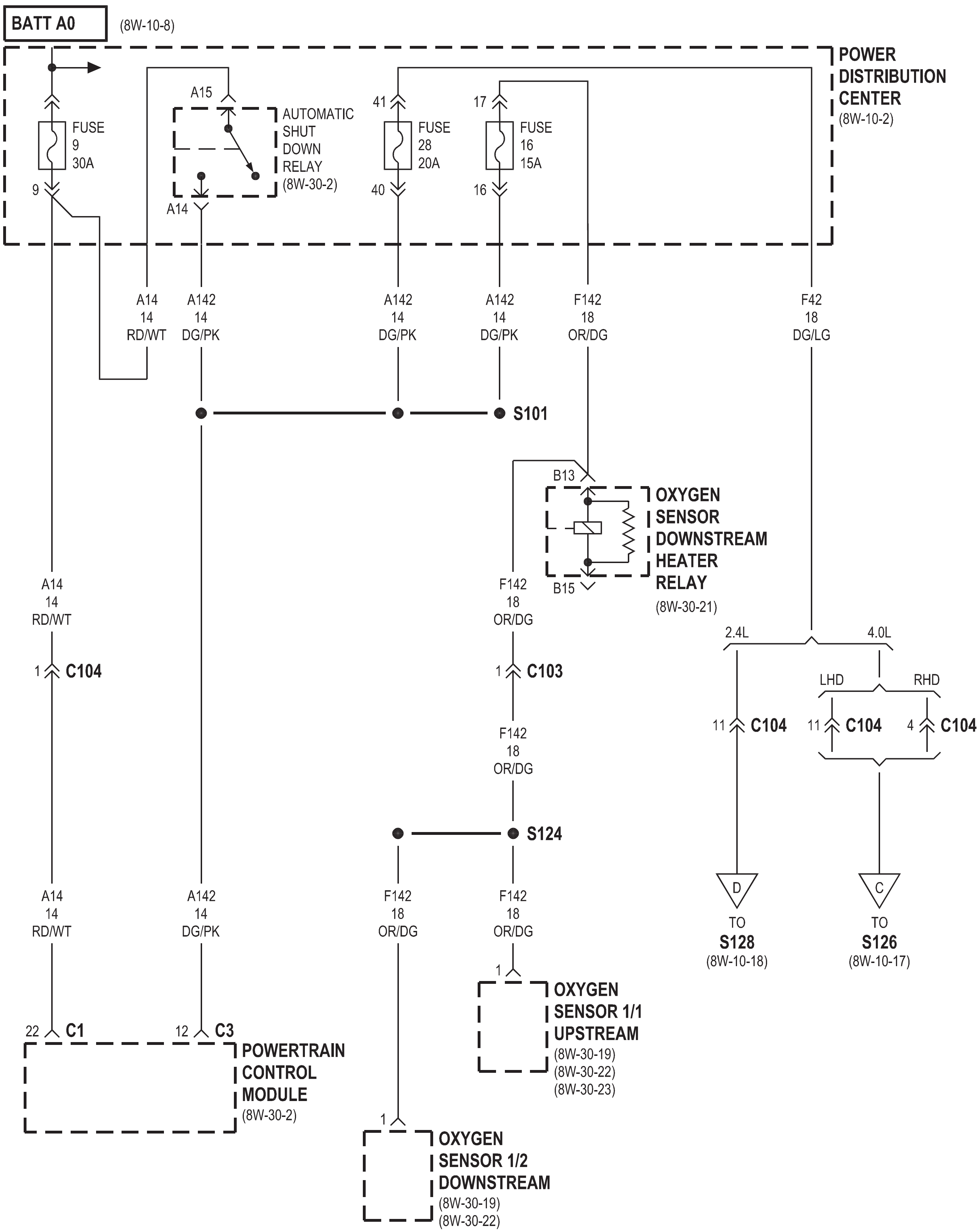

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 40A
FUSE 10 40A
FUSE 4 40A ✳
FUSE 8 40A
FUSE 12 30A
3
10
4
8
12
A16 12 GY
A10 12 RD/DG
A20 12 RD/DB
25
9
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
S180
A6 12 RD/BK
A3 12 RD/WT
A16 12 GY
A16 12 GY
D3
D4
C107
D2
LOW SPEED RADIATOR FAN RELAY (2.4L)
(8W-42-9)
A6 12 RD/BK
A3 12 RD/WT
D10
HIGH SPEED RADIATOR FAN RELAY (2.4L)
(8W-42-9)
1
CIRCUIT BREAKER
(8W-50-2)
1
FUSE BLOCK
(8W-11-2)
FUSE 1 20A (8W-11-4)
FUSE 2 20A (8W-11-4)
FUSE 3 20A (8W-11-4)
21
22
23

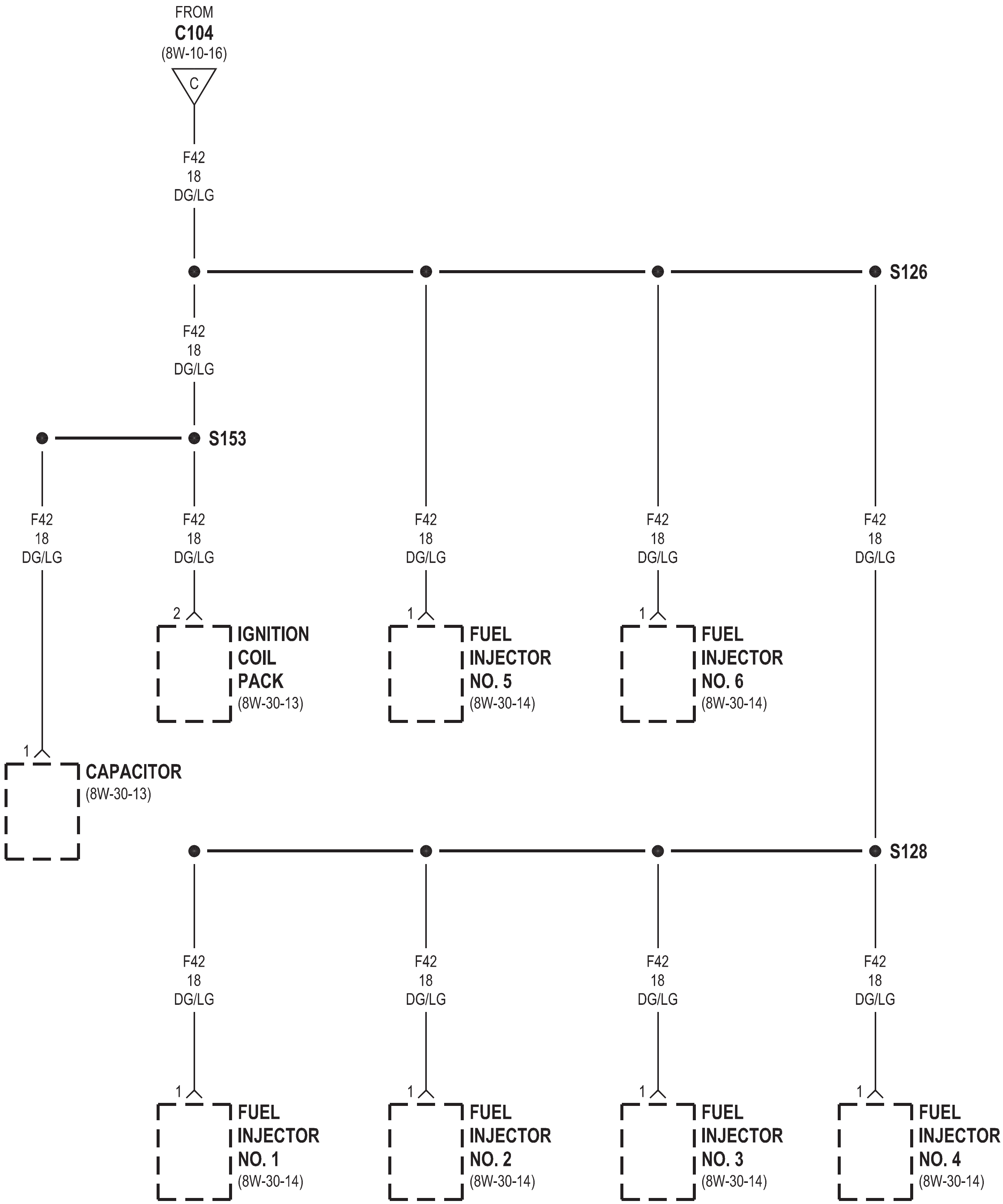
✳ 2.4L

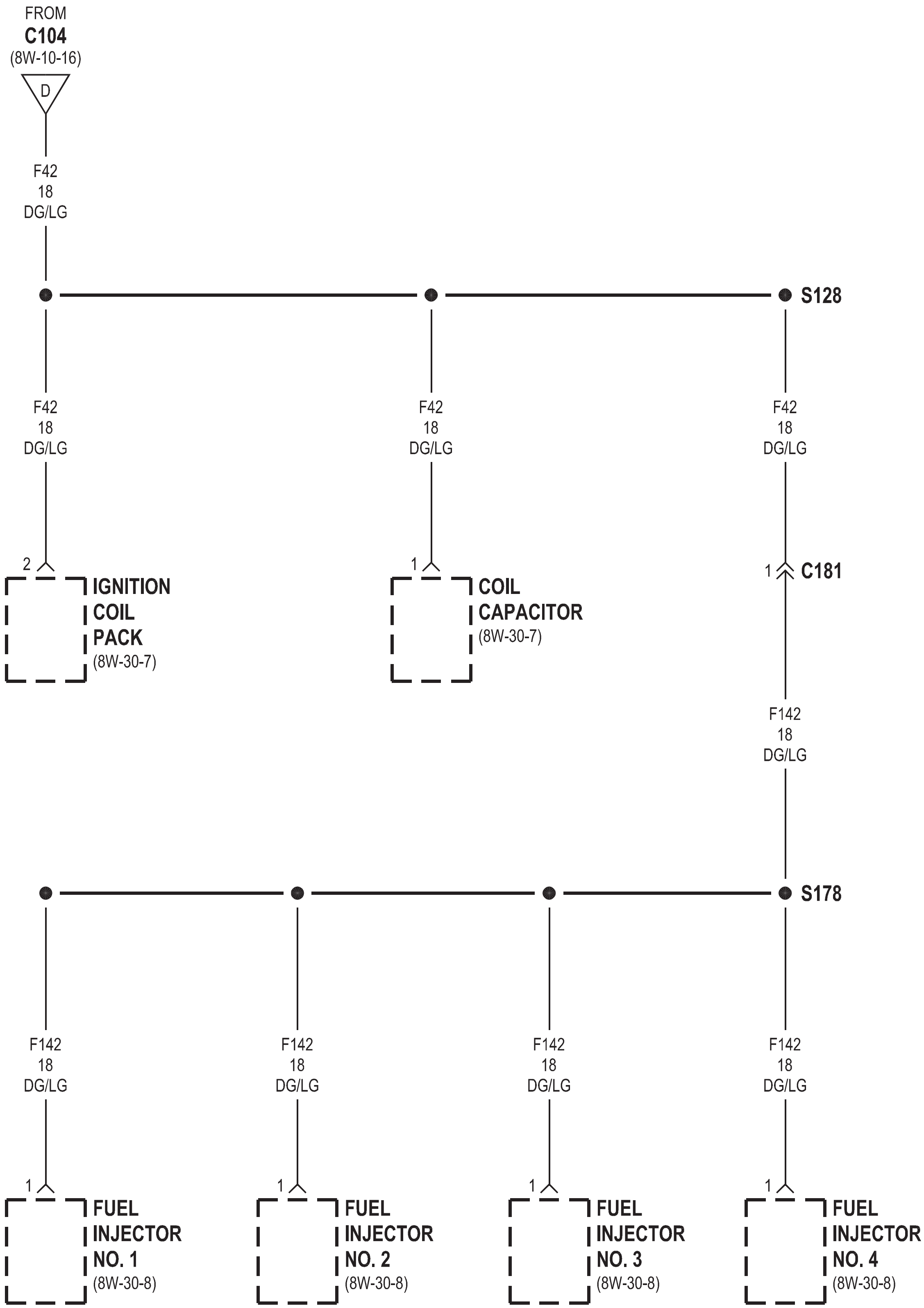

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A
6
FUSE 22 20A (8W-10-14)
28
A2 14 PK/BK
S111
A2 14 PK/BK
A2 14 PK/BK
A1 18 RD
D6
B7
C107
A2 14 PK/BK
A1 18 RD
B1
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
B2
T40 14 BR
LHD
RHD
12 C104
6 C104
T40 12 BR
ENGINE STARTER MOTOR
(8W-21-3)
9
1
IGNITION SWITCH
(8W-10-14)
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
8
6
7
A41 18 YL
S331
A22 14 BK/OR
A41 18 YL
A41 18 YL
5
20
FUSE BLOCK
(8W-11-2)
FUSE 6 20A (8W-11-5)
FUSE 8 10A (8W-11-6)
FUSE 5 10A (8W-11-5)
FUSE 7 10A (8W-11-6)
FUSE 20 20A (8W-11-9)
25
26
27
28
40
2
CLUTCH PEDAL POSITION SWITCH (M/T)
(8W-21-2)
HARDTOP
A/T

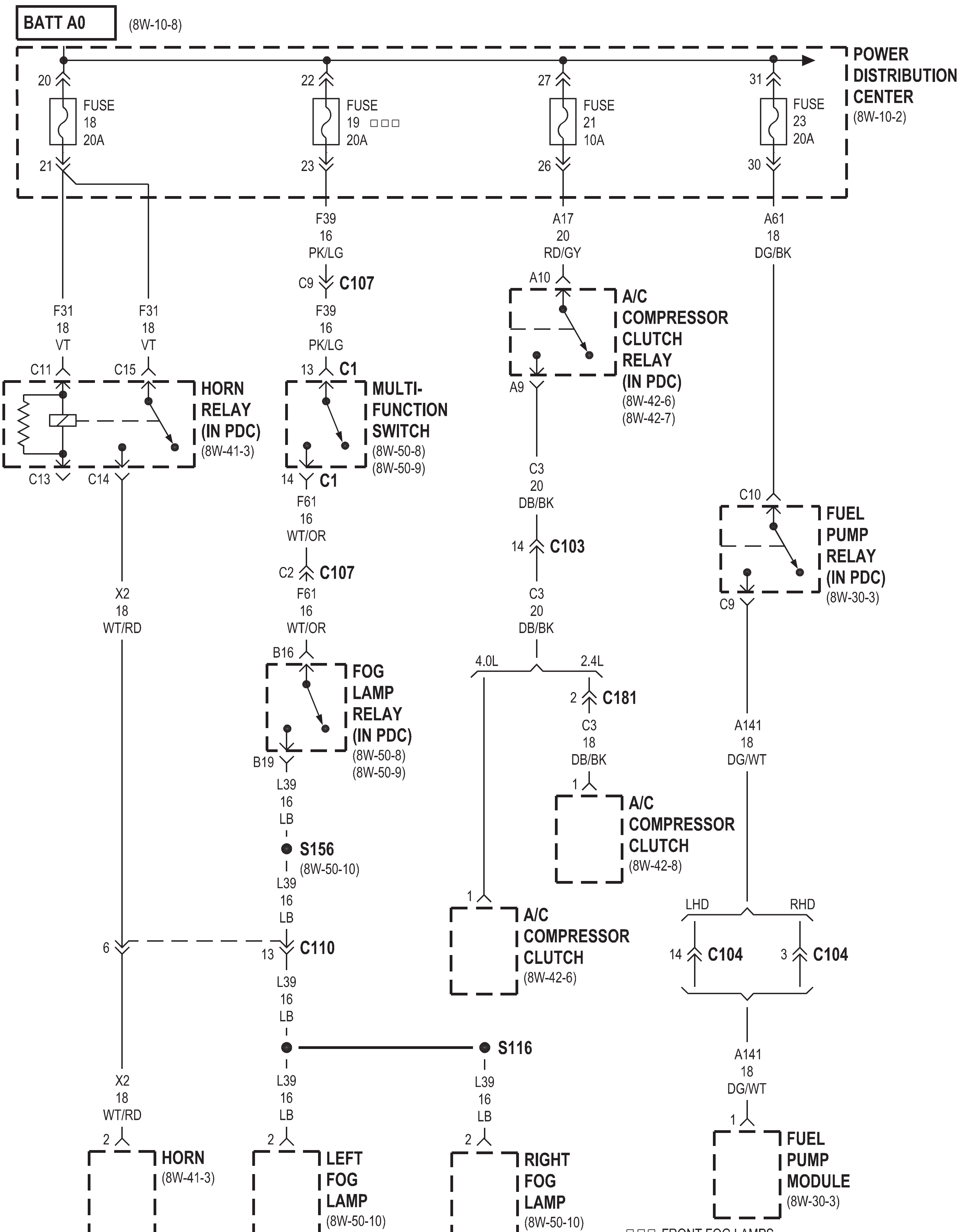

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
22
20A
28
A1
18
RD
B7
C107
INSTRUMENT
CLUSTER
(8W-40-8)
13
C2
G26
20
LB
B7
C202
BATT A2
(8W-10-13)
A2
12
PK/BK
9
1
5
IGNITION
SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
8
2
6
7
10
A22
14
BK/OR
A21
18
DB
A41
18
YL
A31
18
BK/DG
Z1
16
BK
S302
(8W-15-13)
G300
(8W-15-13)
RUN A22
(8W-10-13)
START A41
(8W-10-13)
9
13
FUSE
BLOCK
(8W-11-2)
FUSE
10
10A
(8W-11-7)
FUSE
12
10A
(8W-11-7)
FUSE
14
10A
(8W-11-9)
FUSE
9
10A
(8W-11-7)
FUSE
11
10A
(8W-11-8)
FUSE
13
10A
(8W-11-9)
29
30
31
32
33
34

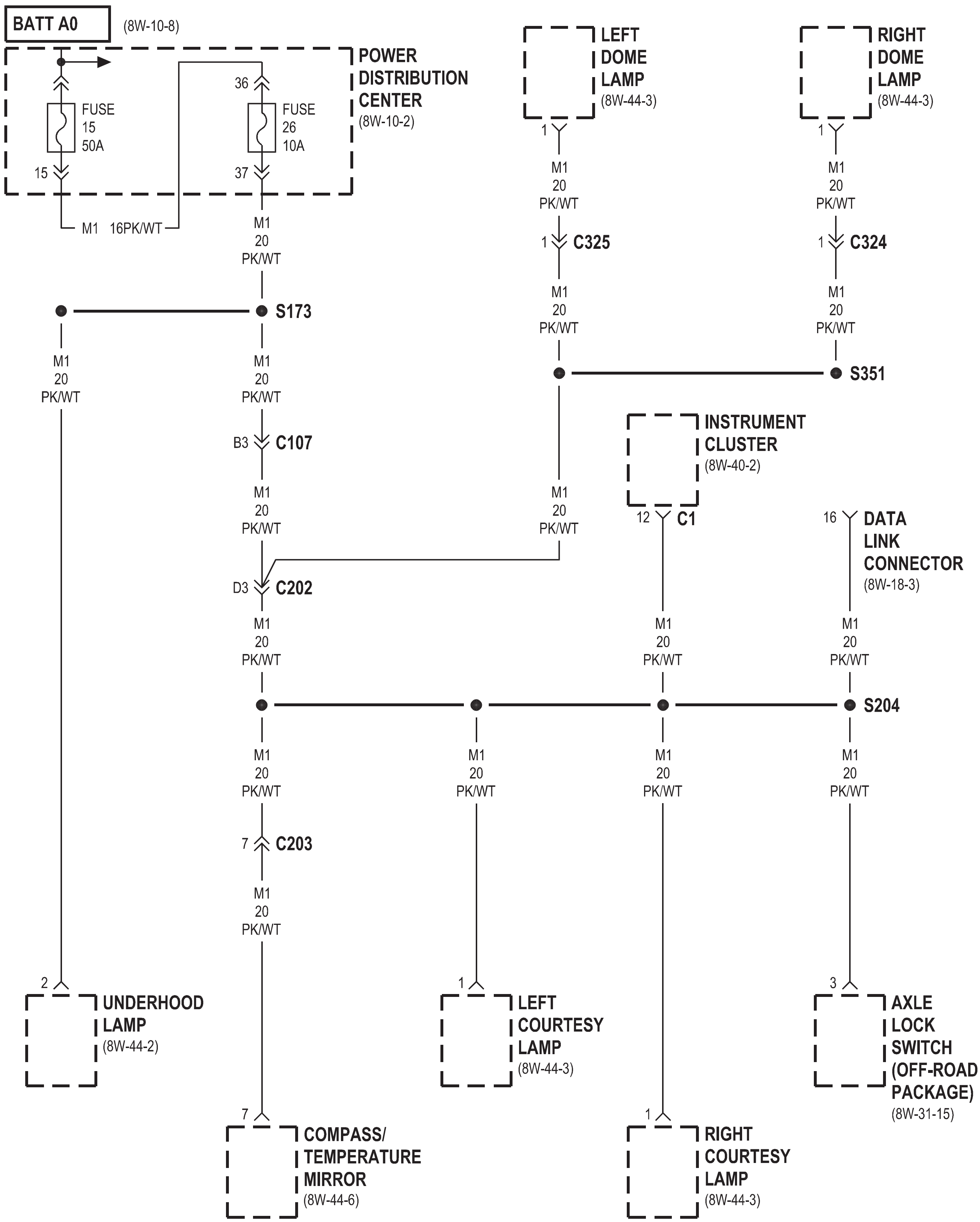

BATT A0
(8W-10-8)
BATT A14
(8W-10-16)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 13 40A
13
A15
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
A14
16
FUSE 16 15A
(8W-10-16)
17
F30 12 RD/PK
A142 14 DG/PK
A142 14 DG/PK
F142 18 OR/DG
S101
(8W-10-16)
B11
OXYGEN SENSOR DOWNSTREAM HEATER RELAY (IN PDC)
(8W-30-21)
B12
A6
C107
F30 12 RD/PK
A242 18 VT/OR
7
C103
A242 18 VT/OR
4
IGNITION SWITCH
1 START
2 RUN
3 LOCK
4 ACC
1
2
3
4
S140
A242 18 VT/OR
A242 18 VT/OR
3
F22 12 WT/PK
1
OXYGEN SENSOR 2/2 DOWNSTREAM
(8W-30-24)
17
FUSE BLOCK
(8W-11-2)
FUSE 18 20A
(8W-11-10)
38
1
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-24)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 9 30A
A15
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
A14
41
FUSE 28 20A
40
17
FUSE 16 15A
16
9
A14 14 RD/WT
A142 14 DG/PK
A142 14 DG/PK
A142 14 DG/PK
F142 18 OR/DG
F42 18 DG/LG
S101
B13
OXYGEN SENSOR DOWNSTREAM HEATER RELAY
(8W-30-21)
B15
A14 14 RD/WT
F142 18 OR/DG
2.4L
4.0L
1 C104
1 C103
LHD
RHD
11 C104
11 C104
4 C104
F142 18 OR/DG
S124
D
TO S128
(8W-10-18)
C
TO S126
(8W-10-17)
A14 14 RD/WT
A142 14 DG/PK
F142 18 OR/DG
F142 18 OR/DG
1
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-19)
(8W-30-22)
(8W-30-23)
22 C1
12 C3
POWERTRAIN CONTROL MODULE
(8W-30-2)
1
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-19)
(8W-30-22)

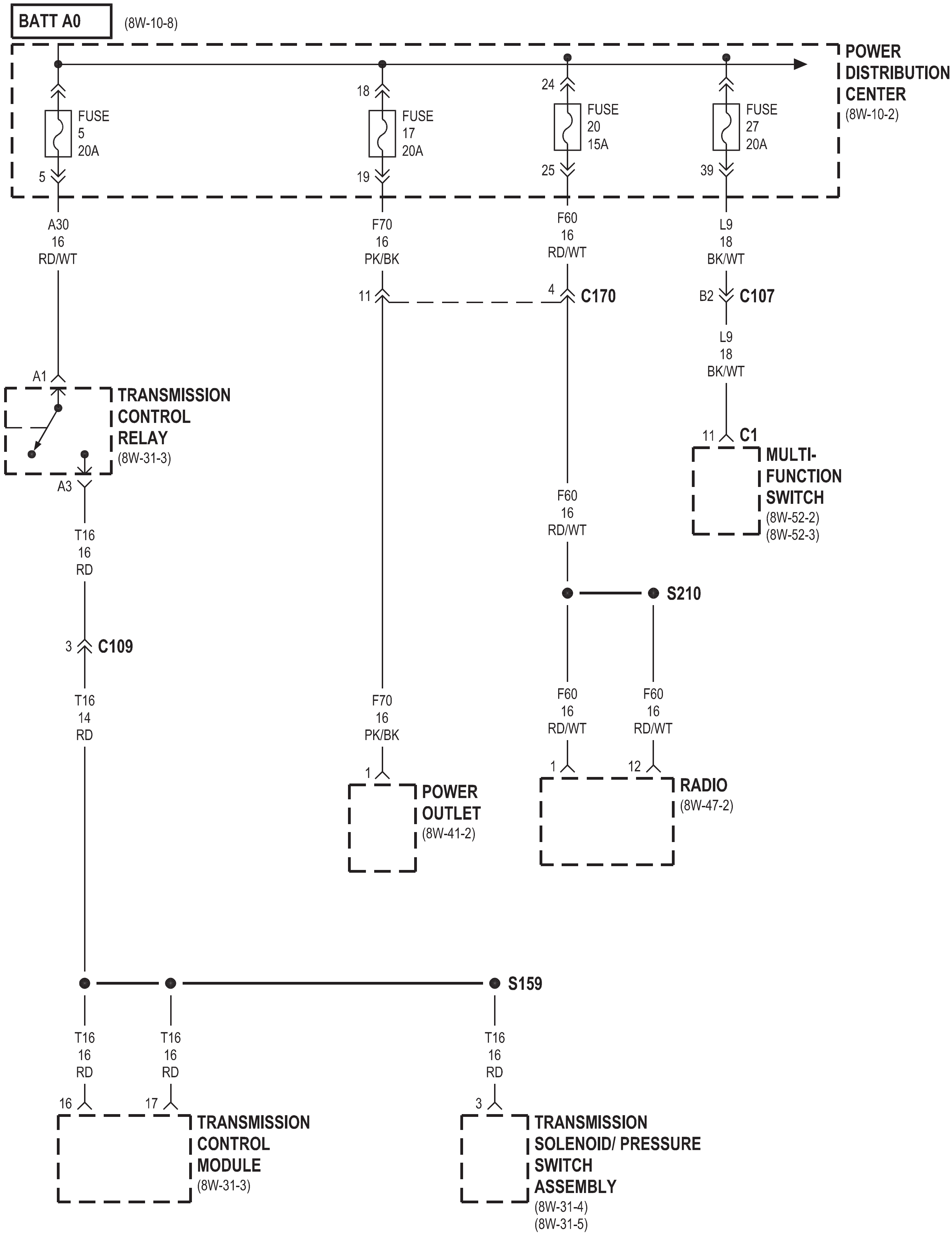

FROM
C104
(8W-10-16)
C
F42
18
DG/LG
S126
S153
S128
IGNITION COIL PACK
(8W-30-13)
FUEL INJECTOR NO. 5
(8W-30-14)
FUEL INJECTOR NO. 6
(8W-30-14)
CAPACITOR
(8W-30-13)
FUEL INJECTOR NO. 1
(8W-30-14)
FUEL INJECTOR NO. 2
(8W-30-14)
FUEL INJECTOR NO. 3
(8W-30-14)
FUEL INJECTOR NO. 4
(8W-30-14)

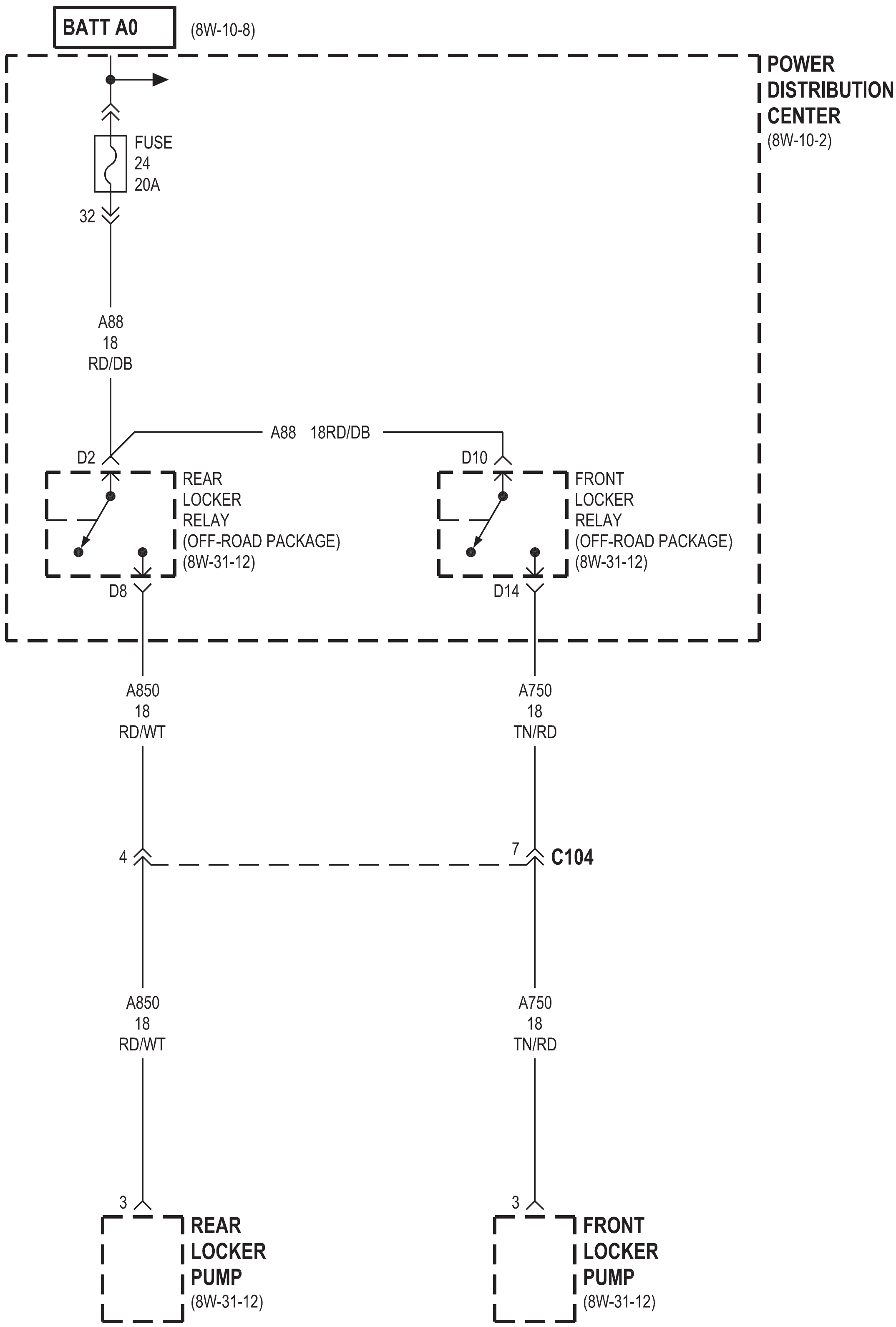

FROM
C104
(8W-10-16)
D
F42
18
DG/LG
S128
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
2
IGNITION
COIL
PACK
(8W-30-7)
1
COIL
CAPACITOR
(8W-30-7)
1
C181
F142
18
DG/LG
S178
F142
18
DG/LG
F142
18
DG/LG
F142
18
DG/LG
F142
18
DG/LG
1
FUEL
INJECTOR
NO. 1
(8W-30-8)
1
FUEL
INJECTOR
NO. 2
(8W-30-8)
1
FUEL
INJECTOR
NO. 3
(8W-30-8)
1
FUEL
INJECTOR
NO. 4
(8W-30-8)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
20
FUSE 18 20A
21
22
FUSE 19 □□□ 20A
23
27
FUSE 21 10A
26
31
FUSE 23 20A
30
F39 16 PK/LG
A17 20 RD/GY
A61 18 DG/BK
C9
C107
F39 16 PK/LG
A10
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-6)
(8W-42-7)
A9
F31 18 VT
F31 18 VT
C11
C15
HORN RELAY (IN PDC)
(8W-41-3)
C13
C14
13
C1
MULTI-FUNCTION SWITCH
(8W-50-8)
(8W-50-9)
14
C1
F61 16 WT/OR
C2
C107
F61 16 WT/OR
C3 20 DB/BK
14
C103
C3 20 DB/BK
C10
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
C9
X2 18 WT/RD
B16
FOG LAMP RELAY (IN PDC)
(8W-50-8)
(8W-50-9)
B19
L39 16 LB
S156
(8W-50-10)
L39 16 LB
4.0L
2.4L
2
C181
C3 18 DB/BK
1
A/C COMPRESSOR CLUTCH
(8W-42-8)
A141 18 DG/WT
1
A/C COMPRESSOR CLUTCH
(8W-42-6)
LHD
RHD
6
13
C110
14
C104
3
C104
L39 16 LB
S116
X2 18 WT/RD
L39 16 LB
L39 16 LB
A141 18 DG/WT
2
HORN
(8W-41-3)
2
LEFT FOG LAMP
(8W-50-10)
2
RIGHT FOG LAMP
(8W-50-10)
1
FUEL PUMP MODULE
(8W-30-3)
□□□ FRONT FOG LAMPS

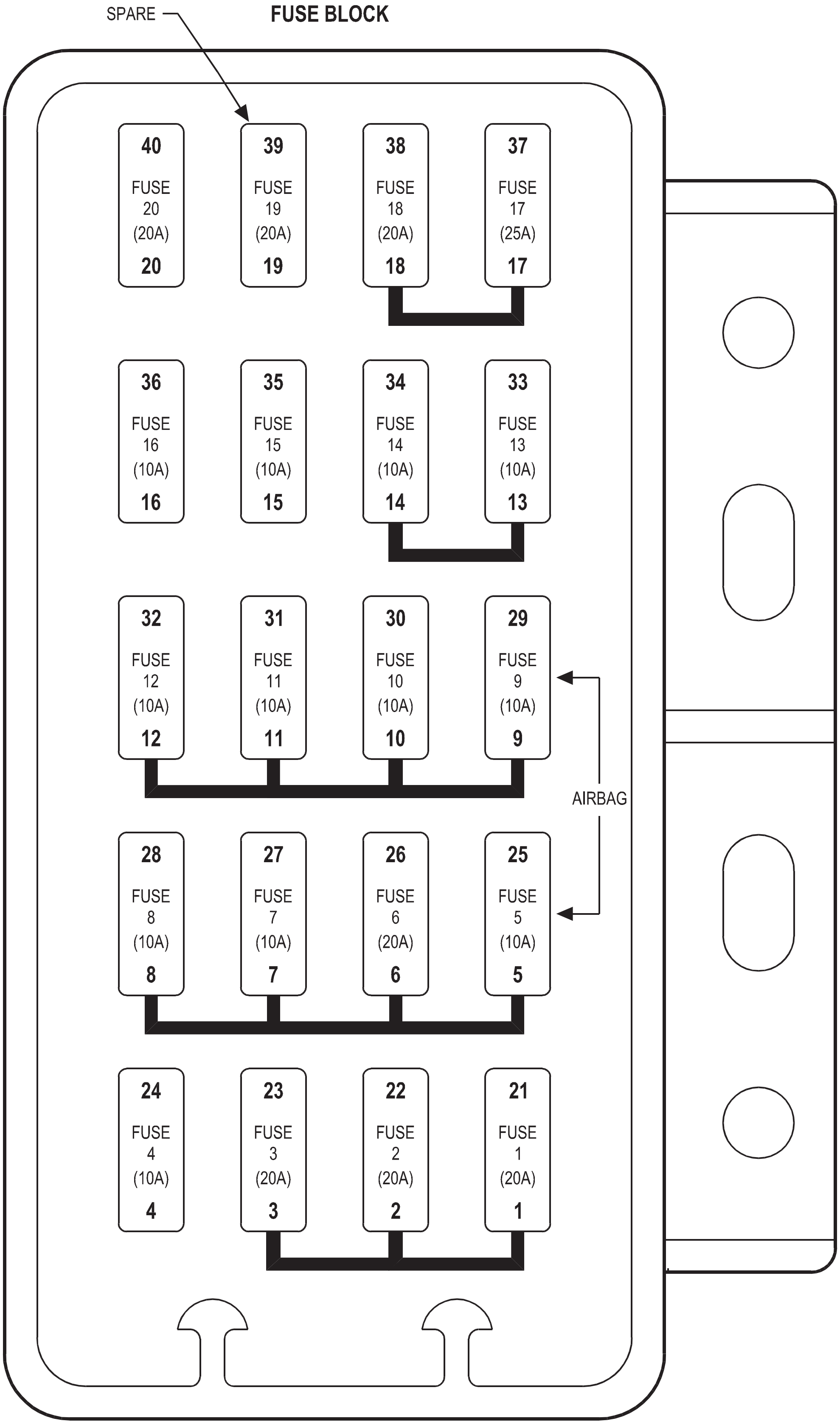


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 15 50A
FUSE 26 10A
36
37
15
M1 16PK/WT
M1 20 PK/WT
S173
C107
B3
C202
D3
C203
7
LEFT DOME LAMP
(8W-44-3)
RIGHT DOME LAMP
(8W-44-3)
C325
C324
S351
INSTRUMENT CLUSTER
(8W-40-2)
12
C1
16
DATA LINK CONNECTOR
(8W-18-3)
S204
UNDERHOOD LAMP
(8W-44-2)
LEFT COURTESY LAMP
(8W-44-3)
AXLE LOCK SWITCH (OFF-ROAD PACKAGE)
(8W-31-15)
COMPASS/ TEMPERATURE MIRROR
(8W-44-6)
RIGHT COURTESY LAMP
(8W-44-3)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 5 20A
FUSE 17 20A
FUSE 20 15A
FUSE 27 20A
5
18
19
24
25
39
A30 16 RD/WT
F70 16 PK/BK
F60 16 RD/WT
L9 18 BK/WT
11
4
C170
B2
C107
L9 18 BK/WT
A1
TRANSMISSION CONTROL RELAY
(8W-31-3)
A3
T16 16 RD
3
C109
T16 14 RD
11
C1
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-52-3)
F60 16 RD/WT
S210
F70 16 PK/BK
F60 16 RD/WT
F60 16 RD/WT
1
POWER OUTLET
(8W-41-2)
1
12
RADIO
(8W-47-2)
S159
T16 16 RD
T16 16 RD
T16 16 RD
16
17
3
TRANSMISSION CONTROL MODULE
(8W-31-3)
TRANSMISSION SOLENOID/ PRESSURE SWITCH ASSEMBLY
(8W-31-4)
(8W-31-5)


BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
24
20A
32
A88
18
RD/DB
A88 18RD/DB
D2
D10
REAR
LOCKER
RELAY
(OFF-ROAD PACKAGE)
(8W-31-12)
FRONT
LOCKER
RELAY
(OFF-ROAD PACKAGE)
(8W-31-12)
D8
D14
A850
18
RD/WT
A750
18
TN/RD
4
7
C104
A850
18
RD/WT
A750
18
TN/RD
3
3
REAR
LOCKER
PUMP
(8W-31-12)
FRONT
LOCKER
PUMP
(8W-31-12)

8W-11 FUSE BLOCK

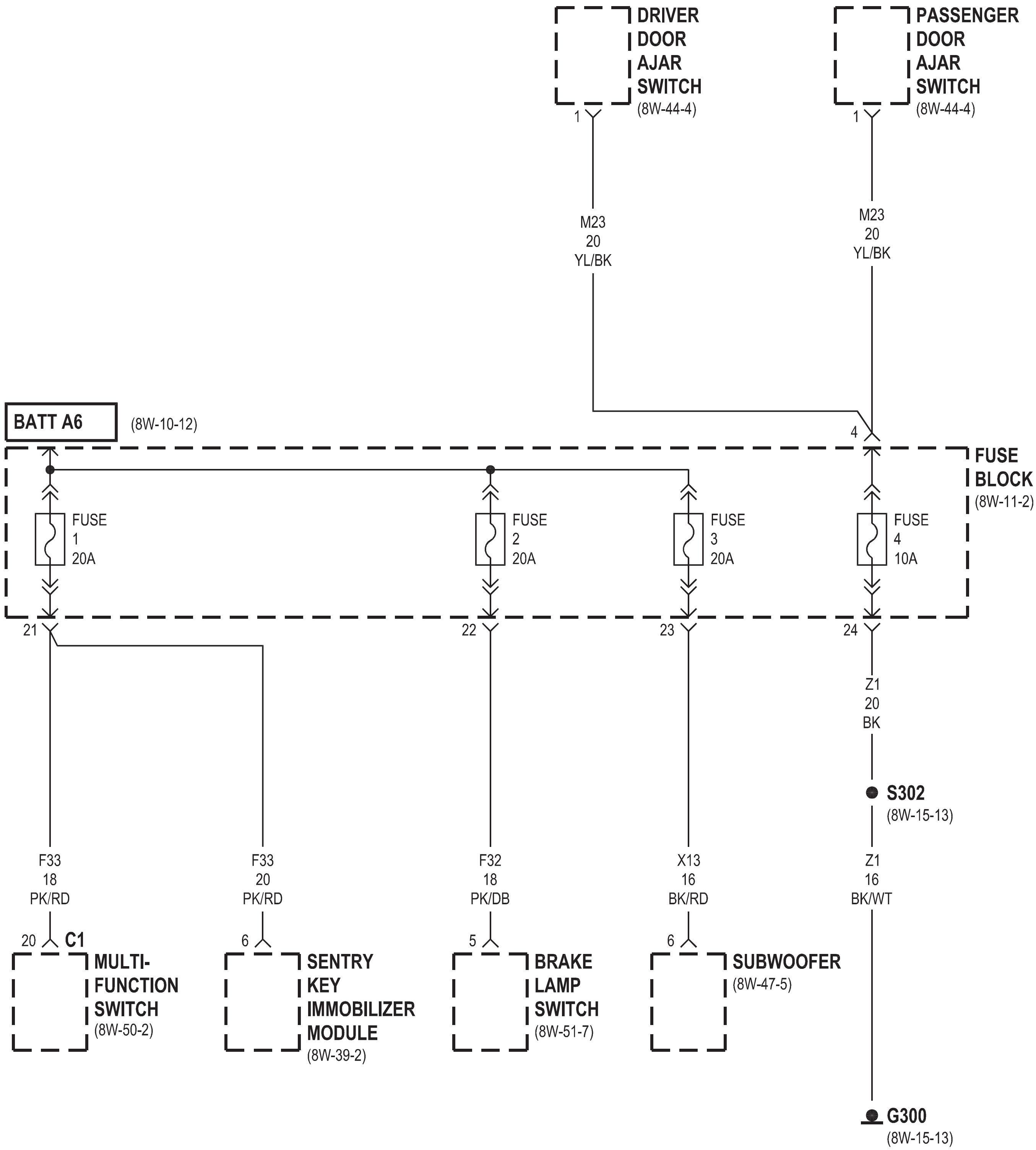


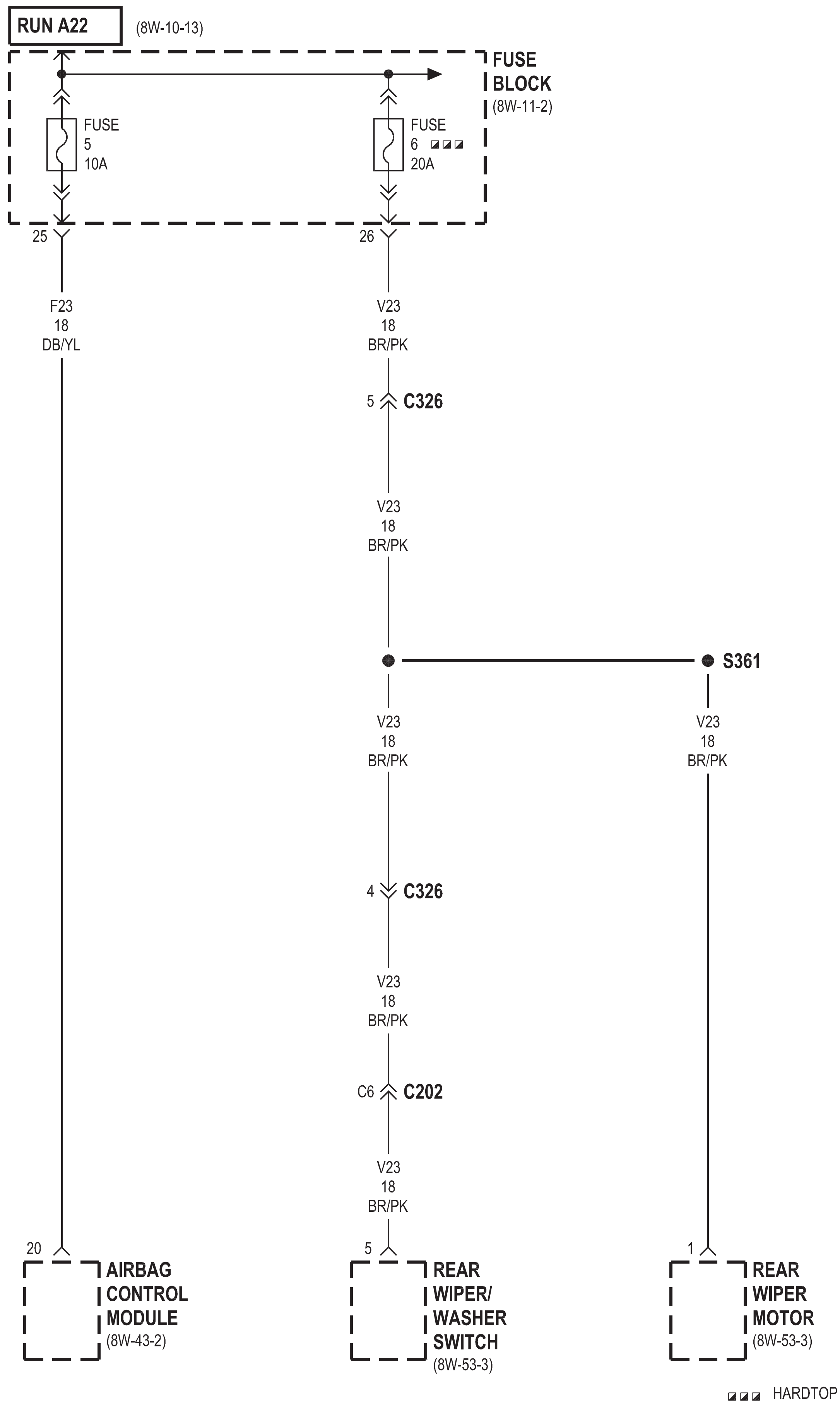
J048W-5 TJ401102

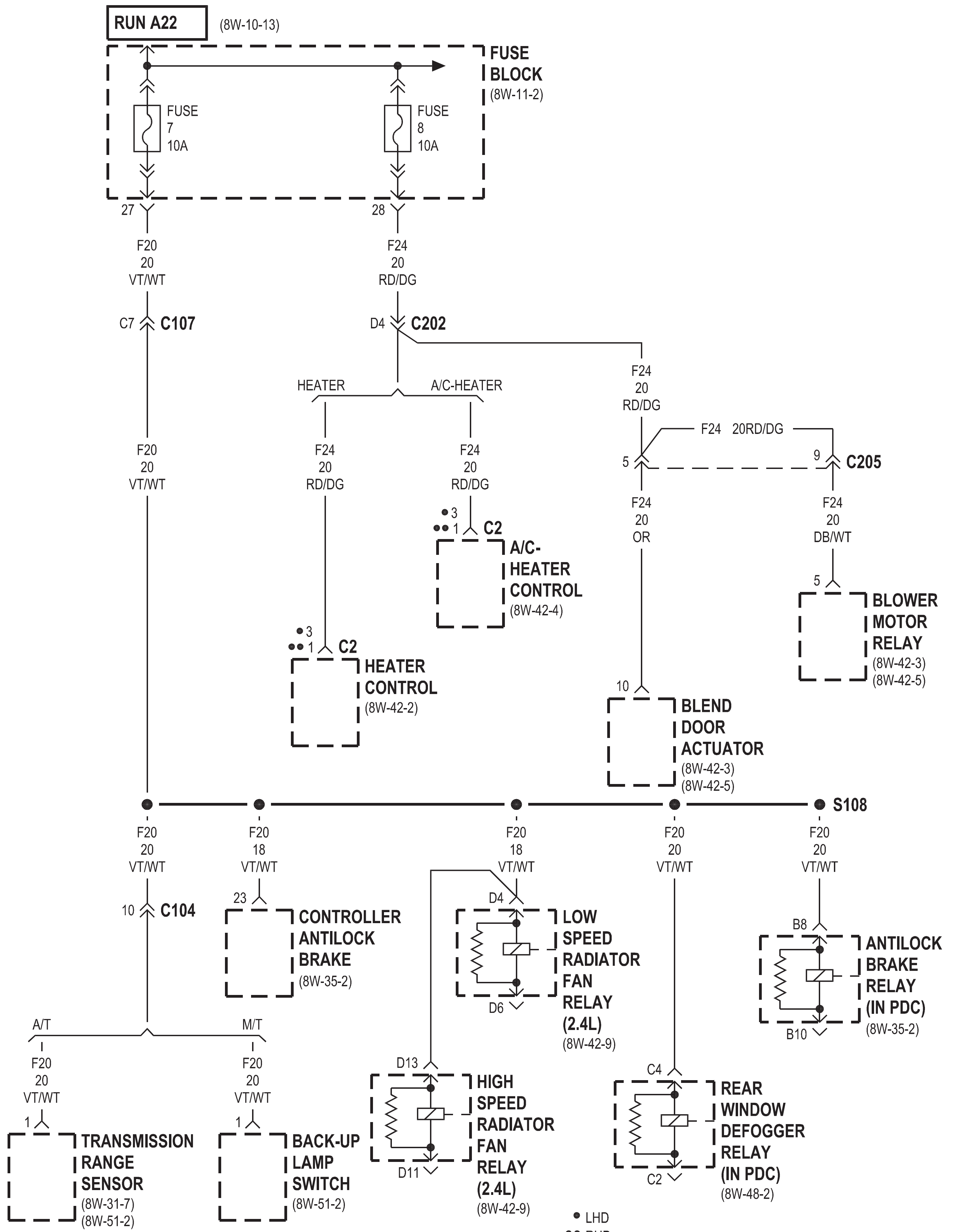
FUSES

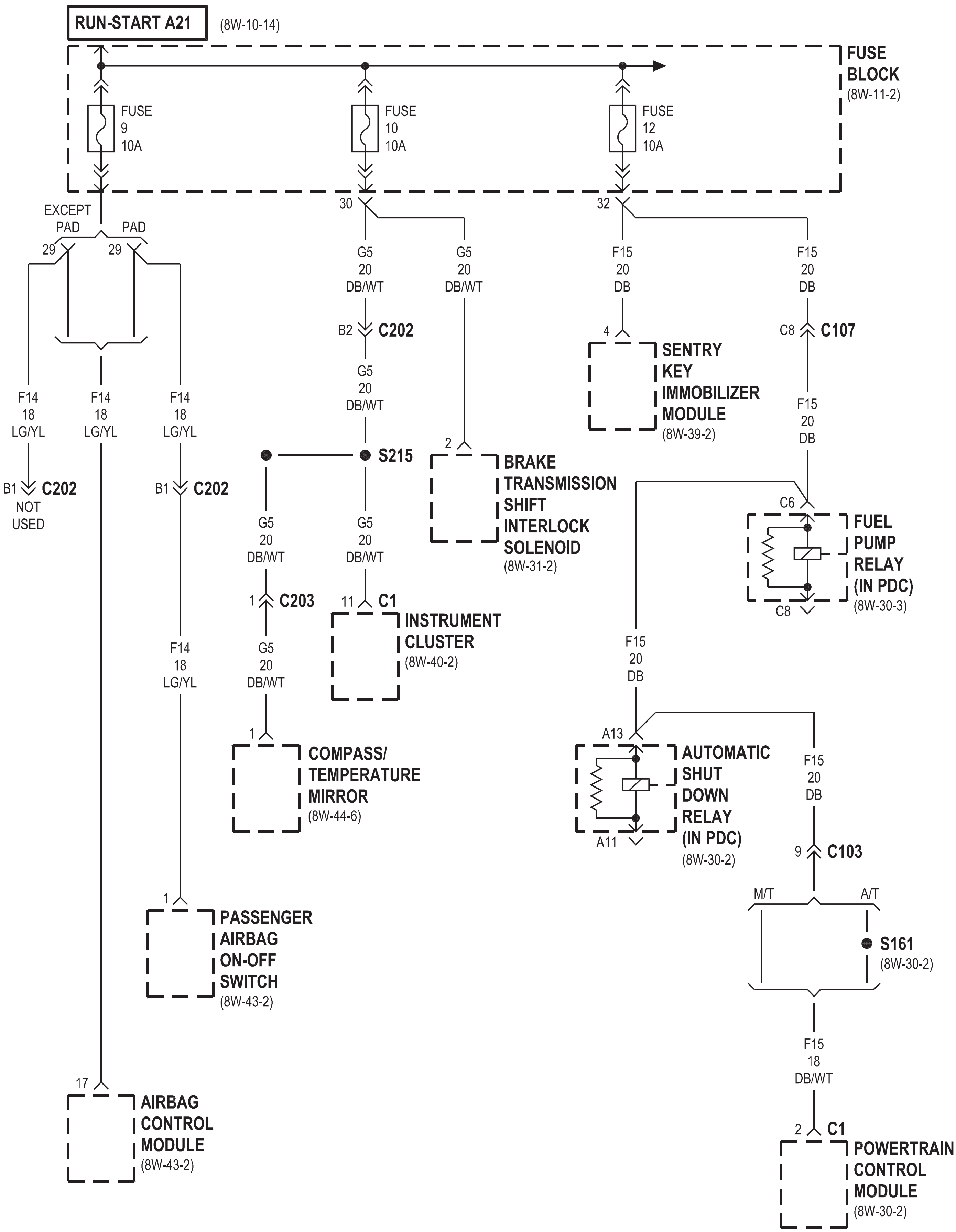
FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	20A	F33 18PK/RD	FUSED B(+)
		F33 20PK/RD	FUSED B(+)
2	20A	F32 18PK/DB	FUSED B(+)
3	20A	X13 16BK/RD △△△	FUSED B(+)
4	10A	Z1 20BK	DOOR AJAR SWITCH OUTPUT
5	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
6	20A	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
7	10A	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
8	10A	F24 20RD/DG ◪◪◪	FUSED IGNITION SWITCH OUTPUT (RUN)
9	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
		F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
10	10A	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
		G5 20DB/WT	
11	10A	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	10A	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
		F15 20DB	
13	10A	L5 20BK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
14	10A	X12 20PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
15	10A	F81 20DB/RD ◪◪◪	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	10A	L22 20LG/DG ▲▲	DIMMER SWITCH LOW BEAM OUTPUT
		L22 20LG/DG ▲▲	
17	25A	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
		V6 16PK/BK	
18	20A	F38 16LB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
19	-	-	-
20	20A	T141 18YL/RD ■■	FUSED IGNITION SWITCH OUTPUT (START)
		T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)

■■ A/T
△△△ SUBWOOFER
▲▲ EXPORT
◪◪◪ HARDTOP


DRIVER DOOR AJAR SWITCH
(8W-44-4)
1
PASSENGER DOOR AJAR SWITCH
(8W-44-4)
1
M23
20
YL/BK
M23
20
YL/BK
BATT A6
(8W-10-12)
4
FUSE BLOCK
(8W-11-2)
FUSE 1 20A
FUSE 2 20A
FUSE 3 20A
FUSE 4 10A
21
22
23
24
Z1
20
BK
S302
(8W-15-13)
F33
18
PK/RD
F33
20
PK/RD
F32
18
PK/DB
X13
16
BK/RD
Z1
16
BK/WT
20
C1
MULTI-FUNCTION SWITCH
(8W-50-2)
6
SENTRY KEY IMMOBILIZER MODULE
(8W-39-2)
5
BRAKE LAMP SWITCH
(8W-51-7)
6
SUBWOOFER
(8W-47-5)
G300
(8W-15-13)

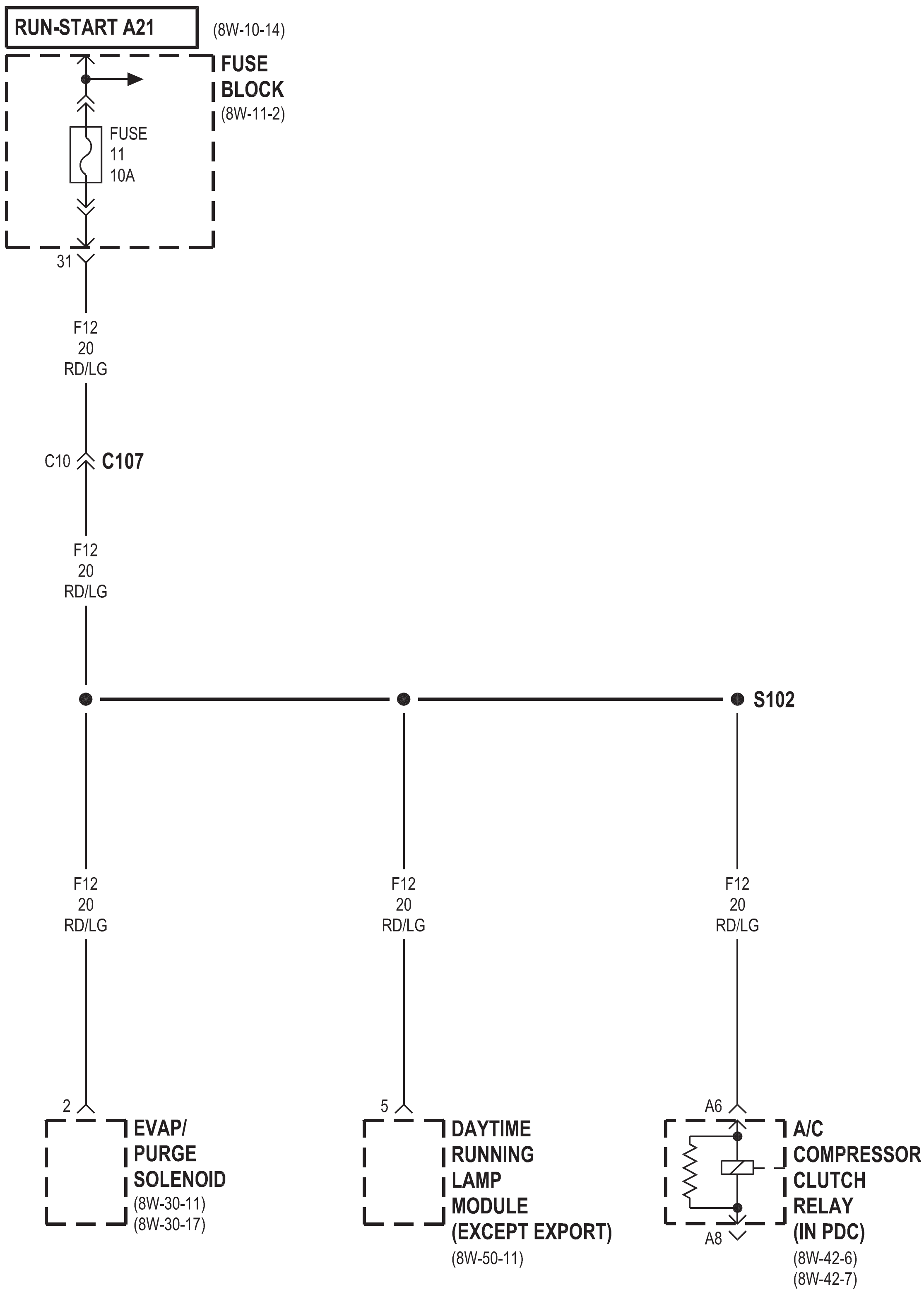

RUN A22
(8W-10-13)
FUSE
BLOCK
(8W-11-2)
FUSE
5
10A
FUSE
6
20A
25
26
F23
18
DB/YL
V23
18
BR/PK
5
C326
V23
18
BR/PK
S361
V23
18
BR/PK
V23
18
BR/PK
4
C326
V23
18
BR/PK
C6
C202
V23
18
BR/PK
20
AIRBAG
CONTROL
MODULE
(8W-43-2)
5
REAR
WIPER/
WASHER
SWITCH
(8W-53-3)
1
REAR
WIPER
MOTOR
(8W-53-3)
HARDTOP

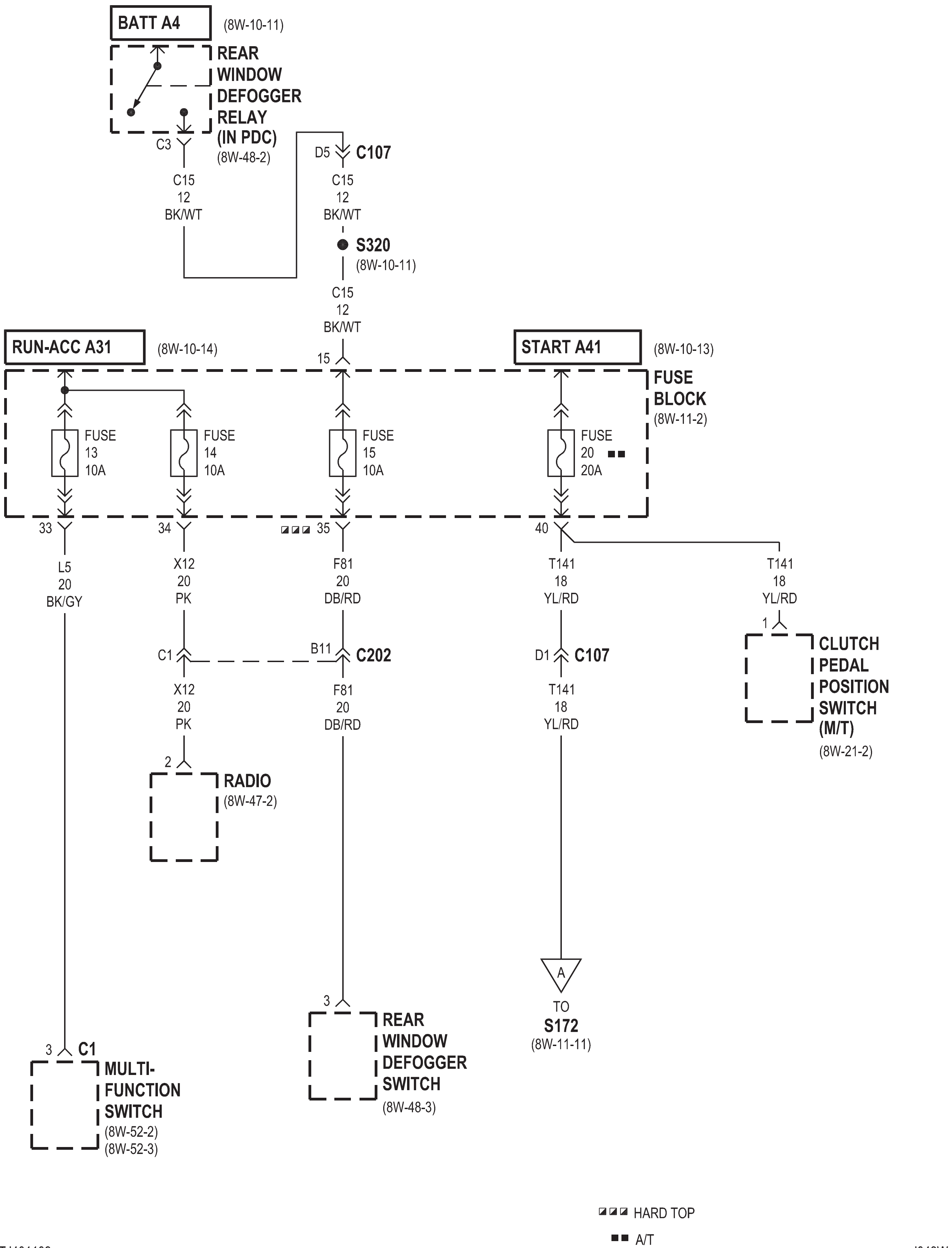

RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 7 10A
FUSE 8 10A
27
28
F20 20 VT/WT
F24 20 RD/DG
C7 C107
D4 C202
HEATER
A/C-HEATER
F24 20 RD/DG
F24 20RD/DG
5
9 C205
F24 20 OR
F24 20 DB/WT
3
1 C2
A/C-HEATER CONTROL
(8W-42-4)
HEATER CONTROL
(8W-42-2)
5
BLOWER MOTOR RELAY
(8W-42-3)
(8W-42-5)
10
BLEND DOOR ACTUATOR
(8W-42-3)
(8W-42-5)
S108
F20 18 VT/WT
10 C104
23
CONTROLLER ANTILOCK BRAKE
(8W-35-2)
D4
D6
LOW SPEED RADIATOR FAN RELAY (2.4L)
(8W-42-9)
B8
B10
ANTILOCK BRAKE RELAY (IN PDC)
(8W-35-2)
A/T
M/T
TRANSMISSION RANGE SENSOR
(8W-31-7)
(8W-51-2)
BACK-UP LAMP SWITCH
(8W-51-2)
D13
D11
HIGH SPEED RADIATOR FAN RELAY (2.4L)
(8W-42-9)
C4
C2
REAR WINDOW DEFOGGER RELAY (IN PDC)
(8W-48-2)
• LHD
•• RHD

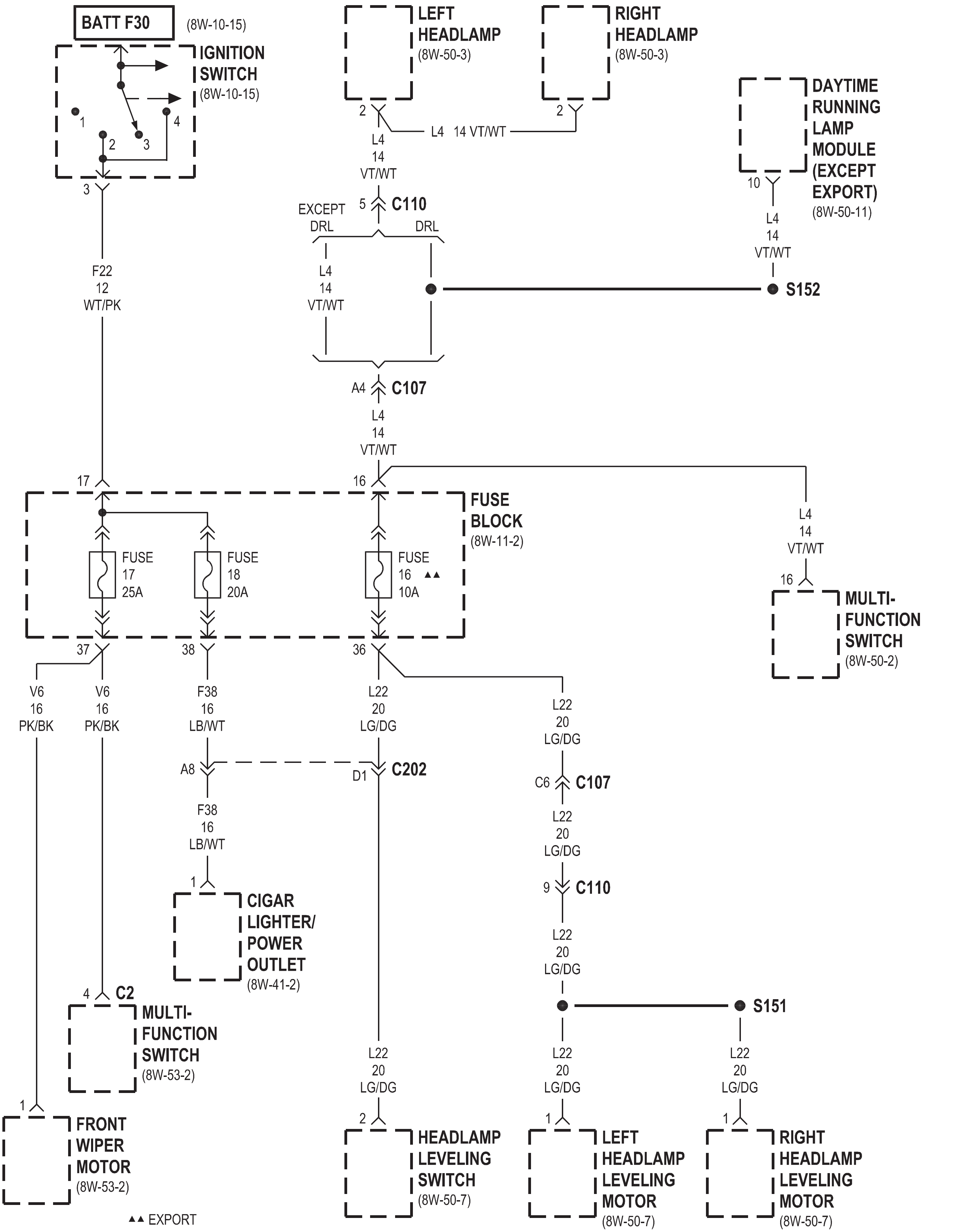


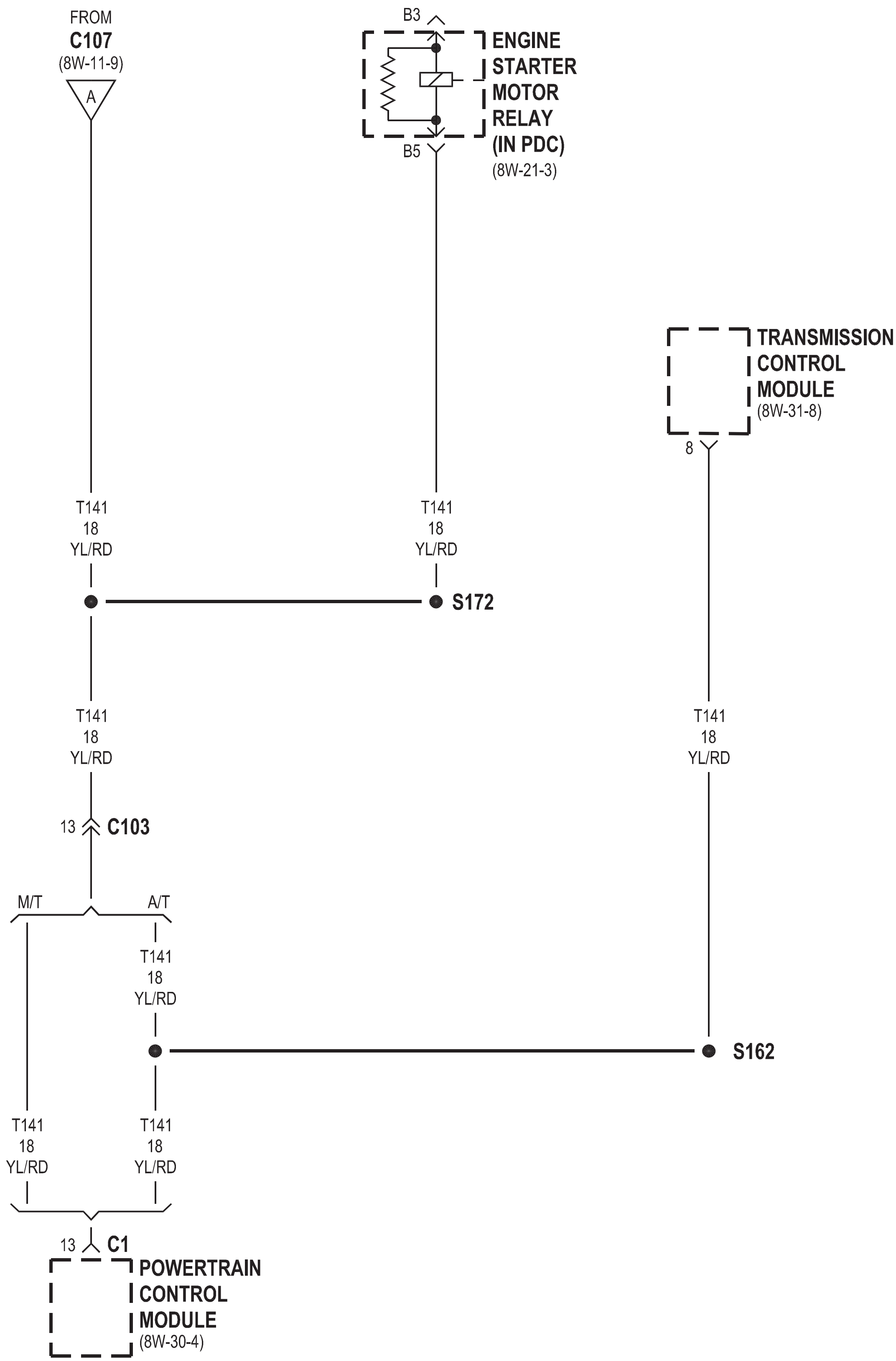
TJ401107

J048W-5

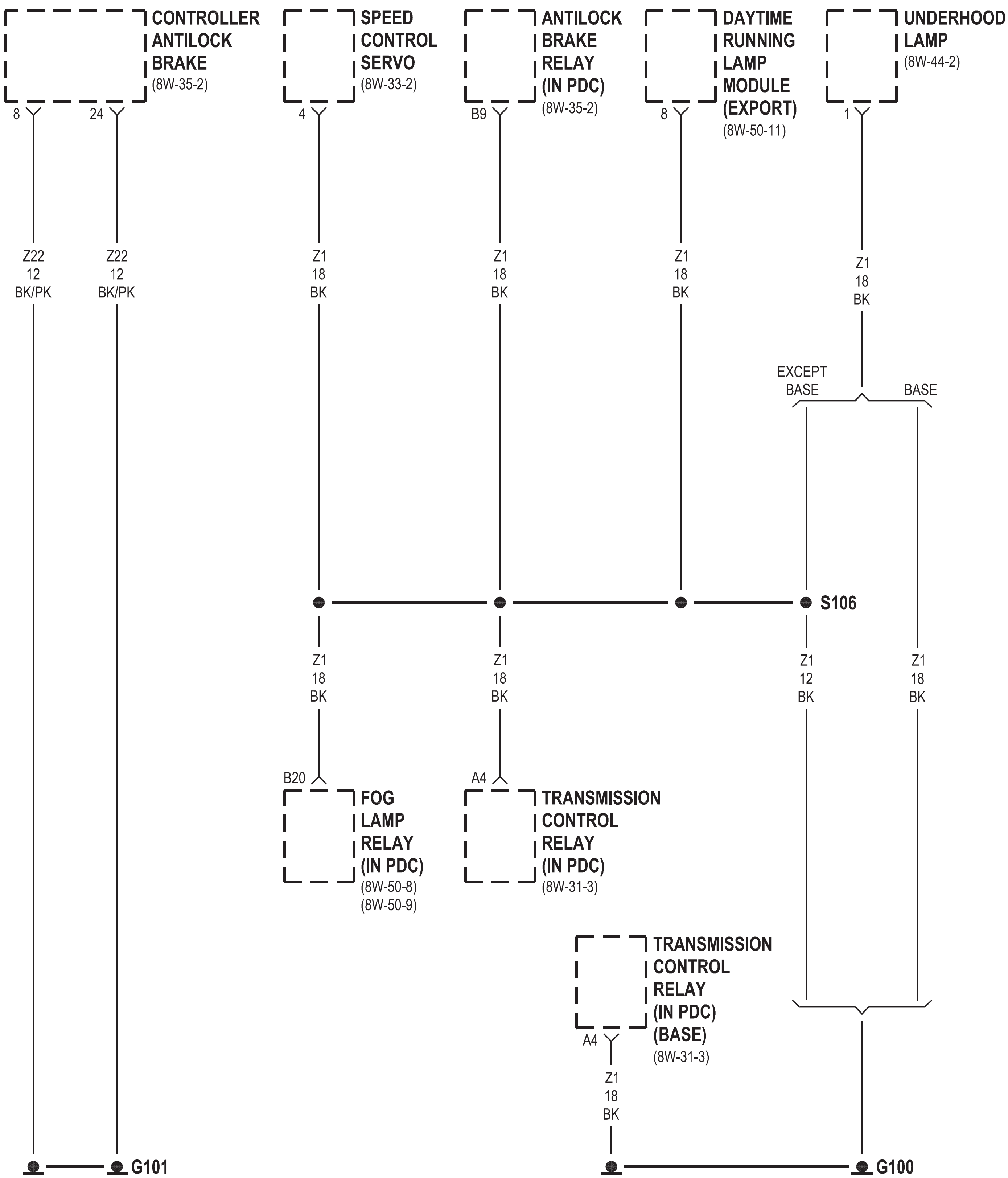

RUN-START A21
(8W-10-14)
FUSE
BLOCK
(8W-11-2)
FUSE
11
10A
31
F12
20
RD/LG
C10
C107
F12
20
RD/LG
S102
F12
20
RD/LG
F12
20
RD/LG
F12
20
RD/LG
2
EVAP/
PURGE
SOLENOID
(8W-30-11)
(8W-30-17)
5
DAYTIME
RUNNING
LAMP
MODULE
(EXCEPT EXPORT)
(8W-50-11)
A6
A8
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-6)
(8W-42-7)


BATT A4
(8W-10-11)
REAR WINDOW DEFOGGER RELAY (IN PDC)
(8W-48-2)
C3
D5
C107
C15
12
BK/WT
S320
(8W-10-11)
RUN-ACC A31
(8W-10-14)
15
START A41
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 13 10A
FUSE 14 10A
FUSE 15 10A
FUSE 20 20A
33
34
35
40
L5 20 BK/GY
X12 20 PK
F81 20 DB/RD
T141 18 YL/RD
1
CLUTCH PEDAL POSITION SWITCH (M/T)
(8W-21-2)
C1
B11
C202
D1
C107
2
RADIO
(8W-47-2)
A
TO S172
(8W-11-11)
3
REAR WINDOW DEFOGGER SWITCH
(8W-48-3)
3
C1
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-52-3)
HARD TOP
A/T

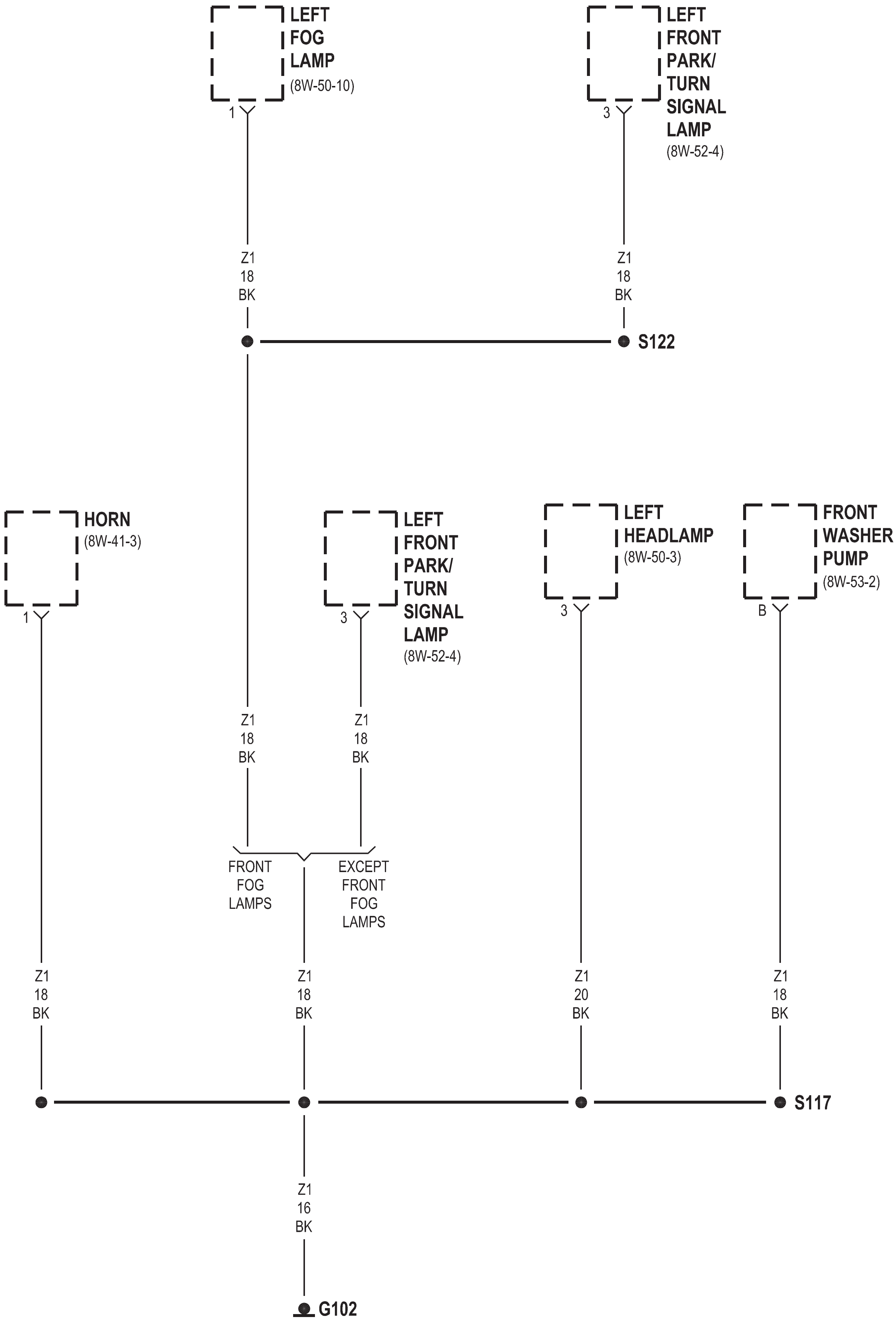

BATT F30
(8W-10-15)
IGNITION SWITCH
(8W-10-15)
LEFT HEADLAMP
(8W-50-3)
RIGHT HEADLAMP
(8W-50-3)
L4 14 VT/WT
DAYTIME RUNNING LAMP MODULE (EXCEPT EXPORT)
(8W-50-11)
C110
EXCEPT DRL
DRL
F22 12 WT/PK
S152
C107
FUSE BLOCK
(8W-11-2)
FUSE 17 25A
FUSE 18 20A
FUSE 16 10A ▲▲
MULTI-FUNCTION SWITCH
(8W-50-2)
V6 16 PK/BK
F38 16 LB/WT
L22 20 LG/DG
C202
C107
C110
CIGAR LIGHTER/ POWER OUTLET
(8W-41-2)
S151
C2
MULTI-FUNCTION SWITCH
(8W-53-2)
FRONT WIPER MOTOR
(8W-53-2)
HEADLAMP LEVELING SWITCH
(8W-50-7)
LEFT HEADLAMP LEVELING MOTOR
(8W-50-7)
RIGHT HEADLAMP LEVELING MOTOR
(8W-50-7)
▲▲ EXPORT


FROM
C107
(8W-11-9)
A
B3
ENGINE
STARTER
MOTOR
RELAY
(IN PDC)
(8W-21-3)
B5
TRANSMISSION
CONTROL
MODULE
(8W-31-8)
8
T141
18
YL/RD
S172
13
C103
M/T
A/T
S162
C1
POWERTRAIN
CONTROL
MODULE
(8W-30-4)

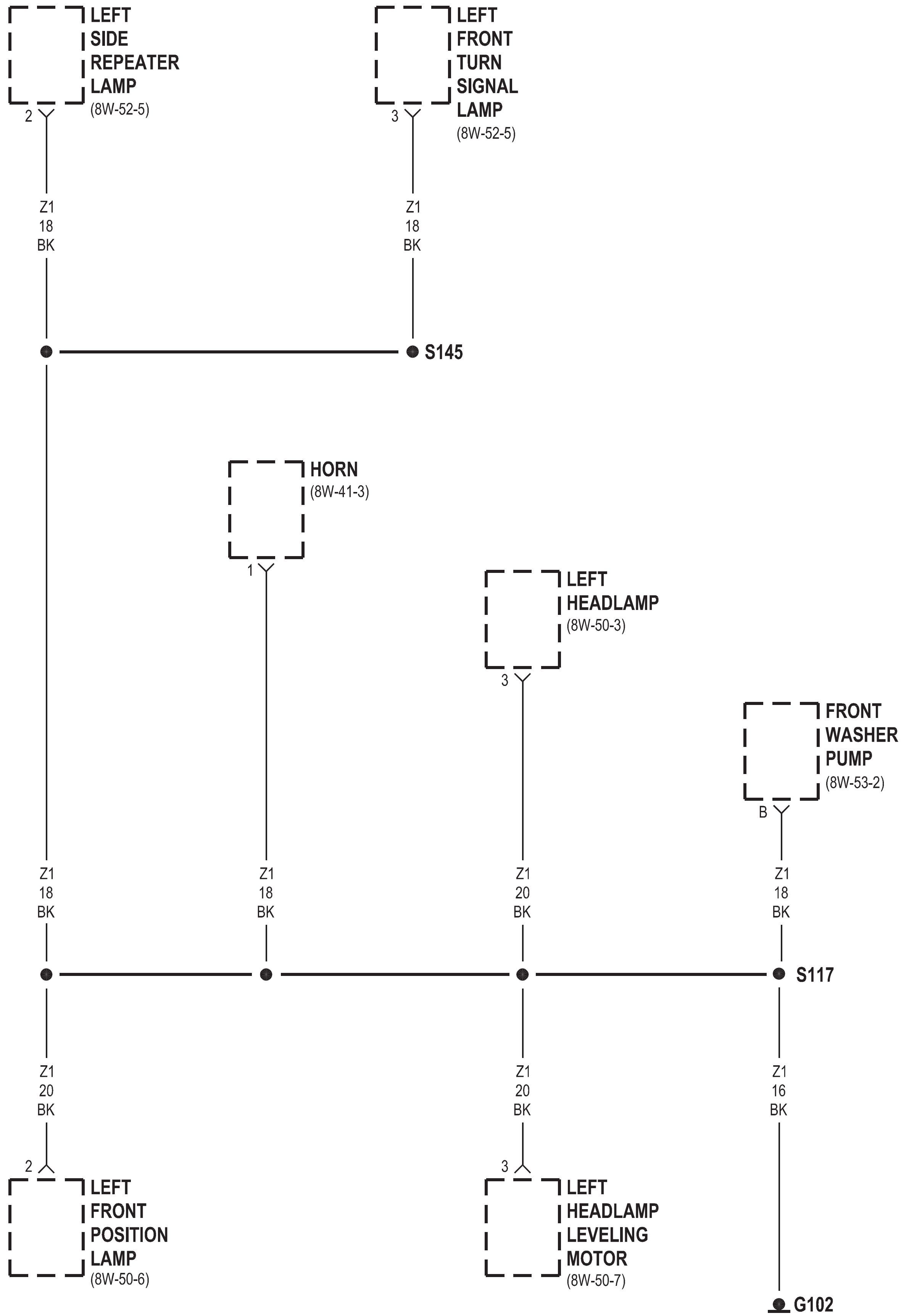
8W-15 GROUND DISTRIBUTION

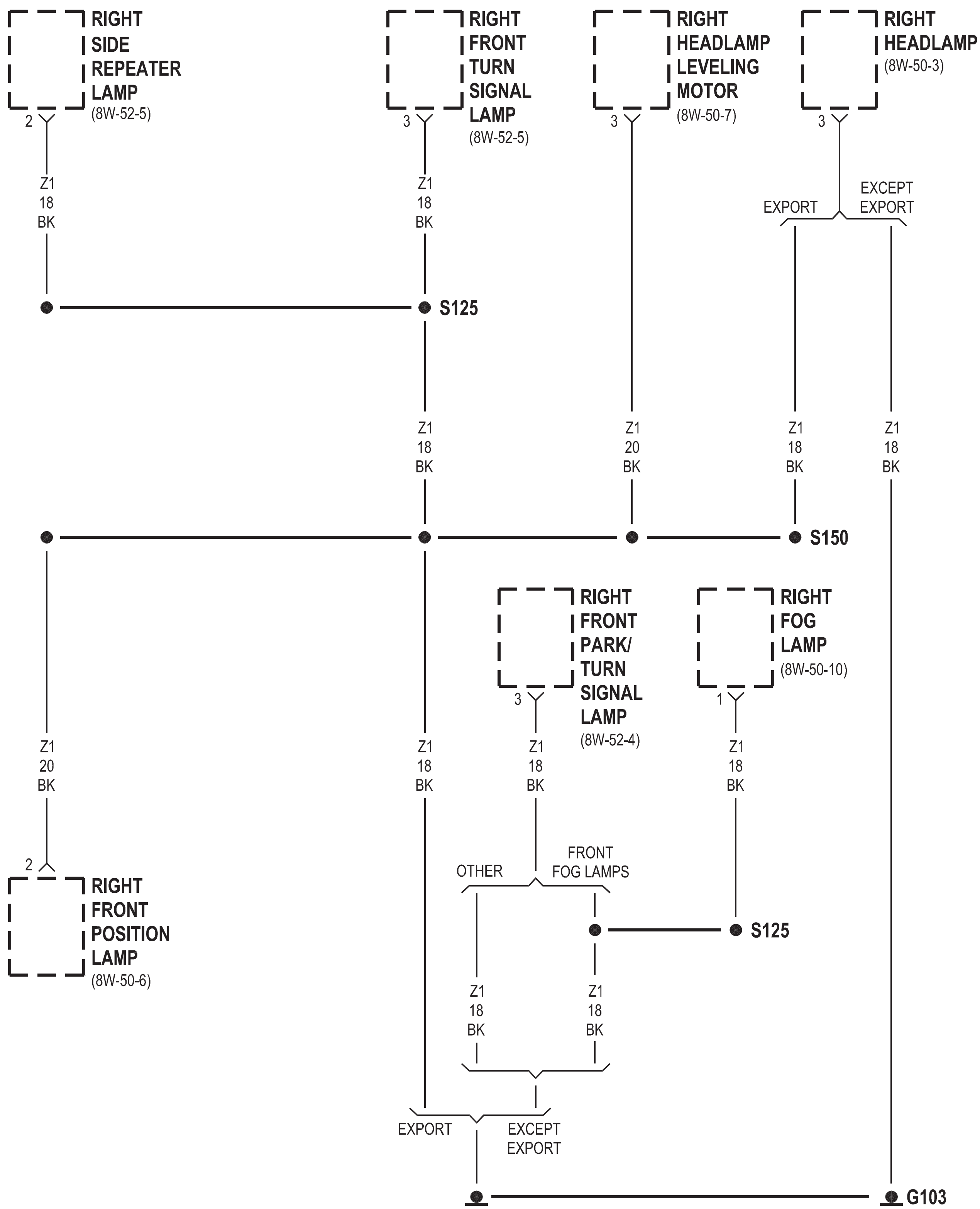

CONTROLLER ANTILOCK BRAKE
(8W-35-2)
SPEED CONTROL SERVO
(8W-33-2)
ANTILOCK BRAKE RELAY (IN PDC)
(8W-35-2)
DAYTIME RUNNING LAMP MODULE (EXPORT)
(8W-50-11)
UNDERHOOD LAMP
(8W-44-2)
8
24
4
B9
8
1
Z22 12 BK/PK
Z22 12 BK/PK
Z1 18 BK
Z1 18 BK
Z1 18 BK
Z1 18 BK
EXCEPT BASE
BASE
S106
Z1 18 BK
Z1 18 BK
Z1 12 BK
Z1 18 BK
B20
A4
FOG LAMP RELAY (IN PDC)
(8W-50-8)
(8W-50-9)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-3)
TRANSMISSION CONTROL RELAY (IN PDC) (BASE)
(8W-31-3)
A4
Z1 18 BK
G101
G100

EXCEPT EXPORT

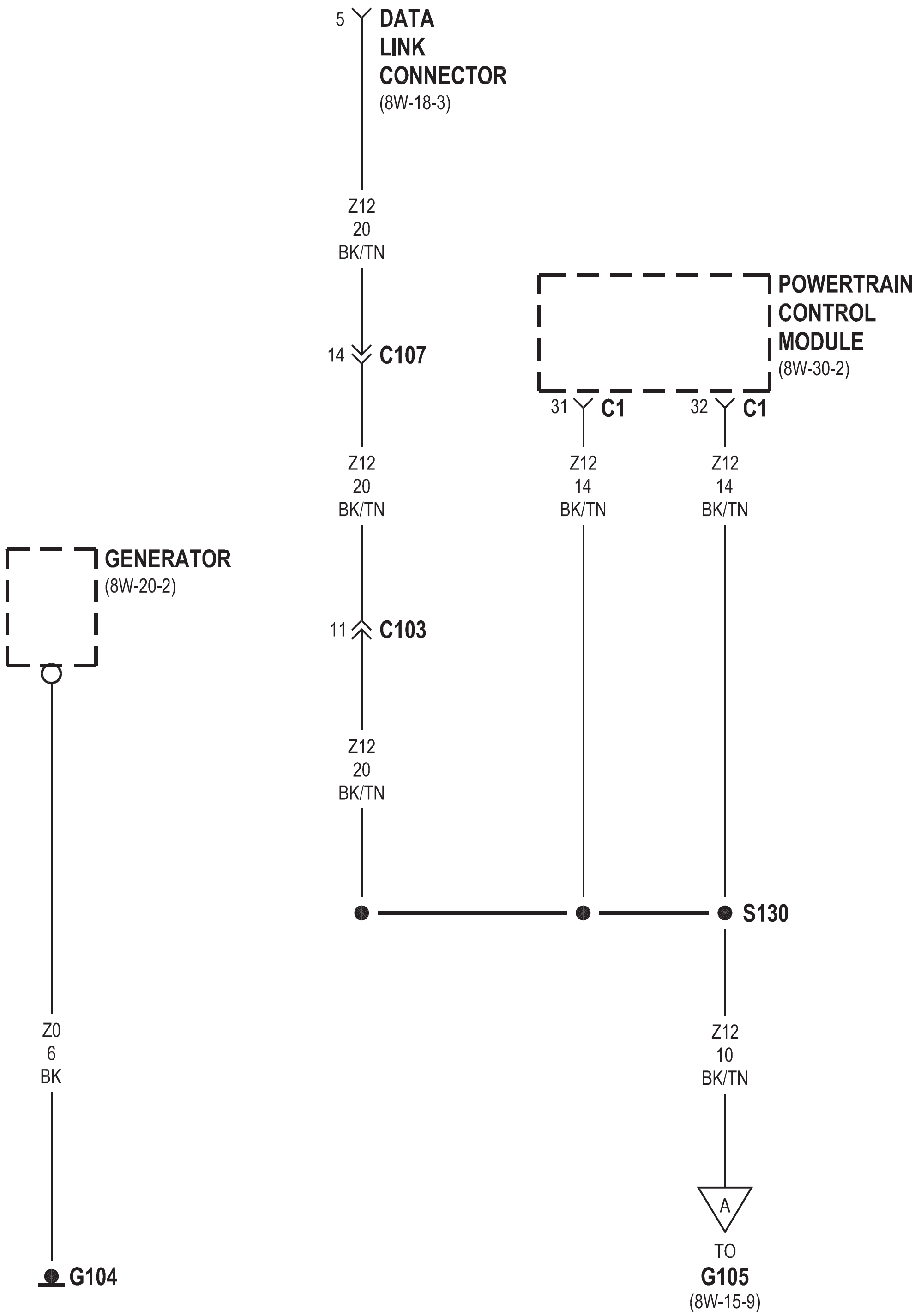


EXPORT

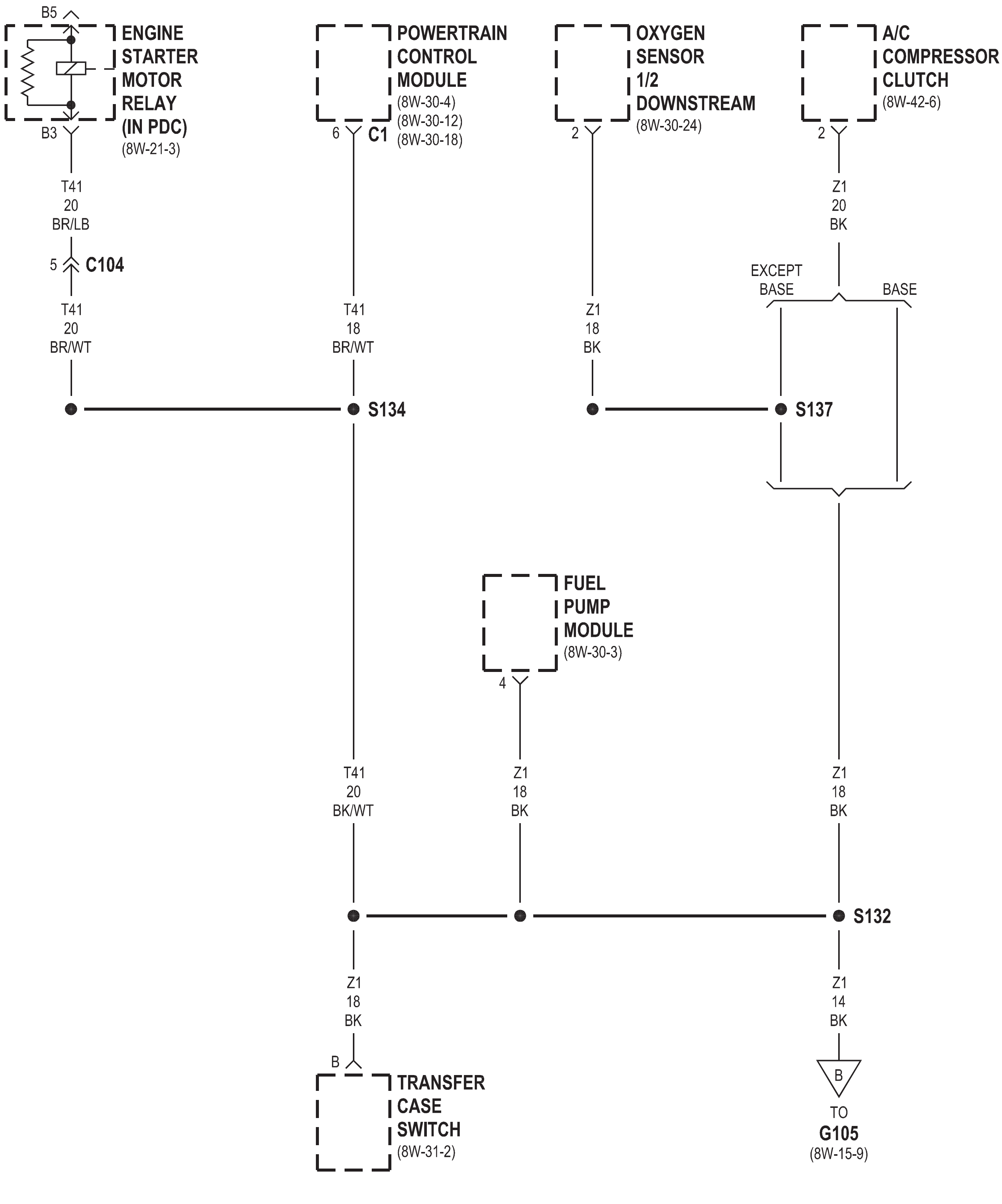

LEFT SIDE REPEATER LAMP
(8W-52-5)
2
LEFT FRONT TURN SIGNAL LAMP
(8W-52-5)
3
Z1 18 BK
Z1 18 BK
S145
HORN
(8W-41-3)
1
LEFT HEADLAMP
(8W-50-3)
3
FRONT WASHER PUMP
(8W-53-2)
B
Z1 18 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
S117
Z1 20 BK
Z1 20 BK
Z1 16 BK
2
LEFT FRONT POSITION LAMP
(8W-50-6)
3
LEFT HEADLAMP LEVELING MOTOR
(8W-50-7)
G102



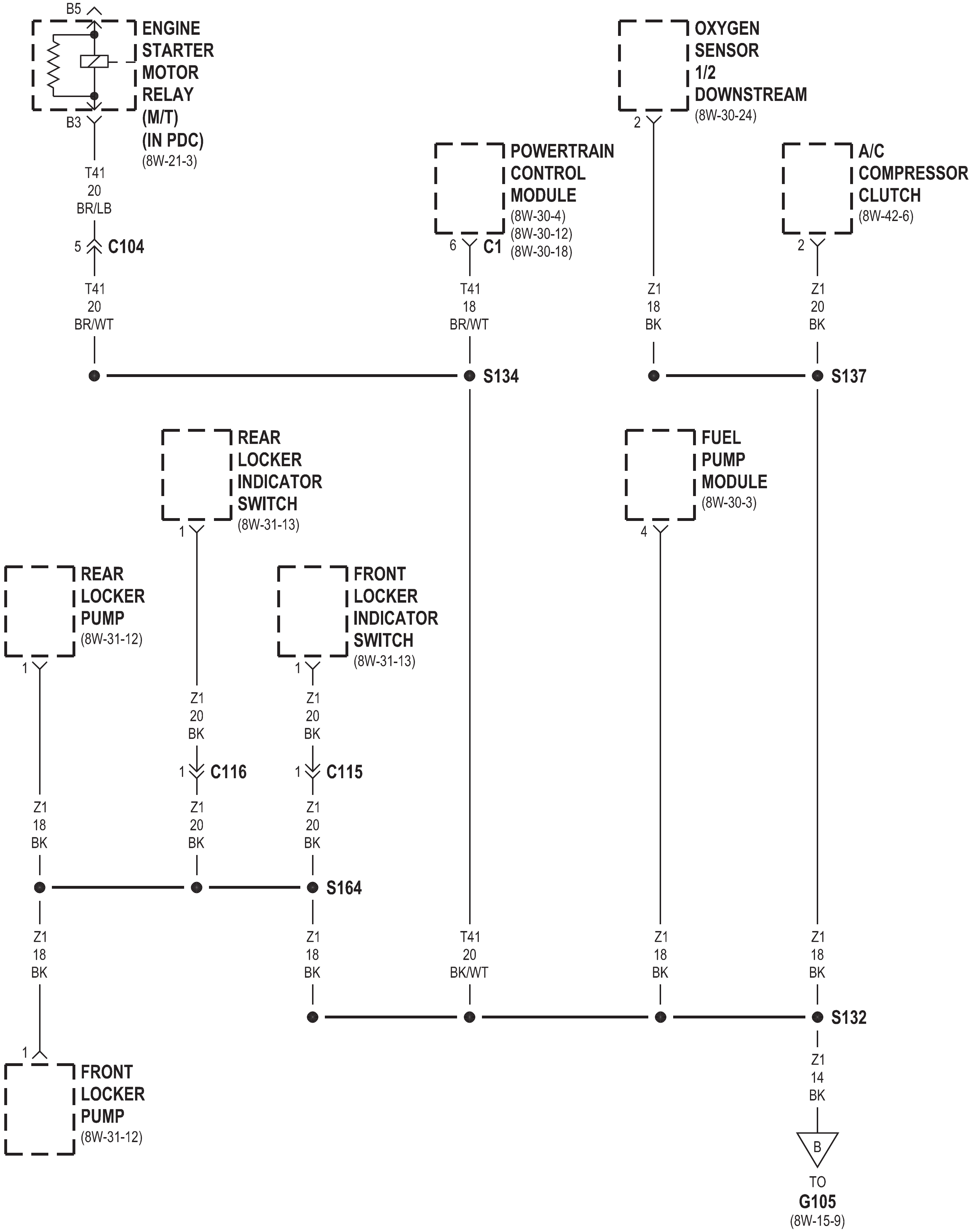
RIGHT SIDE REPEATER LAMP
(8W-52-5)
2
Z1
18
BK
RIGHT FRONT TURN SIGNAL LAMP
(8W-52-5)
3
Z1
18
BK
S125
RIGHT HEADLAMP LEVELING MOTOR
(8W-50-7)
3
RIGHT HEADLAMP
(8W-50-3)
3
EXPORT
EXCEPT EXPORT
Z1
18
BK
Z1
20
BK
Z1
18
BK
Z1
18
BK
S150
RIGHT FRONT PARK/ TURN SIGNAL LAMP
(8W-52-4)
3
RIGHT FOG LAMP
(8W-50-10)
1
Z1
20
BK
Z1
18
BK
Z1
18
BK
Z1
18
BK
2
RIGHT FRONT POSITION LAMP
(8W-50-6)
OTHER
FRONT FOG LAMPS
S125
Z1
18
BK
Z1
18
BK
EXPORT
EXCEPT EXPORT
G103

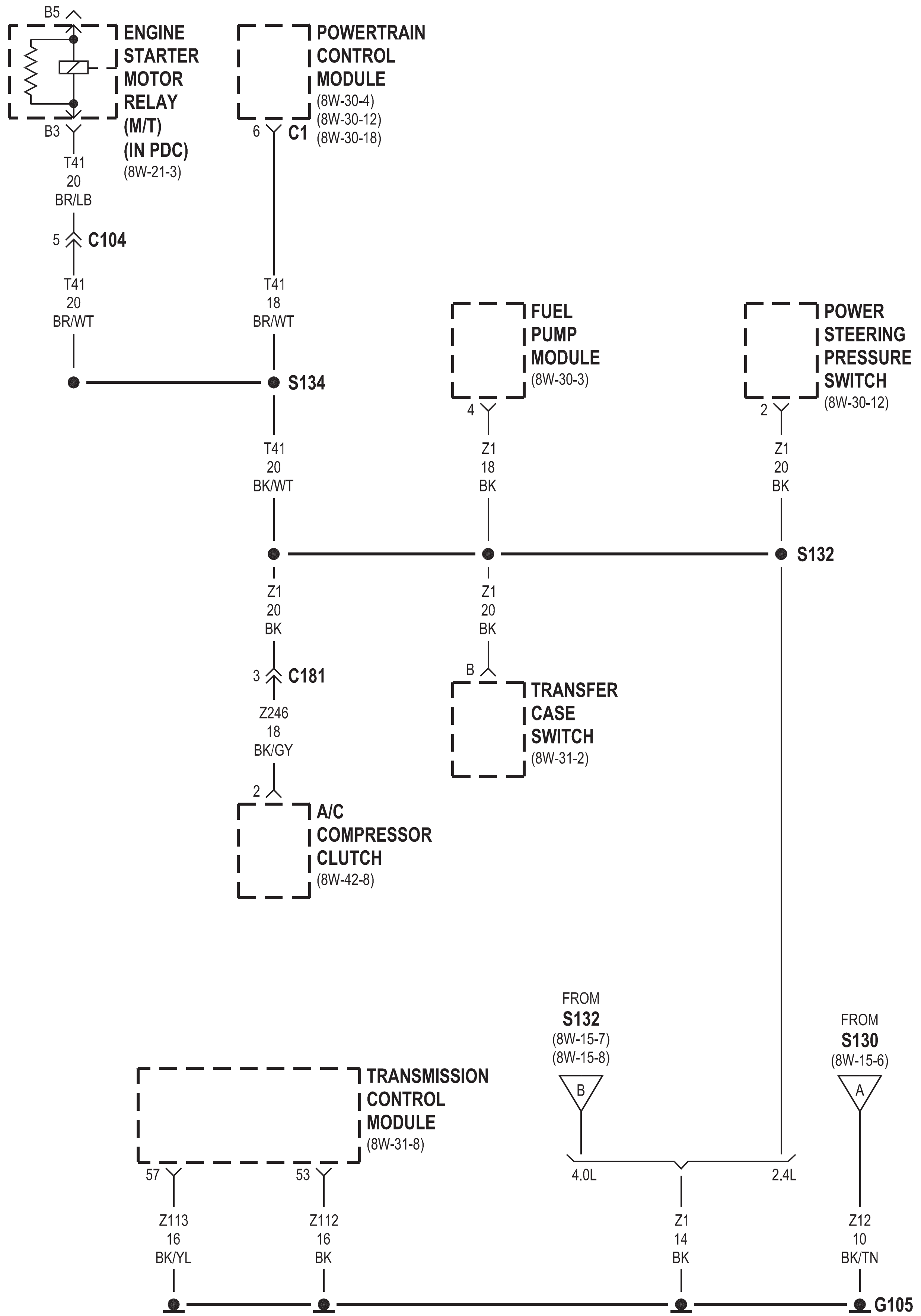

5
DATA
LINK
CONNECTOR
(8W-18-3)
Z12
20
BK/TN
14
C107
Z12
20
BK/TN
POWERTRAIN
CONTROL
MODULE
(8W-30-2)
31
C1
32
C1
Z12
14
BK/TN
Z12
14
BK/TN
GENERATOR
(8W-20-2)
11
C103
Z12
20
BK/TN
S130
Z0
6
BK
Z12
10
BK/TN
A
TO
G105
(8W-15-9)
G104

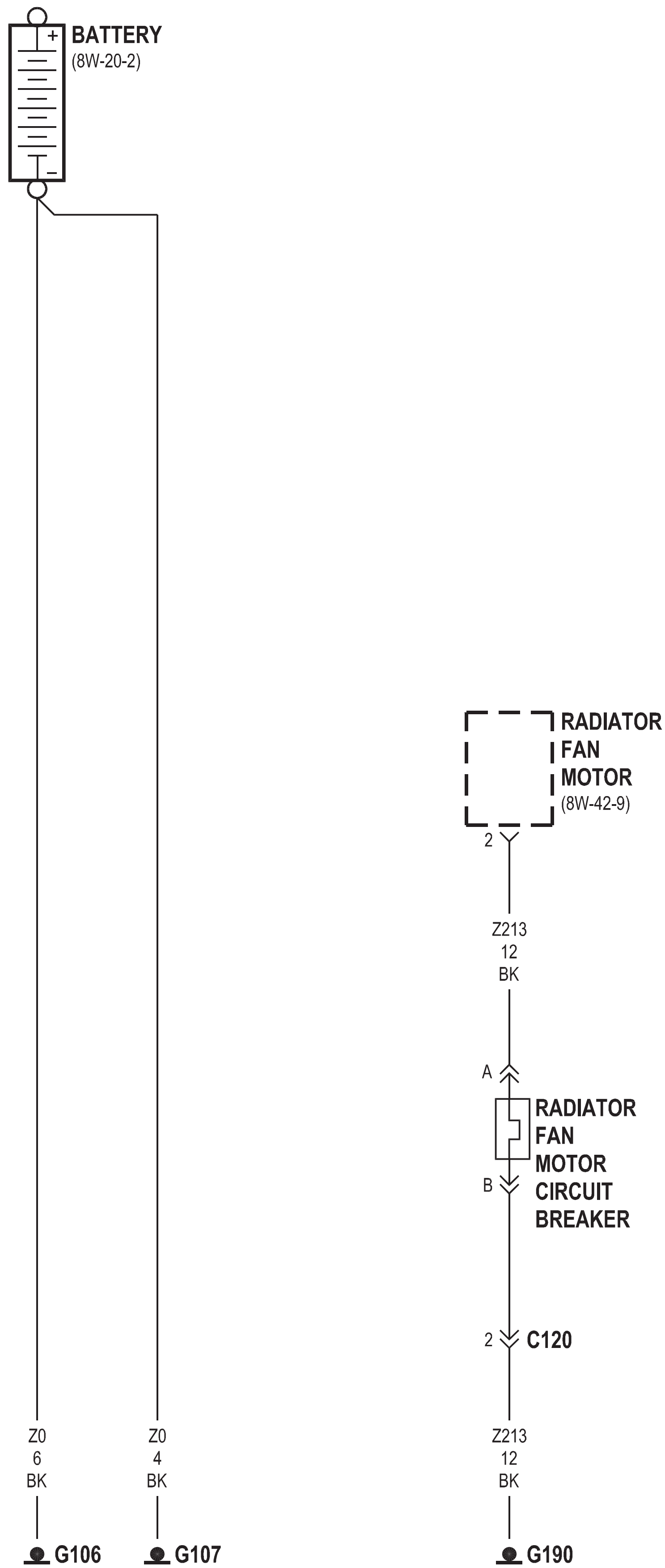
EXCEPT OFF-ROAD PACKAGE



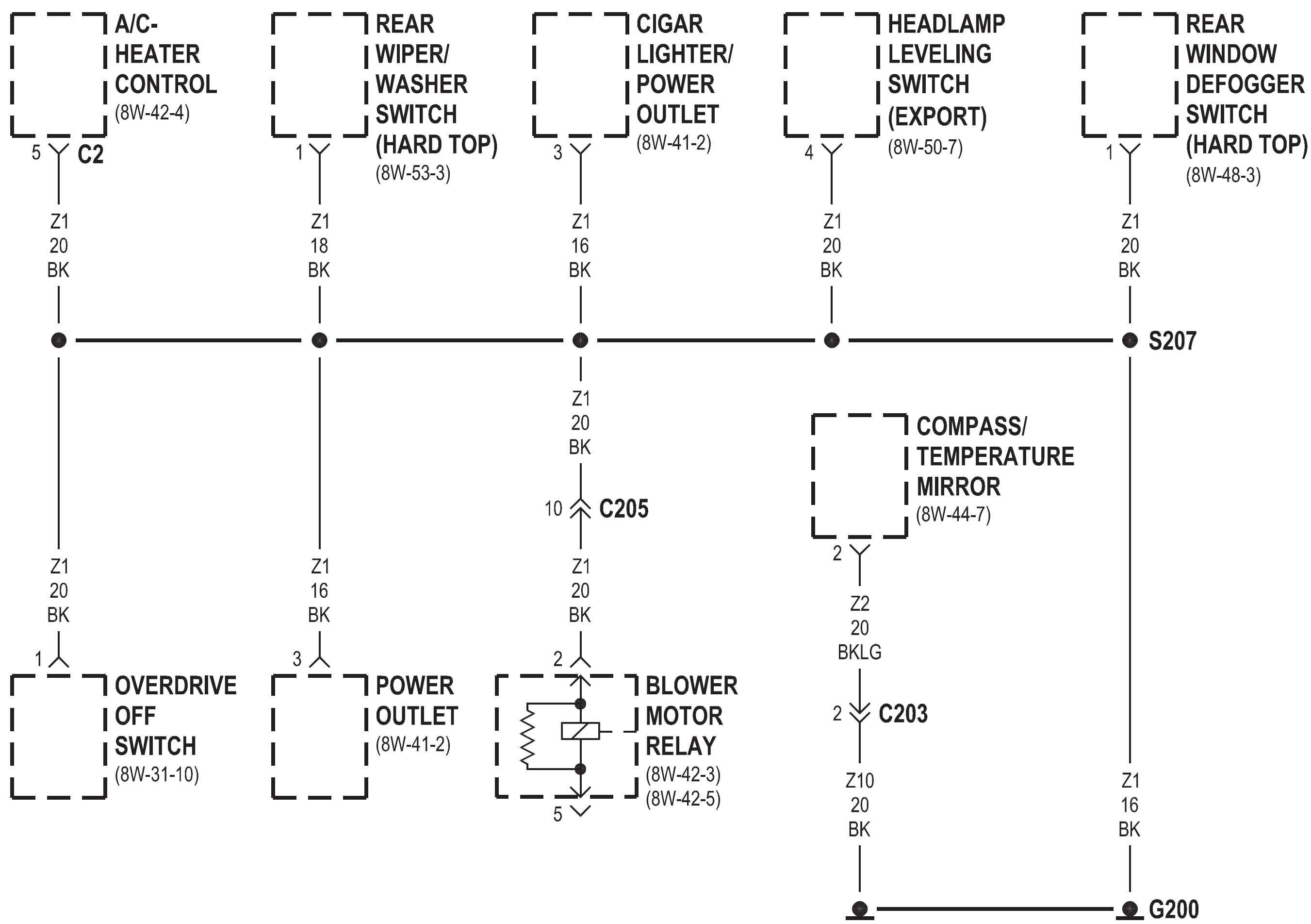
OFF-ROAD PACKAGE

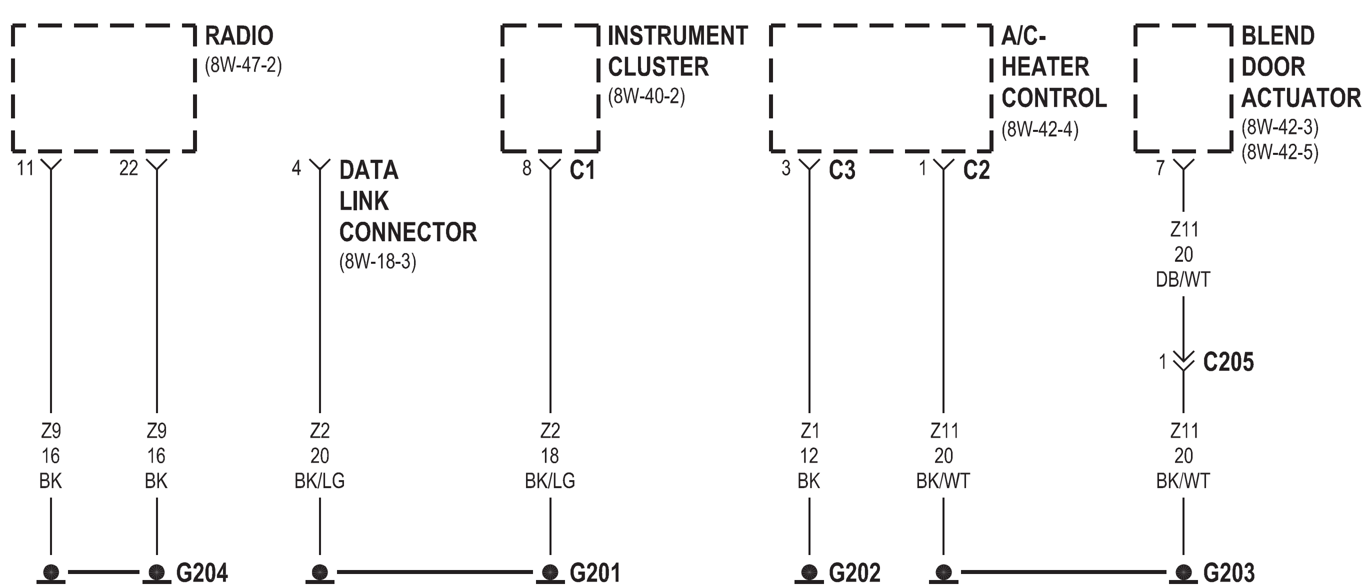



B5
ENGINE STARTER MOTOR RELAY (M/T) (IN PDC)
(8W-21-3)
B3
T41 20 BR/LB
5 C104
T41 20 BR/WT
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-12)
(8W-30-18)
6 C1
T41 18 BR/WT
S134
T41 20 BK/WT
FUEL PUMP MODULE
(8W-30-3)
4
Z1 18 BK
POWER STEERING PRESSURE SWITCH
(8W-30-12)
2
Z1 20 BK
S132
Z1 20 BK
3 C181
Z246 18 BK/GY
2
A/C COMPRESSOR CLUTCH
(8W-42-8)
Z1 20 BK
B
TRANSFER CASE SWITCH
(8W-31-2)
TRANSMISSION CONTROL MODULE
(8W-31-8)
57
53
Z113 16 BK/YL
Z112 16 BK
FROM S132
(8W-15-7)
(8W-15-8)
B
4.0L
2.4L
Z1 14 BK
FROM S130
(8W-15-6)
A
Z12 10 BK/TN
G105

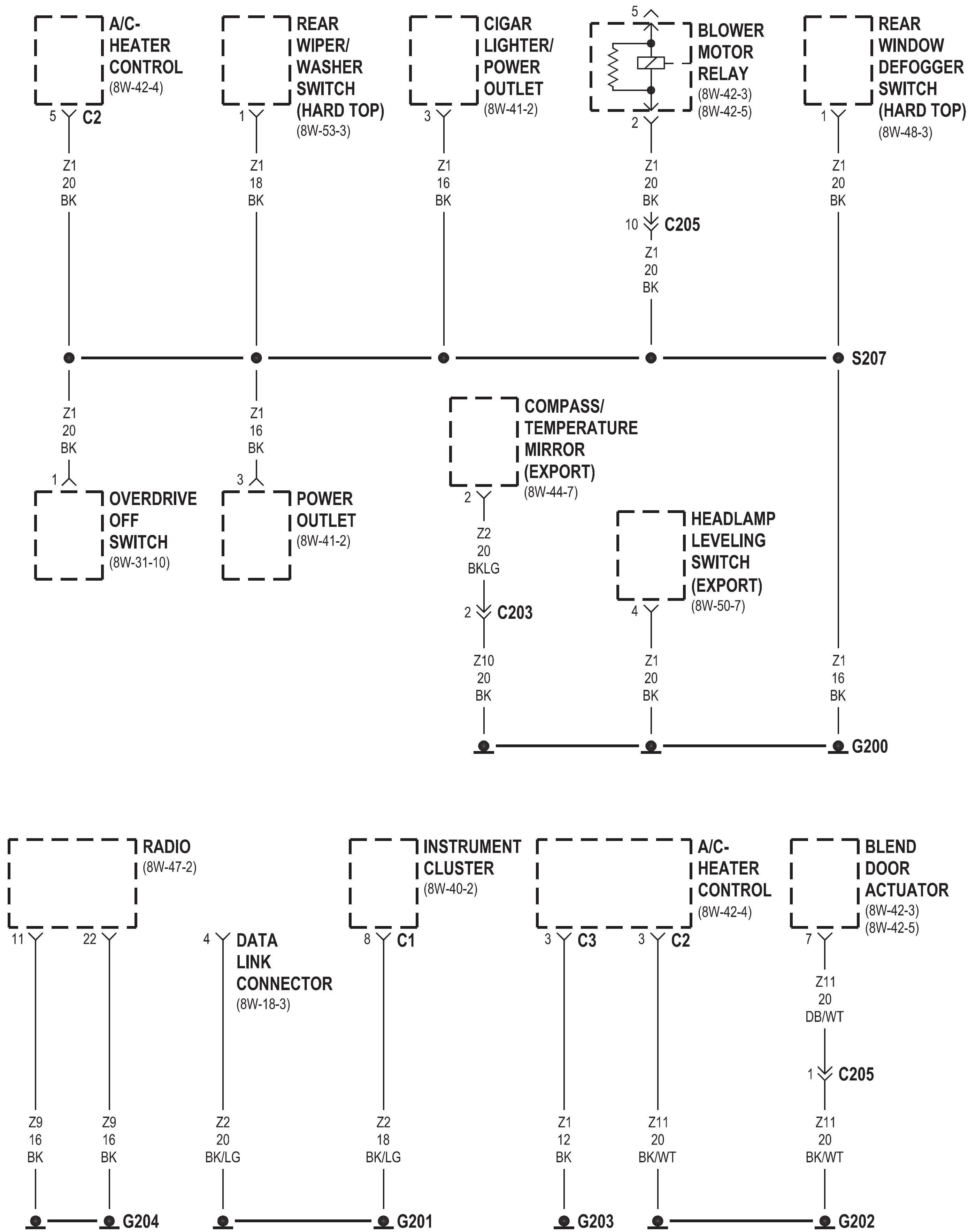

BATTERY
(8W-20-2)
RADIATOR FAN MOTOR
(8W-42-9)
2
Z213
12
BK
A
RADIATOR FAN MOTOR CIRCUIT BREAKER
B
2
C120
Z0
6
BK
Z0
4
BK
Z213
12
BK
G106
G107
G190

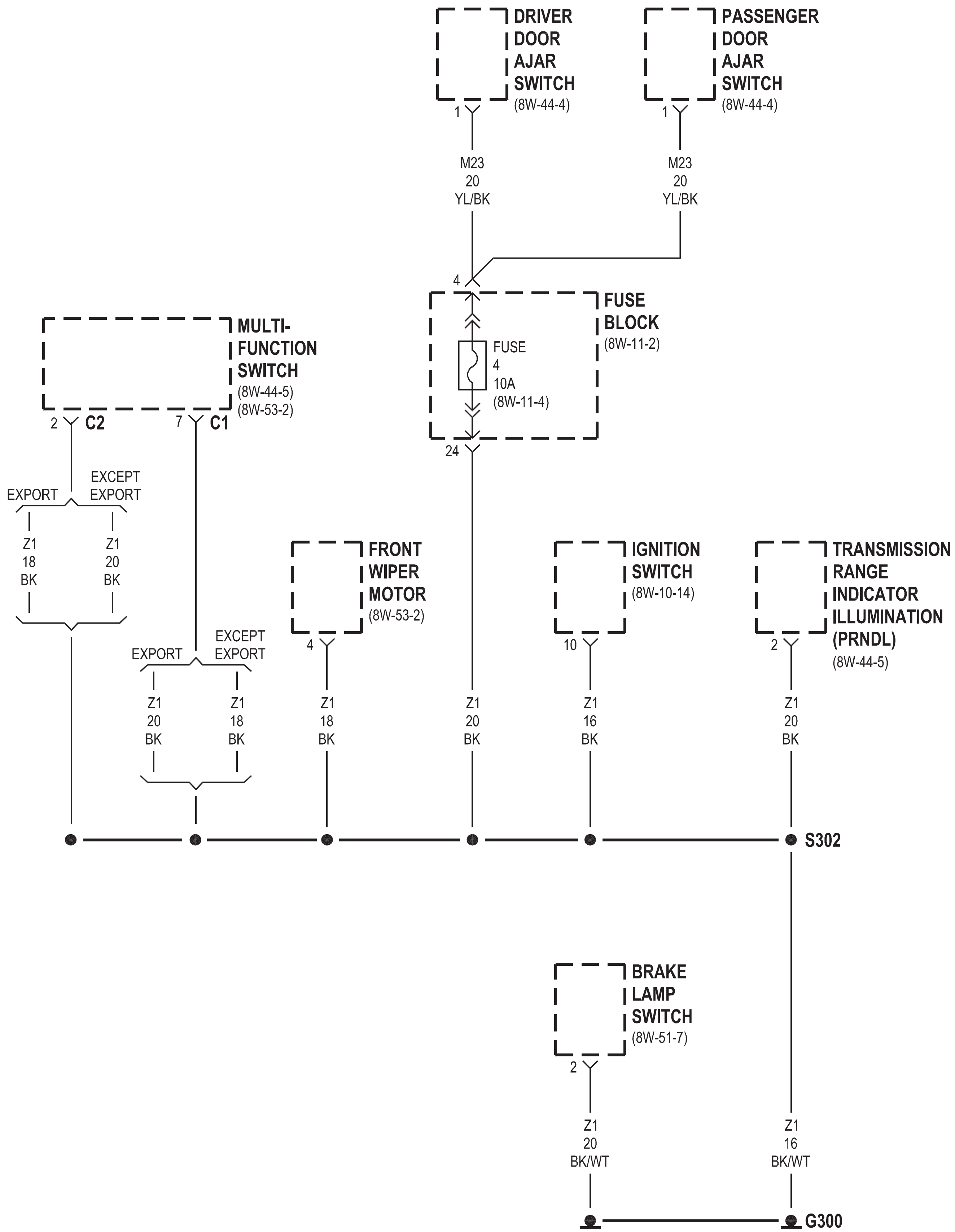
LHD

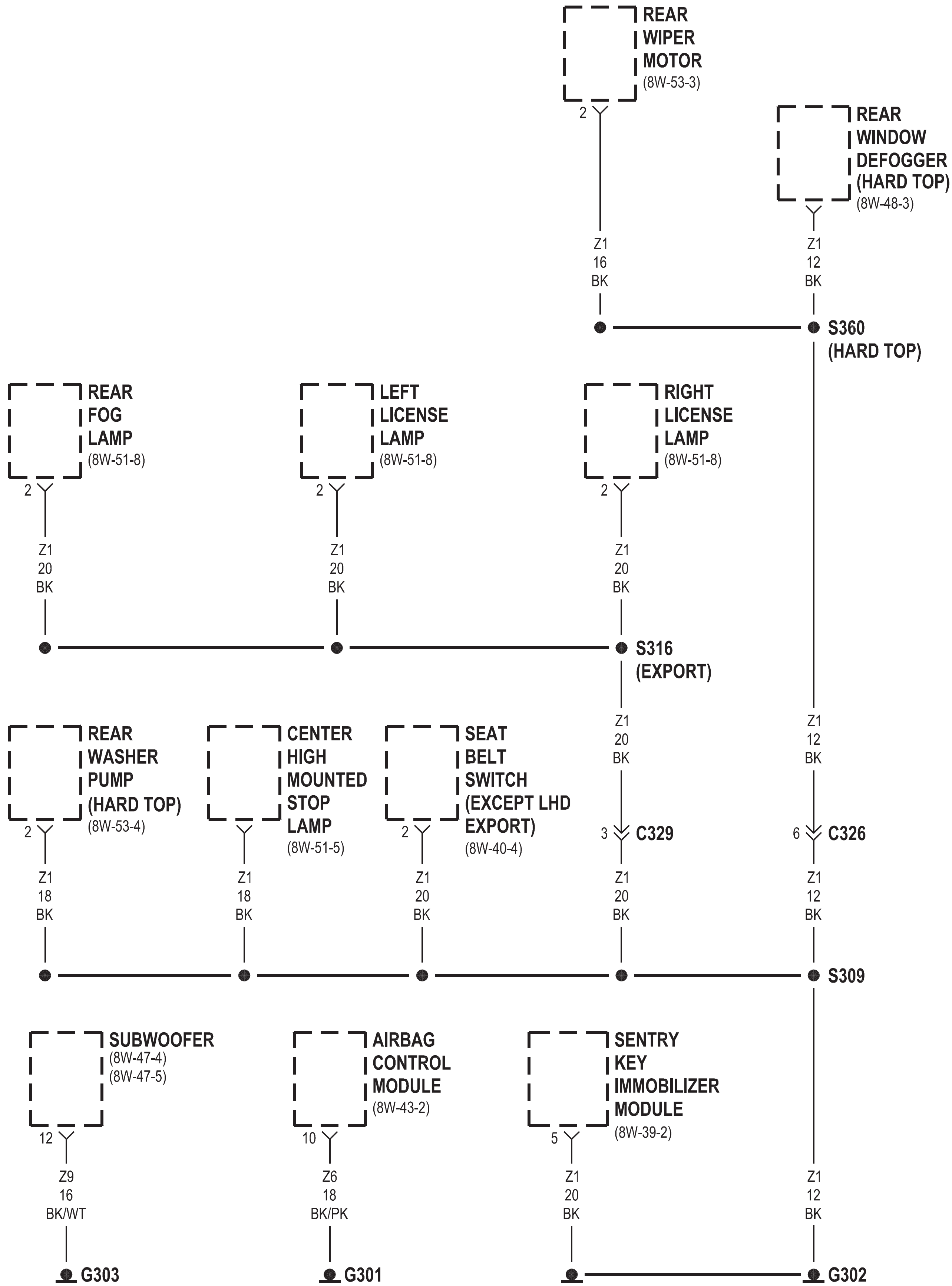

A/C-
HEATER
CONTROL
(8W-42-4)
C2
Z1
20
BK
REAR
WIPER/
WASHER
SWITCH
(HARD TOP)
(8W-53-3)
Z1
18
BK
CIGAR
LIGHTER/
POWER
OUTLET
(8W-41-2)
Z1
16
BK
HEADLAMP
LEVELING
SWITCH
(EXPORT)
(8W-50-7)
Z1
20
BK
REAR
WINDOW
DEFOGGER
SWITCH
(HARD TOP)
(8W-48-3)
Z1
20
BK
S207
Z1
20
BK
C205
COMPASS/
TEMPERATURE
MIRROR
(8W-44-7)
Z2
20
BKLG
C203
Z10
20
BK
Z1
16
BK
G200
Z1
20
BK
OVERDRIVE
OFF
SWITCH
(8W-31-10)
Z1
16
BK
POWER
OUTLET
(8W-41-2)
Z1
20
BK
BLOWER
MOTOR
RELAY
(8W-42-3)
(8W-42-5)


RADIO
(8W-47-2)
Z9
16
BK
Z9
16
BK
G204
DATA
LINK
CONNECTOR
(8W-18-3)
Z2
20
BK/LG
INSTRUMENT
CLUSTER
(8W-40-2)
C1
Z2
18
BK/LG
G201
A/C-
HEATER
CONTROL
(8W-42-4)
C3
C2
Z1
12
BK
G202
Z11
20
BK/WT
BLEND
DOOR
ACTUATOR
(8W-42-3)
(8W-42-5)
Z11
20
DB/WT
C205
Z11
20
BK/WT
G203

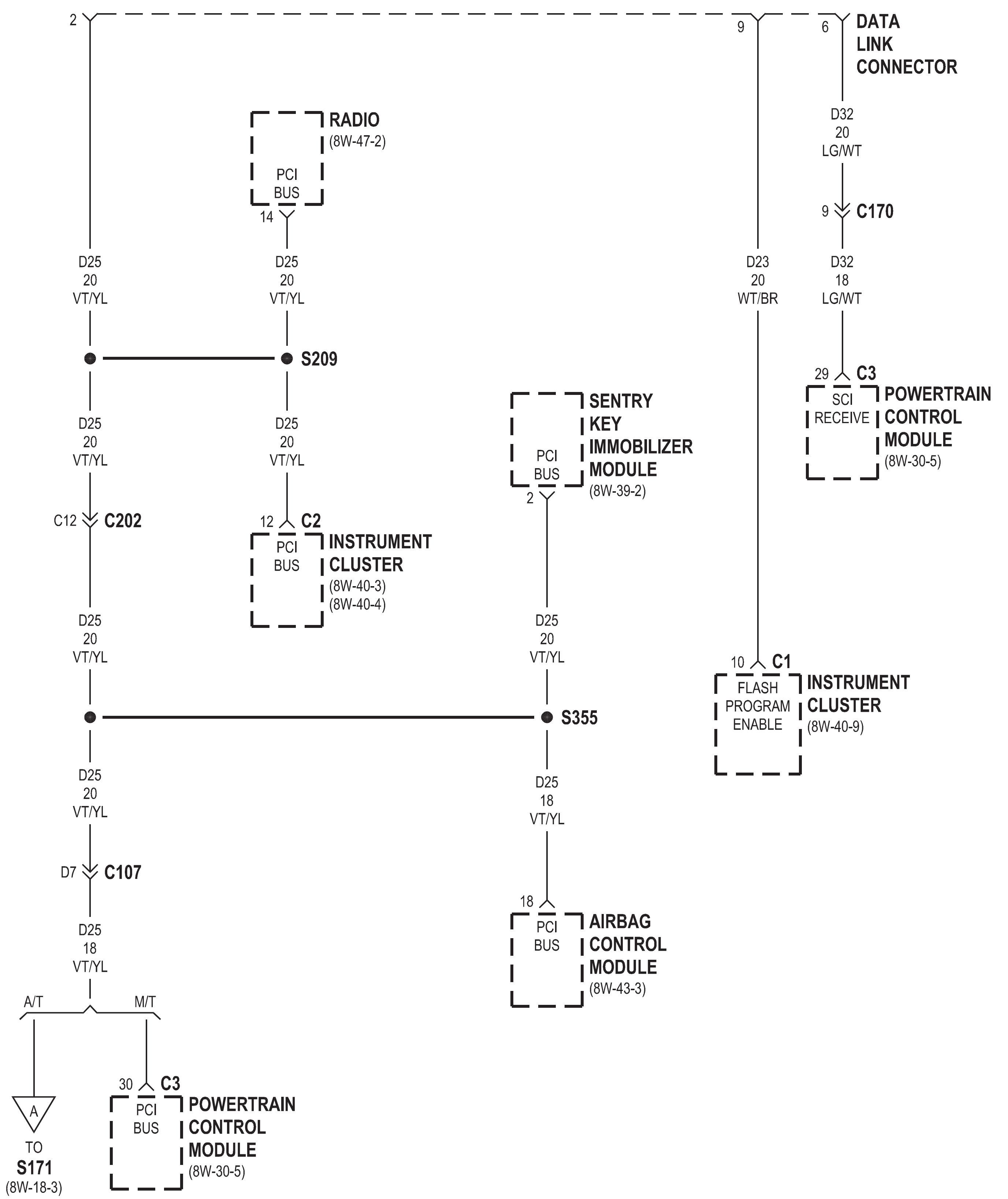
RHD


A/C-HEATER CONTROL
(8W-42-4)
5 C2
Z1 20 BK
REAR WIPER/ WASHER SWITCH (HARD TOP)
(8W-53-3)
1
Z1 18 BK
CIGAR LIGHTER/ POWER OUTLET
(8W-41-2)
3
Z1 16 BK
BLOWER MOTOR RELAY
(8W-42-3)
(8W-42-5)
5
2
Z1 20 BK
10 C205
Z1 20 BK
REAR WINDOW DEFOGGER SWITCH (HARD TOP)
(8W-48-3)
1
Z1 20 BK
S207
Z1 20 BK
Z1 16 BK
1
OVERDRIVE OFF SWITCH
(8W-31-10)
3
POWER OUTLET
(8W-41-2)
COMPASS/ TEMPERATURE MIRROR (EXPORT)
(8W-44-7)
2
Z2 20 BKLG
2 C203
Z10 20 BK
HEADLAMP LEVELING SWITCH (EXPORT)
(8W-50-7)
4
Z1 20 BK
Z1 16 BK
G200
RADIO
(8W-47-2)
11
22
Z9 16 BK
Z9 16 BK
G204
4
DATA LINK CONNECTOR
(8W-18-3)
Z2 20 BK/LG
INSTRUMENT CLUSTER
(8W-40-2)
8 C1
Z2 18 BK/LG
G201
A/C-HEATER CONTROL
(8W-42-4)
3 C3
3 C2
Z1 12 BK
G203
Z11 20 BK/WT
BLEND DOOR ACTUATOR
(8W-42-3)
(8W-42-5)
7
Z11 20 DB/WT
1 C205
Z11 20 BK/WT
G202

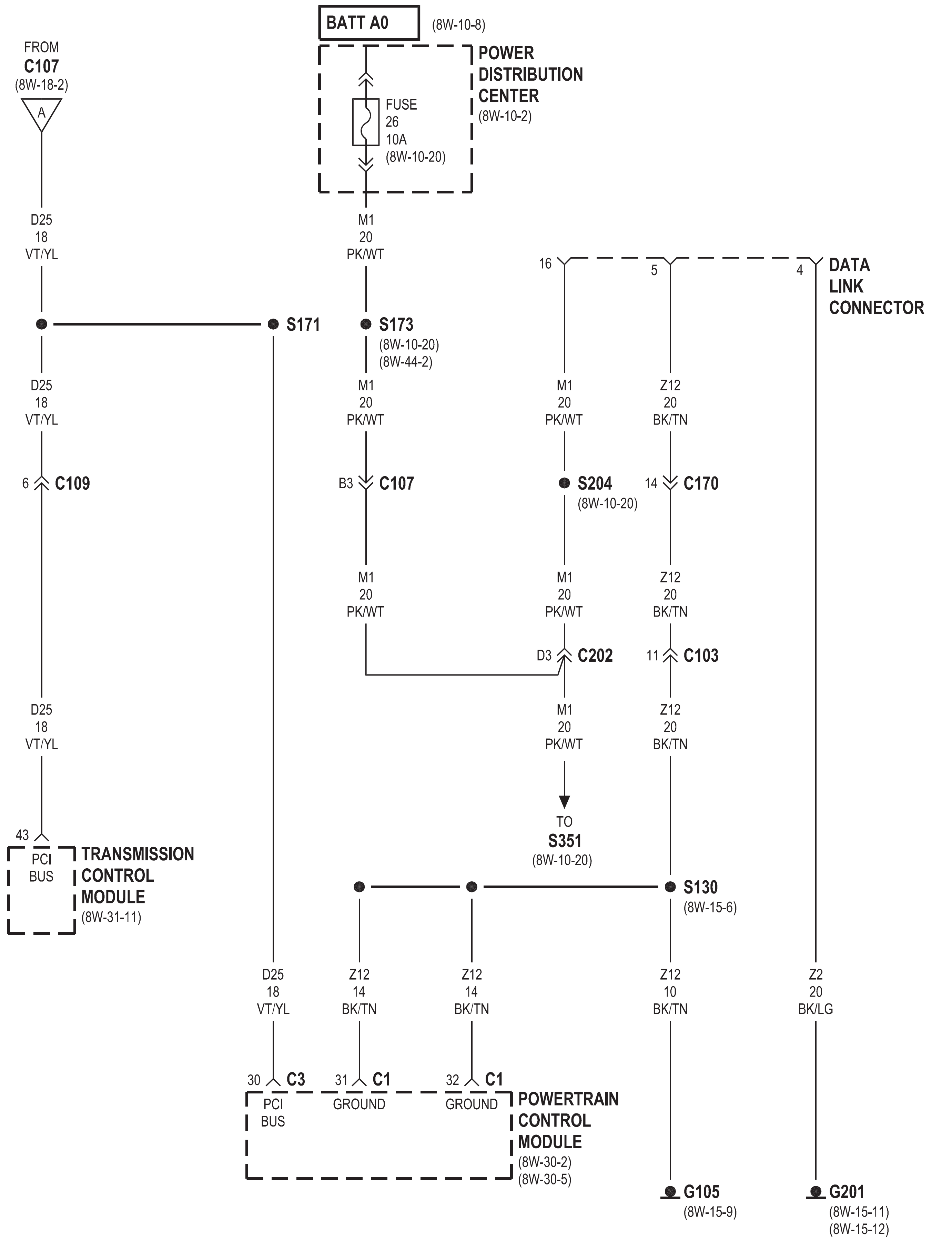

DRIVER DOOR AJAR SWITCH
(8W-44-4)
PASSENGER DOOR AJAR SWITCH
(8W-44-4)
1
M23
20
YL/BK
4
FUSE BLOCK
(8W-11-2)
FUSE
4
10A
(8W-11-4)
24
MULTI-FUNCTION SWITCH
(8W-44-5)
(8W-53-2)
2 C2
7 C1
EXPORT
EXCEPT EXPORT
Z1
18
BK
Z1
20
BK
FRONT WIPER MOTOR
(8W-53-2)
IGNITION SWITCH
(8W-10-14)
TRANSMISSION RANGE INDICATOR ILLUMINATION (PRNDL)
(8W-44-5)
4
10
2
Z1
16
BK
S302
BRAKE LAMP SWITCH
(8W-51-7)
Z1
20
BK/WT
Z1
16
BK/WT
G300

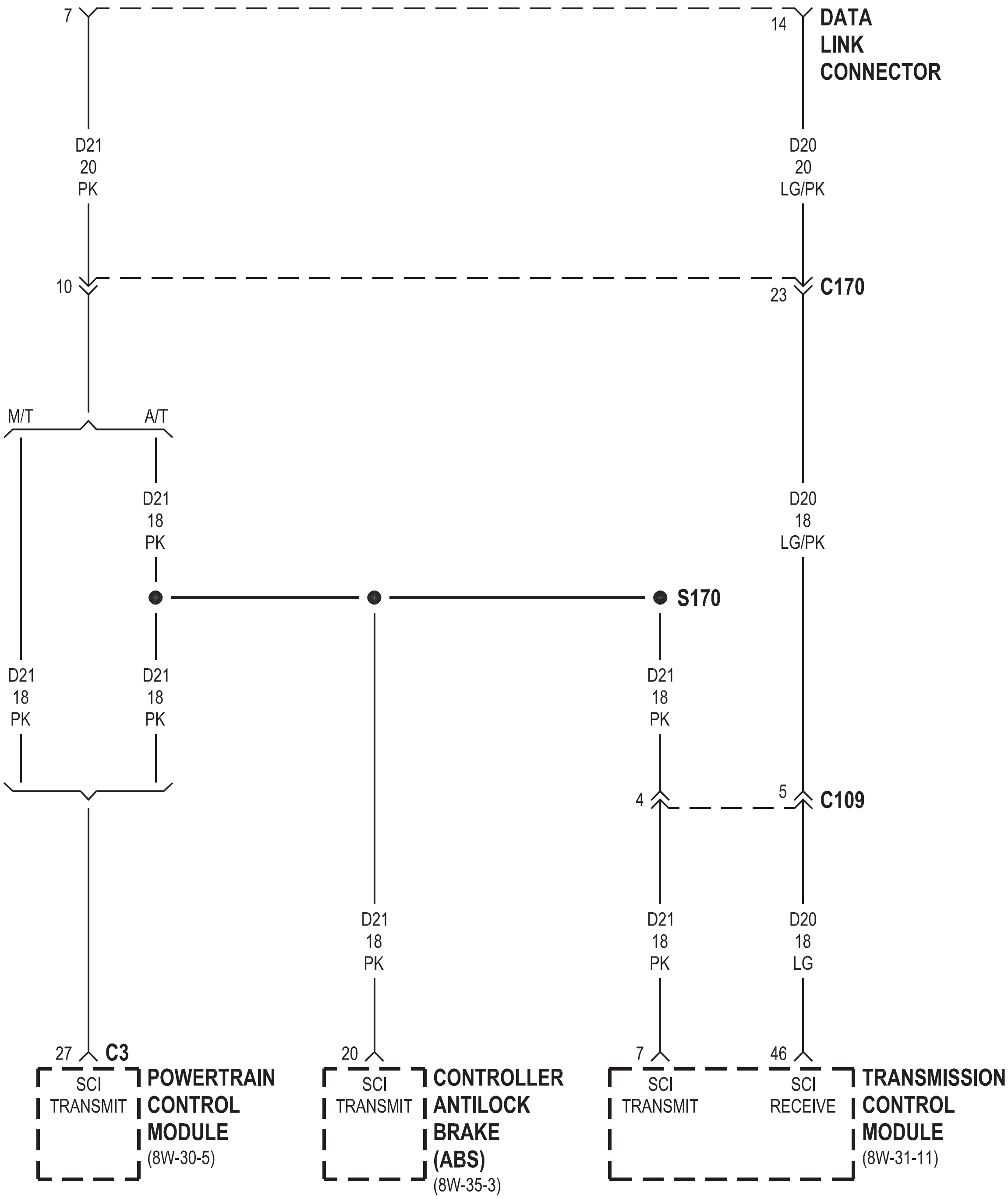

REAR WIPER MOTOR (8W-53-3)
2
Z1 16 BK
REAR WINDOW DEFOGGER (HARD TOP) (8W-48-3)
Z1 12 BK
S360 (HARD TOP)
REAR FOG LAMP (8W-51-8)
2
Z1 20 BK
LEFT LICENSE LAMP (8W-51-8)
2
Z1 20 BK
RIGHT LICENSE LAMP (8W-51-8)
2
Z1 20 BK
S316 (EXPORT)
Z1 20 BK
Z1 12 BK
REAR WASHER PUMP (HARD TOP) (8W-53-4)
2
CENTER HIGH MOUNTED STOP LAMP (8W-51-5)
SEAT BELT SWITCH (EXCEPT LHD EXPORT) (8W-40-4)
2
3 C329
6 C326
Z1 18 BK
Z1 18 BK
Z1 20 BK
Z1 20 BK
Z1 12 BK
S309
SUBWOOFER (8W-47-4) (8W-47-5)
12
Z9 16 BK/WT
G303
AIRBAG CONTROL MODULE (8W-43-2)
10
Z6 18 BK/PK
G301
SENTRY KEY IMMOBILIZER MODULE (8W-39-2)
5
Z1 20 BK
Z1 12 BK
G302

8W-18 BUS COMMUNICATIONS



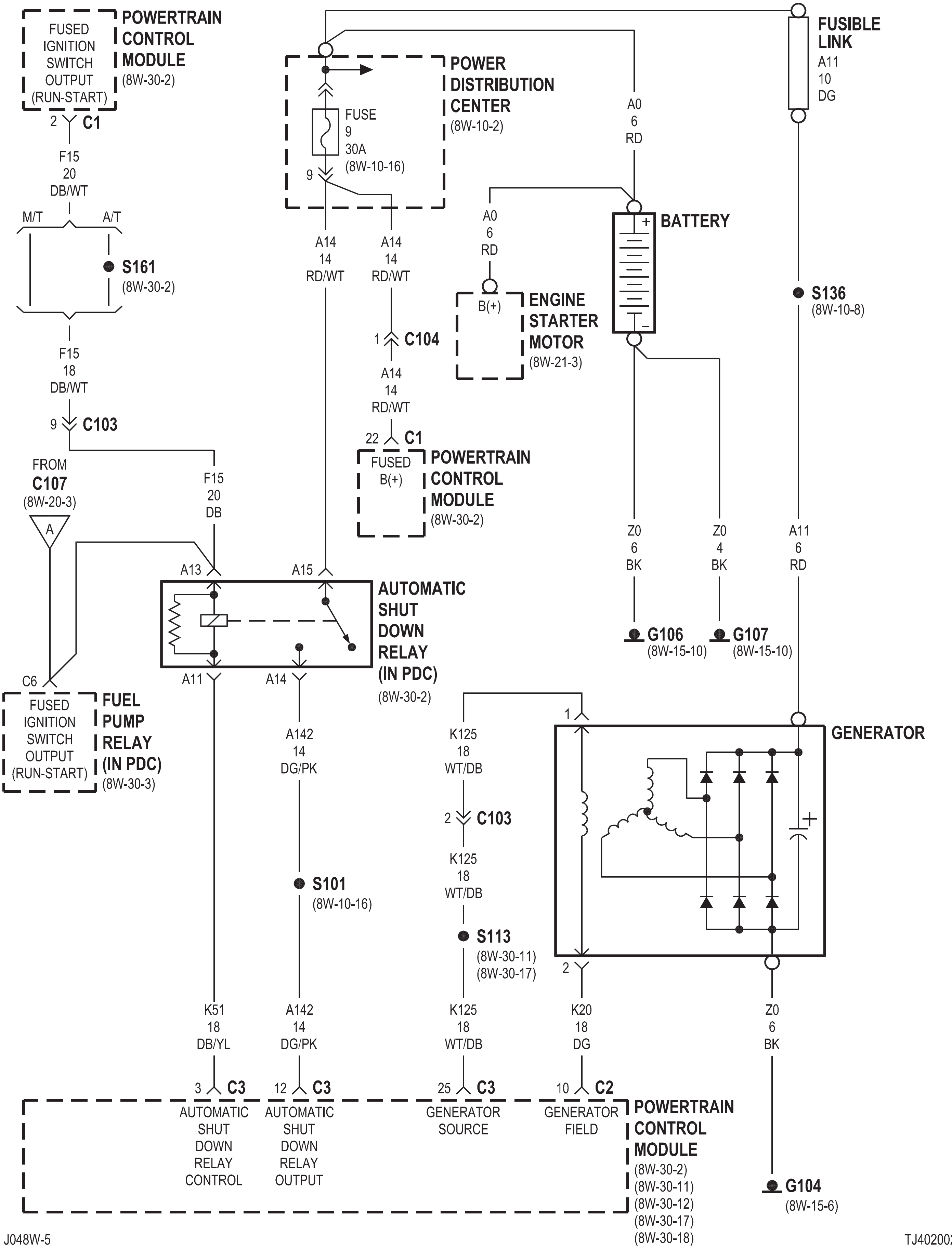
2
9
6
DATA LINK CONNECTOR
RADIO
(8W-47-2)
PCI BUS
14
D32
20
LG/WT
9
C170
D25
20
VT/YL
D23
20
WT/BR
D32
18
LG/WT
S209
29
C3
SCI RECEIVE
POWERTRAIN CONTROL MODULE
(8W-30-5)
SENTRY KEY IMMOBILIZER MODULE
(8W-39-2)
C12
C202
12
C2
INSTRUMENT CLUSTER
(8W-40-3)
(8W-40-4)
10
C1
FLASH PROGRAM ENABLE
INSTRUMENT CLUSTER
(8W-40-9)
S355
D25
18
VT/YL
D7
C107
18
AIRBAG CONTROL MODULE
(8W-43-3)
A/T
M/T
30
C3
POWERTRAIN CONTROL MODULE
(8W-30-5)
A
TO
S171
(8W-18-3)


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 26 10A
(8W-10-20)
FROM C107
(8W-18-2)
A
D25 18 VT/YL
M1 20 PK/WT
S171
S173
(8W-10-20)
(8W-44-2)
16
5
4
DATA LINK CONNECTOR
M1 20 PK/WT
Z12 20 BK/TN
6 C109
B3 C107
S204
(8W-10-20)
14 C170
D3 C202
11 C103
TO S351
(8W-10-20)
43
PCI BUS
TRANSMISSION CONTROL MODULE
(8W-31-11)
S130
(8W-15-6)
D25 18 VT/YL
Z12 14 BK/TN
Z12 14 BK/TN
Z12 10 BK/TN
Z2 20 BK/LG
30 C3
31 C1
32 C1
PCI BUS
GROUND
GROUND
POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-5)
G105
(8W-15-9)
G201
(8W-15-11)
(8W-15-12)

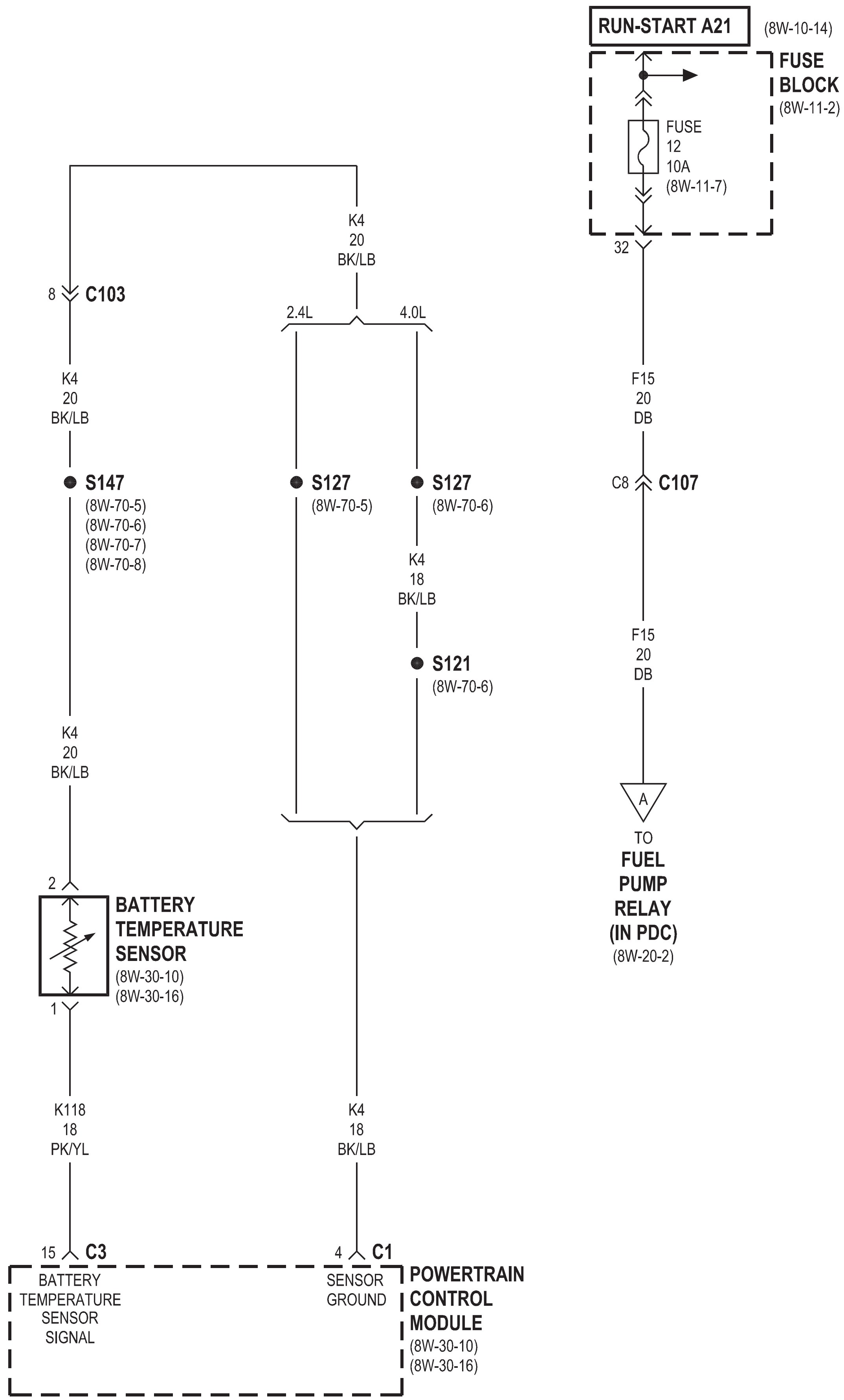


DATA LINK CONNECTOR
7
14
D21
20
PK
D20
20
LG/PK
10
23
C170
M/T
A/T
D21
18
PK
D20
18
LG/PK
S170
D21
18
PK
D21
18
PK
D21
18
PK
4
5
C109
D21
18
PK
D21
18
PK
D20
18
LG
27
C3
SCI TRANSMIT
POWERTRAIN CONTROL MODULE
(8W-30-5)
20
SCI TRANSMIT
CONTROLLER ANTILOCK BRAKE (ABS)
(8W-35-3)
7
46
SCI TRANSMIT
SCI RECEIVE
TRANSMISSION CONTROL MODULE
(8W-31-11)

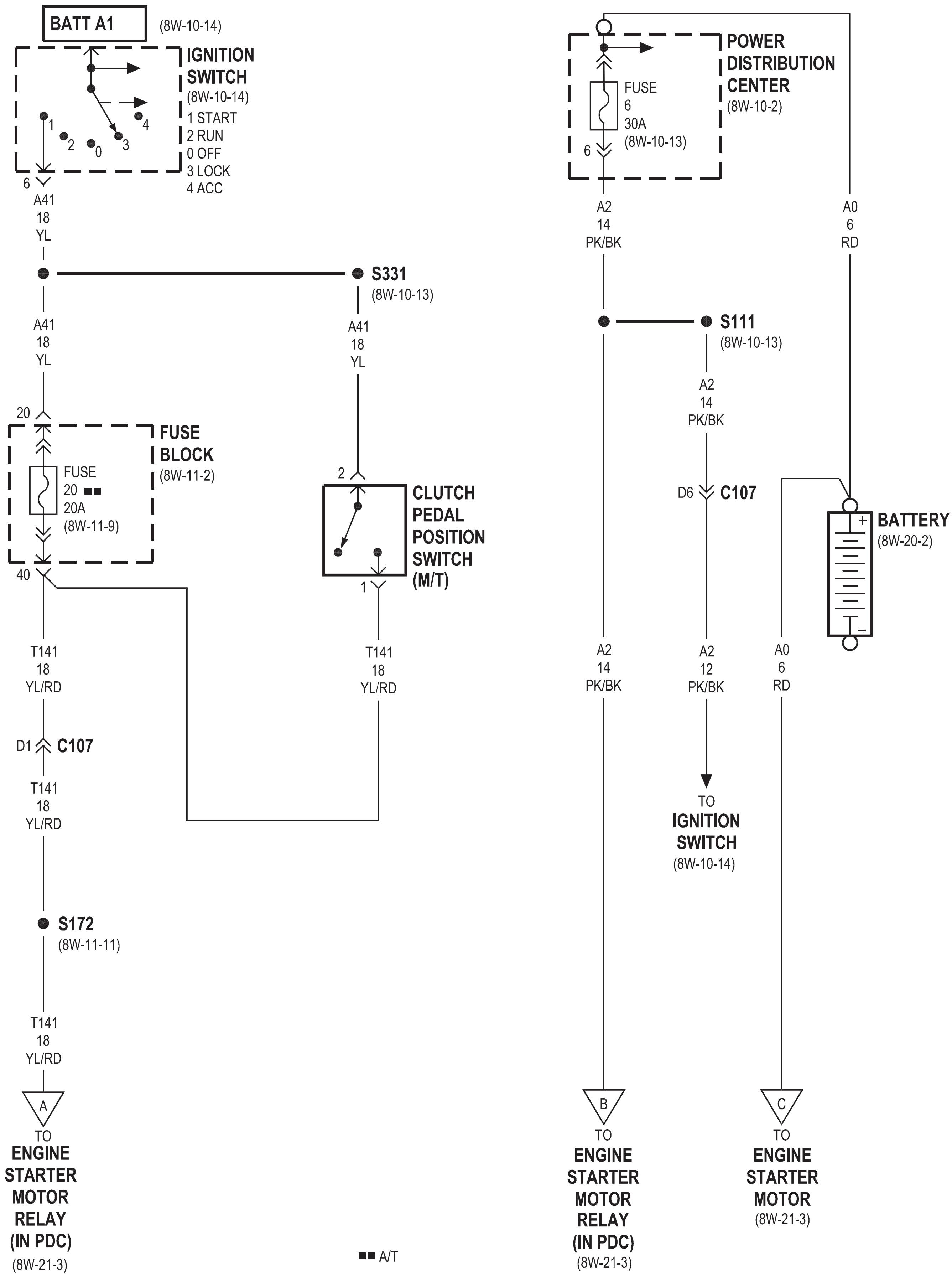
8W-20 CHARGING SYSTEM



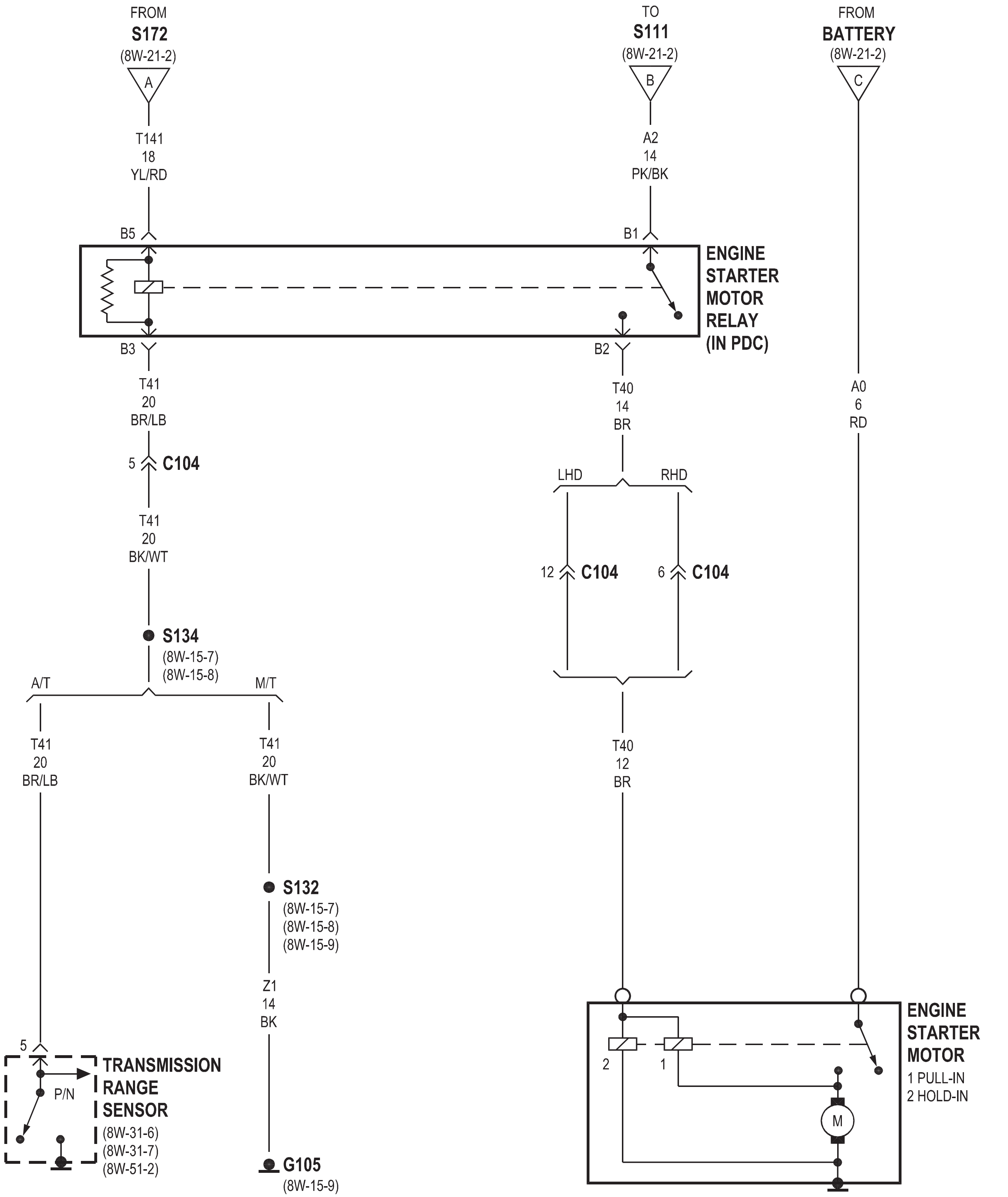
J048W-5 TJ402002


RUN-START A21
(8W-10-14)
FUSE
BLOCK
(8W-11-2)
FUSE
12
10A
(8W-11-7)
32
F15
20
DB
C8
C107
F15
20
DB
A
TO
FUEL
PUMP
RELAY
(IN PDC)
(8W-20-2)
K4
20
BK/LB
8
C103
2.4L
4.0L
K4
20
BK/LB
S147
(8W-70-5)
(8W-70-6)
(8W-70-7)
(8W-70-8)
S127
(8W-70-5)
S127
(8W-70-6)
K4
18
BK/LB
S121
(8W-70-6)
K4
20
BK/LB
2
BATTERY
TEMPERATURE
SENSOR
(8W-30-10)
(8W-30-16)
1
K118
18
PK/YL
K4
18
BK/LB
15
C3
4
C1
BATTERY
TEMPERATURE
SENSOR
SIGNAL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE
(8W-30-10)
(8W-30-16)

8W-21 STARTING SYSTEM



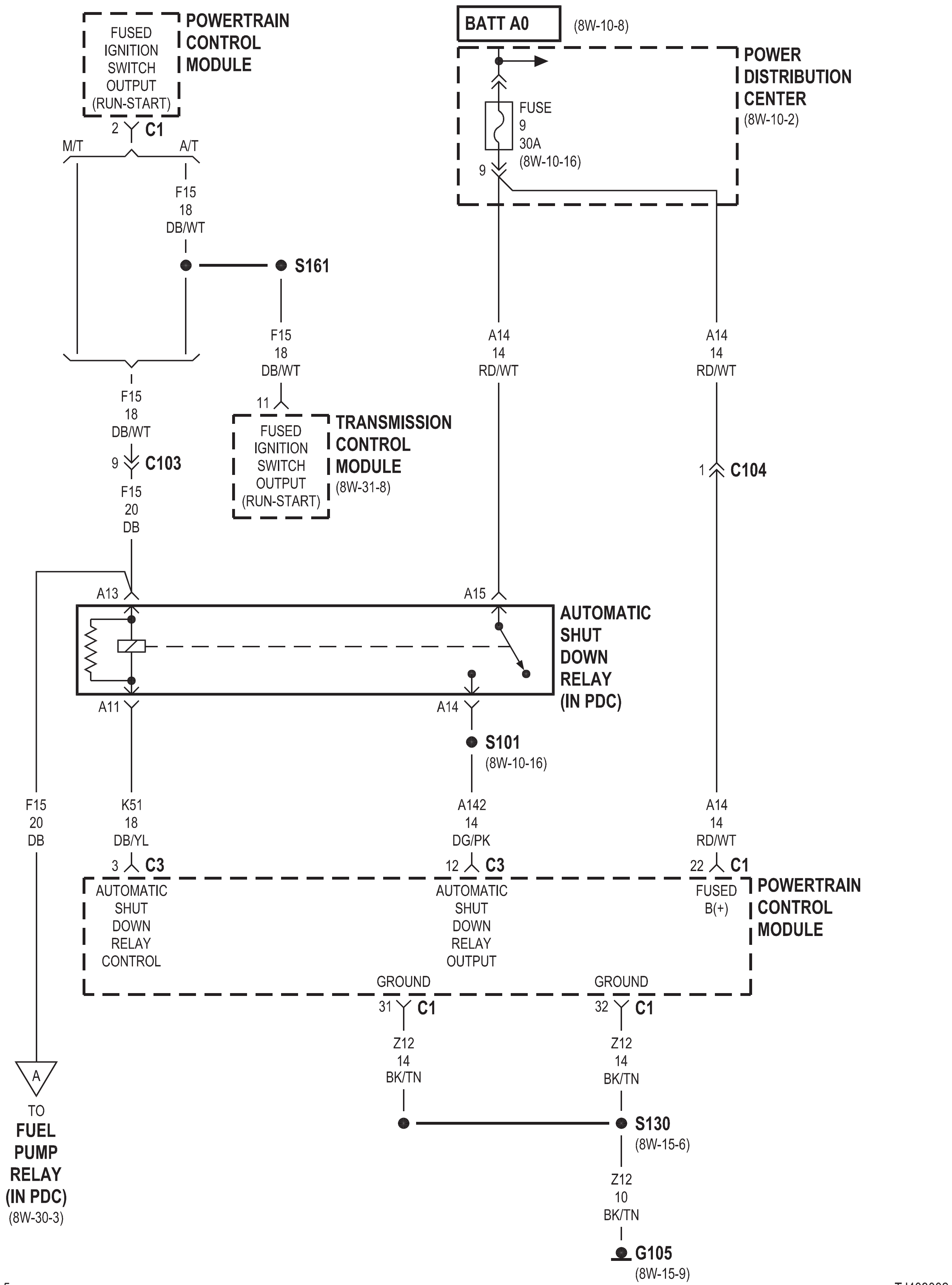
BATT A1
(8W-10-14)
IGNITION SWITCH
(8W-10-14)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
6
A41
18
YL
S331
(8W-10-13)
A41
18
YL
20
FUSE BLOCK
(8W-11-2)
FUSE
20 ■■
20A
(8W-11-9)
40
2
CLUTCH PEDAL POSITION SWITCH (M/T)
1
T141
18
YL/RD
D1
C107
S172
(8W-11-11)
A
TO
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
6
30A
(8W-10-13)
A2
14
PK/BK
A0
6
RD
S111
(8W-10-13)
D6
C107
BATTERY
(8W-20-2)
A2
12
PK/BK
TO
IGNITION SWITCH
(8W-10-14)
B
TO
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
C
TO
ENGINE STARTER MOTOR
(8W-21-3)
■■ A/T

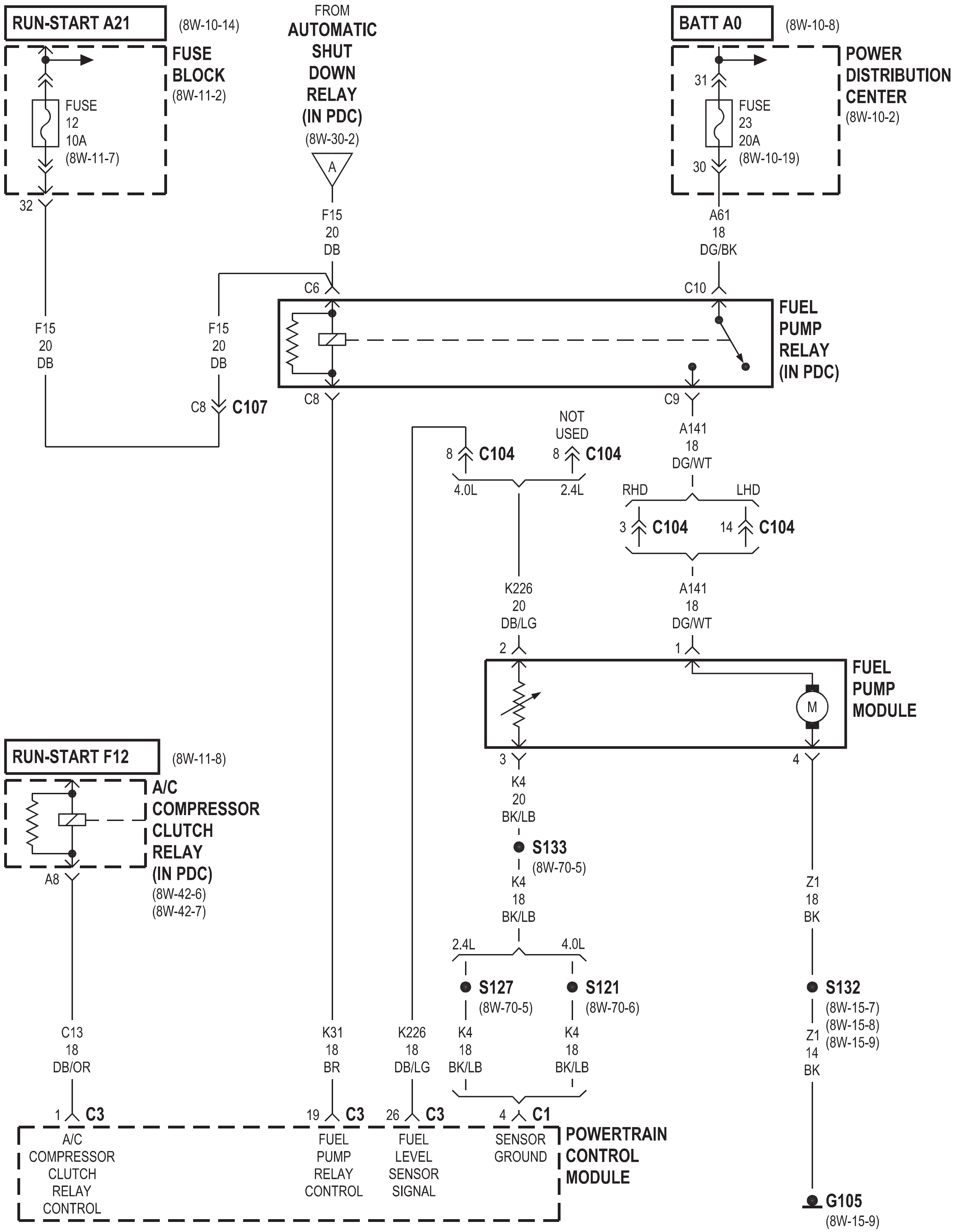


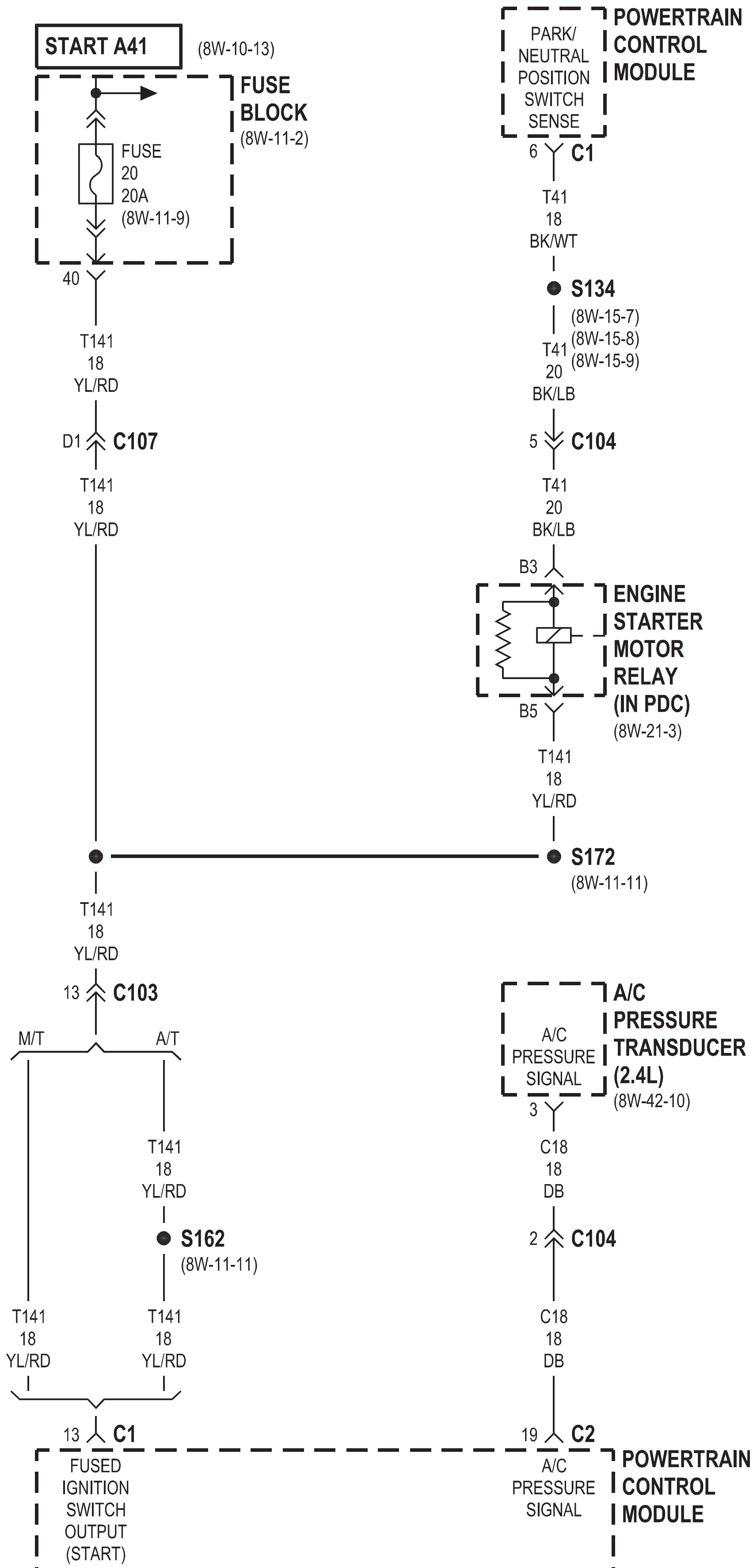
TJ402103

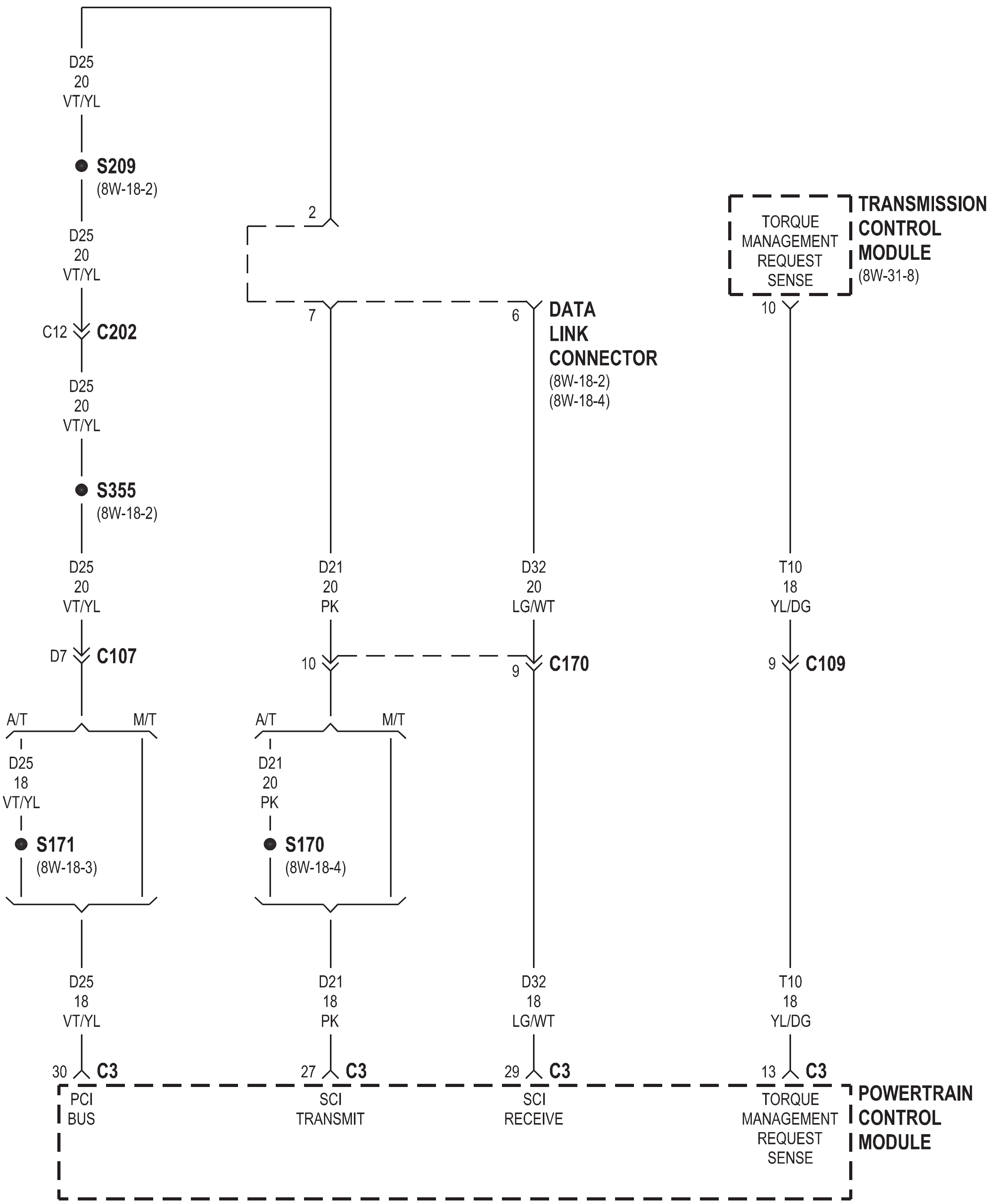
J048W-5

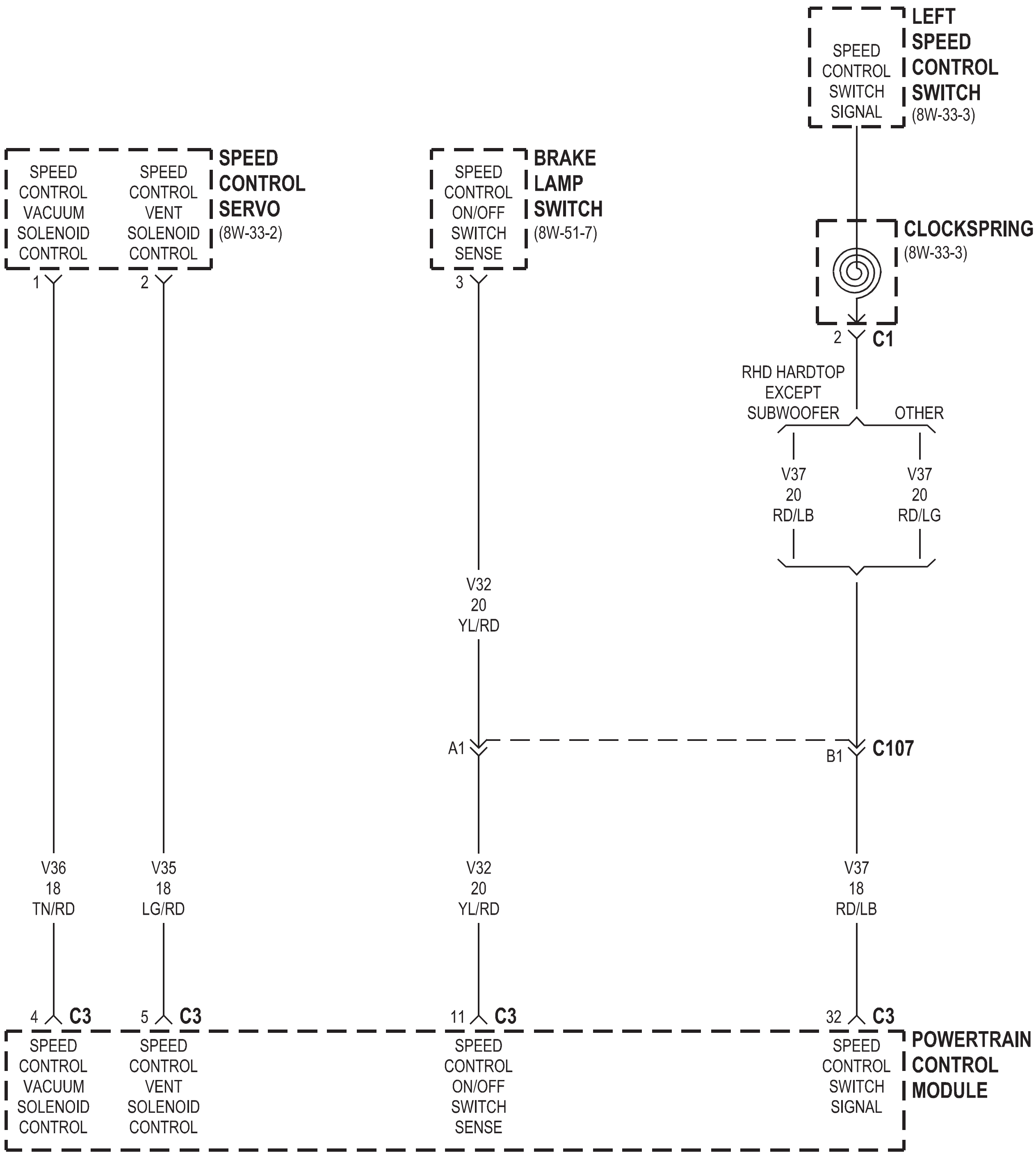
8W-30 FUEL/IGNITION SYSTEM

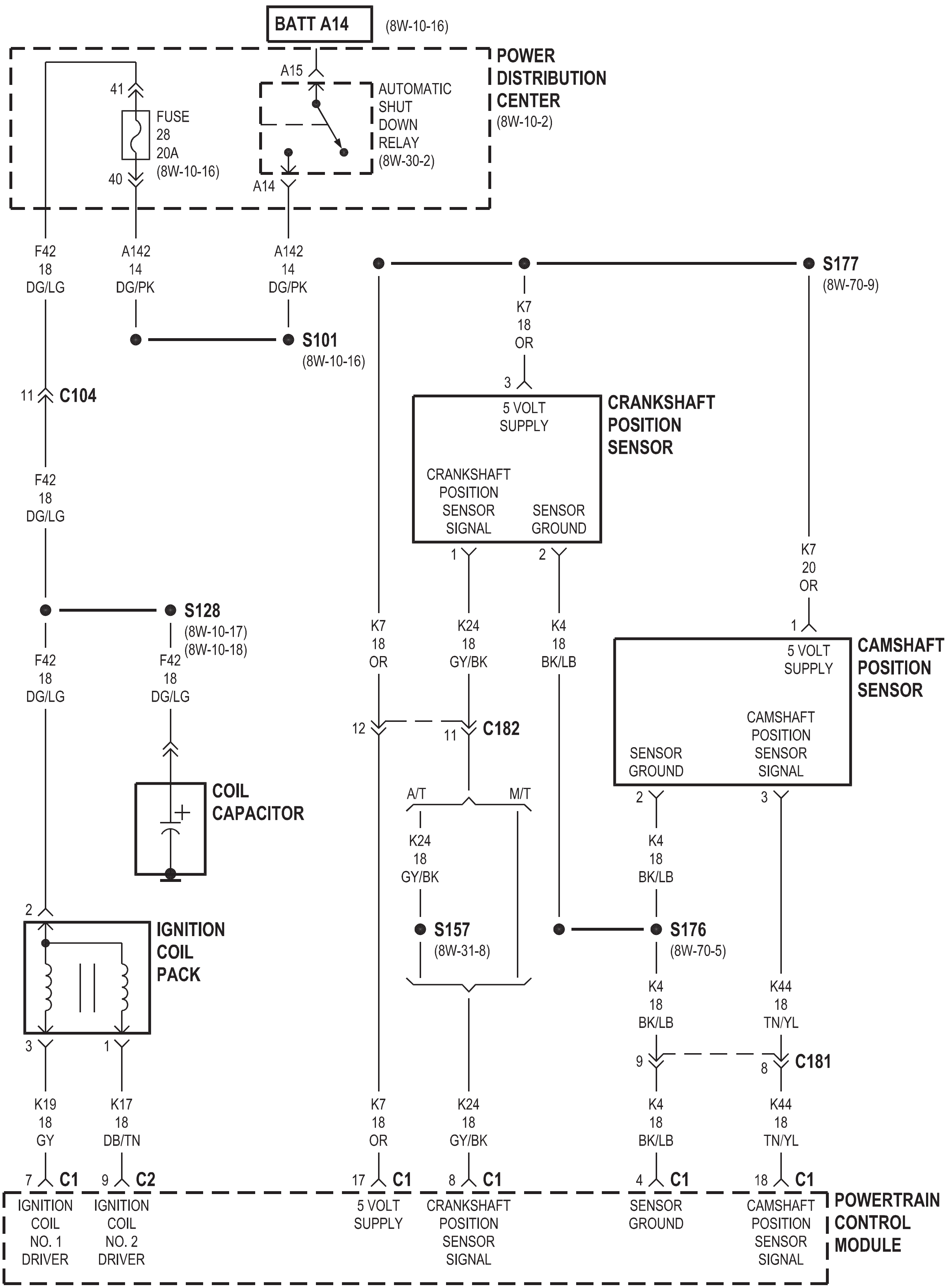

POWERTRAIN CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
2 C1
M/T
A/T
F15 18 DB/WT
S161
F15 18 DB/WT
11
TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
(8W-31-8)
F15 18 DB/WT
9 C103
F15 20 DB
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 9 30A (8W-10-16)
9
A14 14 RD/WT
A14 14 RD/WT
1 C104
A13
A15
AUTOMATIC SHUT DOWN RELAY (IN PDC)
A11
A14
S101
(8W-10-16)
F15 20 DB
K51 18 DB/YL
A142 14 DG/PK
A14 14 RD/WT
3 C3
12 C3
22 C1
AUTOMATIC SHUT DOWN RELAY CONTROL
AUTOMATIC SHUT DOWN RELAY OUTPUT
FUSED B(+)
POWERTRAIN CONTROL MODULE
GROUND
GROUND
31 C1
32 C1
Z12 14 BK/TN
Z12 14 BK/TN
S130
(8W-15-6)
Z12 10 BK/TN
G105
(8W-15-9)
A
TO FUEL PUMP RELAY (IN PDC)
(8W-30-3)

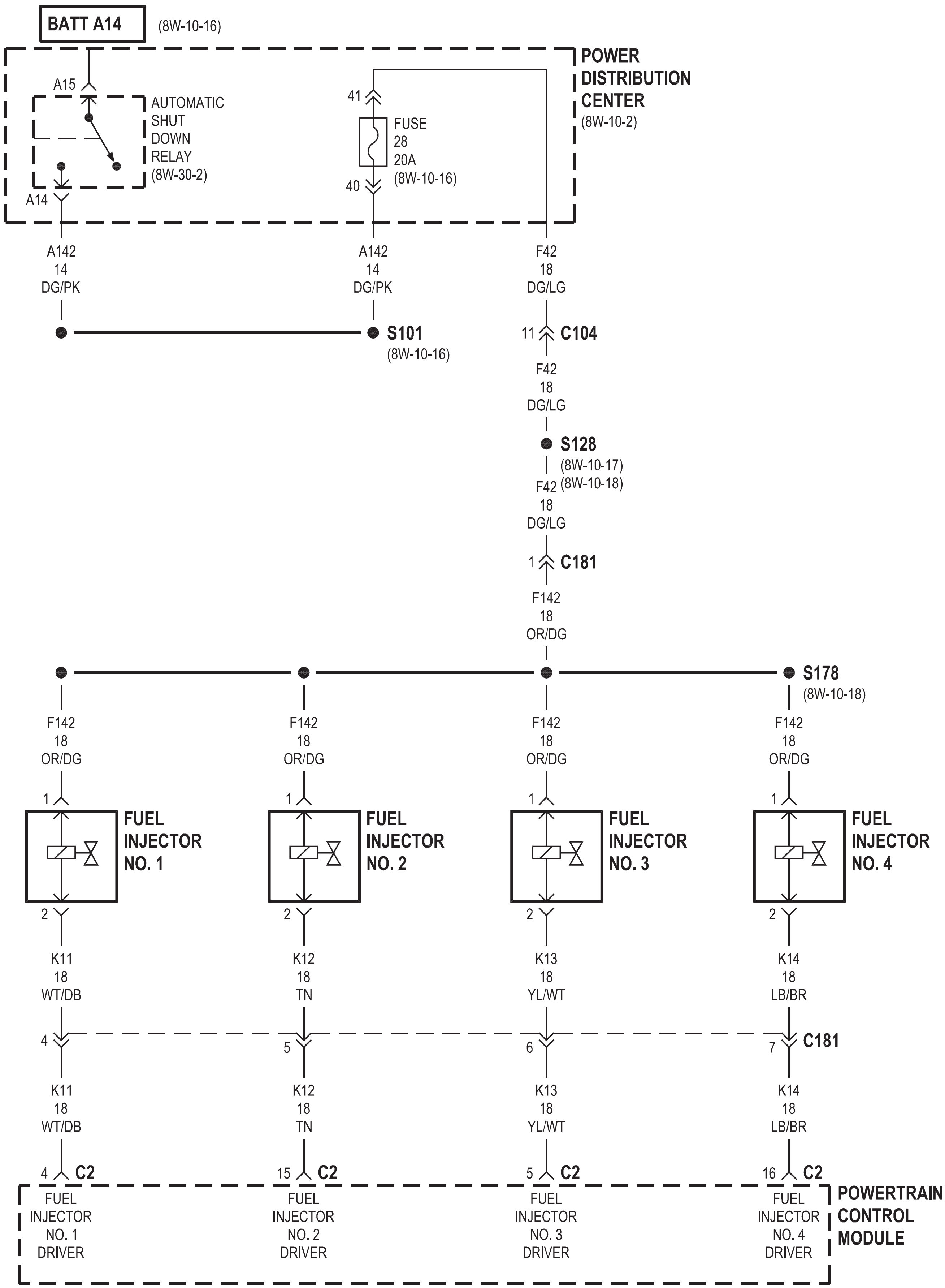

RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 12 10A (8W-11-7)
32
FROM AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
A
F15 20 DB
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
31
FUSE 23 20A (8W-10-19)
30
A61 18 DG/BK
C6
C10
FUEL PUMP RELAY (IN PDC)
F15 20 DB
F15 20 DB
C8
C107
C8
C9
NOT USED
8 C104
8 C104
4.0L
2.4L
A141 18 DG/WT
RHD
LHD
3 C104
14 C104
K226 20 DB/LG
A141 18 DG/WT
2
1
FUEL PUMP MODULE
M
3
4
RUN-START F12
(8W-11-8)
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-6)
(8W-42-7)
A8
K4 20 BK/LB
S133
(8W-70-5)
K4 18 BK/LB
Z1 18 BK
2.4L
4.0L
S127
(8W-70-5)
S121
(8W-70-6)
S132
(8W-15-7)
(8W-15-8)
(8W-15-9)
C13 18 DB/OR
K31 18 BR
K226 18 DB/LG
K4 18 BK/LB
K4 18 BK/LB
Z1 14 BK
1 C3
19 C3
26 C3
4 C1
A/C COMPRESSOR CLUTCH RELAY CONTROL
FUEL PUMP RELAY CONTROL
FUEL LEVEL SENSOR SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE
G105
(8W-15-9)

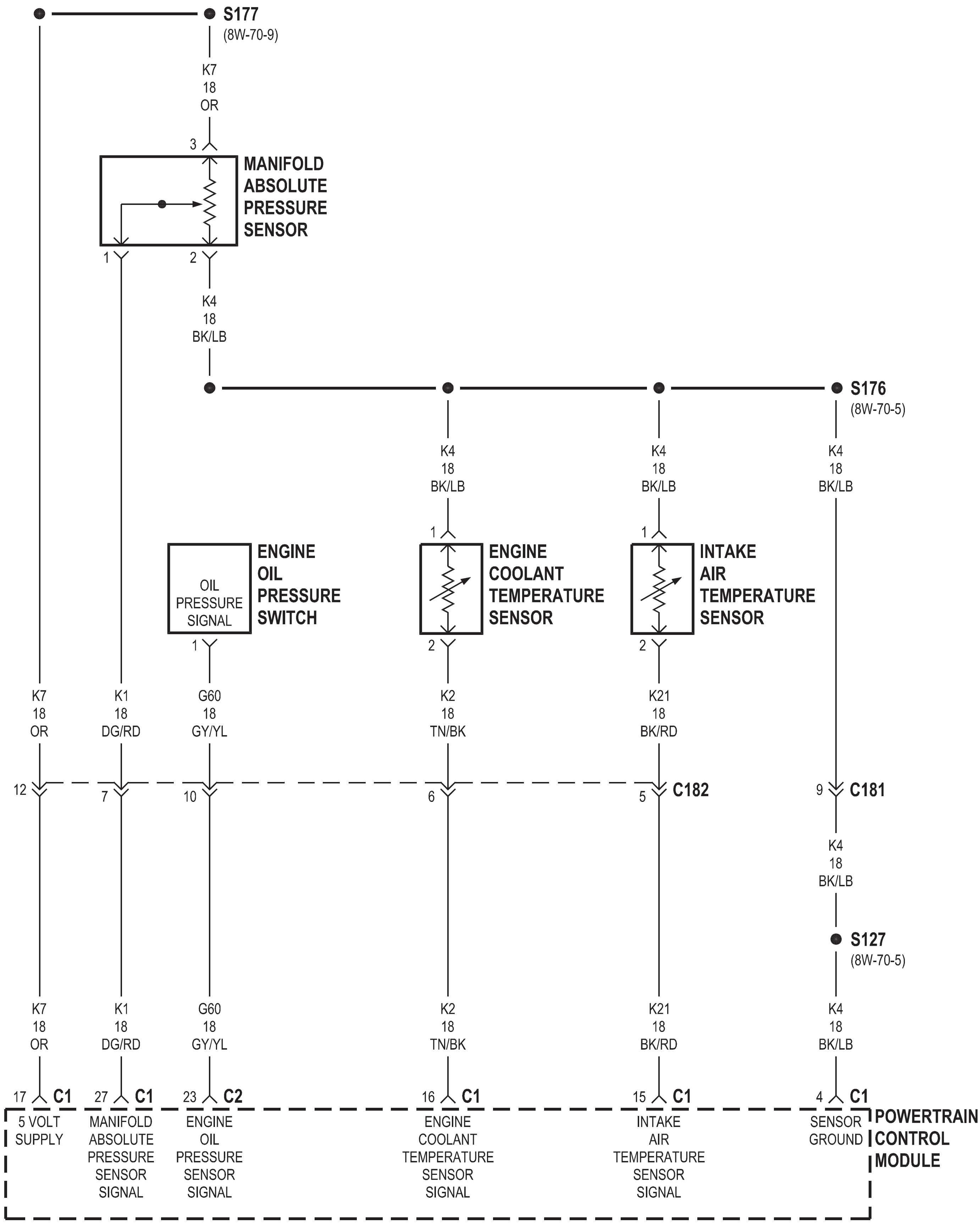

START A41
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE
20
20A
(8W-11-9)
40
T141
18
YL/RD
D1
C107
T141
18
YL/RD
POWERTRAIN CONTROL MODULE
PARK/ NEUTRAL POSITION SWITCH SENSE
6
C1
T41
18
BK/WT
S134
(8W-15-7)
(8W-15-8)
(8W-15-9)
T41
20
BK/LB
5
C104
T41
20
BK/LB
B3
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
B5
T141
18
YL/RD
S172
(8W-11-11)
T141
18
YL/RD
13
C103
M/T
A/T
T141
18
YL/RD
S162
(8W-11-11)
T141
18
YL/RD
T141
18
YL/RD
A/C PRESSURE TRANSDUCER (2.4L)
(8W-42-10)
A/C PRESSURE SIGNAL
3
C18
18
DB
2
C104
C18
18
DB
13
C1
19
C2
FUSED IGNITION SWITCH OUTPUT (START)
A/C PRESSURE SIGNAL
POWERTRAIN CONTROL MODULE

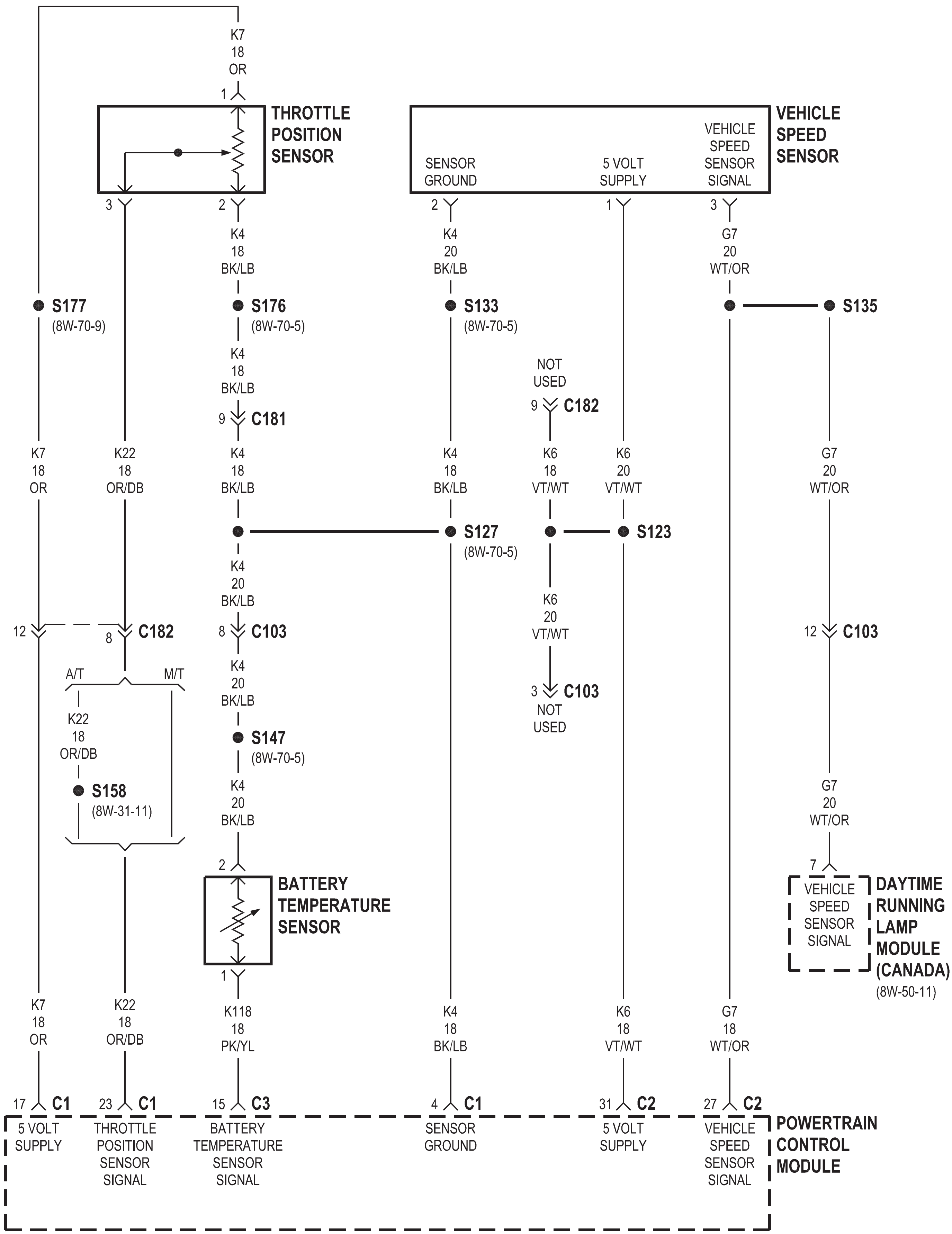

D25
20
VT/YL
S209
(8W-18-2)
D25
20
VT/YL
C12
C202
D25
20
VT/YL
S355
(8W-18-2)
D25
20
VT/YL
D7
C107
A/T
M/T
D25
18
VT/YL
S171
(8W-18-3)
D25
18
VT/YL
30
C3
PCI
BUS
2
7
6
DATA
LINK
CONNECTOR
(8W-18-2)
(8W-18-4)
D21
20
PK
10
A/T
M/T
D21
20
PK
S170
(8W-18-4)
D21
18
PK
27
C3
SCI
TRANSMIT
D32
20
LG/WT
9
C170
D32
18
LG/WT
29
C3
SCI
RECEIVE
TORQUE
MANAGEMENT
REQUEST
SENSE
TRANSMISSION
CONTROL
MODULE
(8W-31-8)
10
T10
18
YL/DG
9
C109
T10
18
YL/DG
13
C3
TORQUE
MANAGEMENT
REQUEST
SENSE
POWERTRAIN
CONTROL
MODULE


LEFT SPEED CONTROL SWITCH
(8W-33-3)
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL SERVO
(8W-33-2)
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
BRAKE LAMP SWITCH
(8W-51-7)
SPEED CONTROL ON/OFF SWITCH SENSE
CLOCKSPRING
(8W-33-3)
2 C1
RHD HARDTOP EXCEPT SUBWOOFER
OTHER
V37 20 RD/LB
V37 20 RD/LG
V32 20 YL/RD
A1
B1
C107
V36 18 TN/RD
V35 18 LG/RD
V32 20 YL/RD
V37 18 RD/LB
4 C3
5 C3
11 C3
32 C3
POWERTRAIN CONTROL MODULE
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL ON/OFF SWITCH SENSE
SPEED CONTROL SWITCH SIGNAL


BATT A14
(8W-10-16)
POWER DISTRIBUTION CENTER
(8W-10-2)
41
FUSE
28
20A
(8W-10-16)
40
A15
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
A14
F42 18 DG/LG
A142 14 DG/PK
A142 14 DG/PK
S101
(8W-10-16)
11 C104
F42 18 DG/LG
S128
(8W-10-17)
(8W-10-18)
F42 18 DG/LG
F42 18 DG/LG
COIL CAPACITOR
2
IGNITION COIL PACK
3
1
K19 18 GY
K17 18 DB/TN
S177
(8W-70-9)
K7 18 OR
3
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
1
2
K7 18 OR
K24 18 GY/BK
K4 18 BK/LB
12
11
C182
A/T
M/T
K24 18 GY/BK
S157
(8W-31-8)
K7 20 OR
1
5 VOLT SUPPLY
CAMSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
2
3
K4 18 BK/LB
S176
(8W-70-5)
K4 18 BK/LB
K44 18 TN/YL
9
8
C181
K7 18 OR
K24 18 GY/BK
K4 18 BK/LB
K44 18 TN/YL
7 C1
9 C2
17 C1
8 C1
4 C1
18 C1
IGNITION COIL NO. 1 DRIVER
IGNITION COIL NO. 2 DRIVER
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE


BATT A14
(8W-10-16)
POWER DISTRIBUTION CENTER
(8W-10-2)
A15
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
A14
41
FUSE 28 20A
(8W-10-16)
40
A142 14 DG/PK
A142 14 DG/PK
F42 18 DG/LG
S101
(8W-10-16)
11 C104
F42 18 DG/LG
S128
(8W-10-17)
(8W-10-18)
F42 18 DG/LG
1 C181
F142 18 OR/DG
S178
(8W-10-18)
F142 18 OR/DG
F142 18 OR/DG
F142 18 OR/DG
F142 18 OR/DG
1
FUEL INJECTOR NO. 1
1
FUEL INJECTOR NO. 2
1
FUEL INJECTOR NO. 3
1
FUEL INJECTOR NO. 4
2
K11 18 WT/DB
2
K12 18 TN
2
K13 18 YL/WT
2
K14 18 LB/BR
4
5
6
7
C181
K11 18 WT/DB
K12 18 TN
K13 18 YL/WT
K14 18 LB/BR
4 C2
15 C2
5 C2
16 C2
FUEL INJECTOR NO. 1 DRIVER
FUEL INJECTOR NO. 2 DRIVER
FUEL INJECTOR NO. 3 DRIVER
FUEL INJECTOR NO. 4 DRIVER
POWERTRAIN CONTROL MODULE


S177
(8W-70-9)
K7
18
OR
3
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
1
2
K4
18
BK/LB
S176
(8W-70-5)
K4
18
BK/LB
K4
18
BK/LB
K4
18
BK/LB
ENGINE
OIL
PRESSURE
SWITCH
OIL
PRESSURE
SIGNAL
1
1
ENGINE
COOLANT
TEMPERATURE
SENSOR
2
1
INTAKE
AIR
TEMPERATURE
SENSOR
2
K7
18
OR
K1
18
DG/RD
G60
18
GY/YL
K2
18
TN/BK
K21
18
BK/RD
12
7
10
6
5
C182
9
C181
K4
18
BK/LB
S127
(8W-70-5)
K7
18
OR
K1
18
DG/RD
G60
18
GY/YL
K2
18
TN/BK
K21
18
BK/RD
K4
18
BK/LB
17 C1
27 C1
23 C2
16 C1
15 C1
4 C1
5 VOLT
SUPPLY
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
SIGNAL
ENGINE
OIL
PRESSURE
SENSOR
SIGNAL
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
INTAKE
AIR
TEMPERATURE
SENSOR
SIGNAL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE



J048W-5

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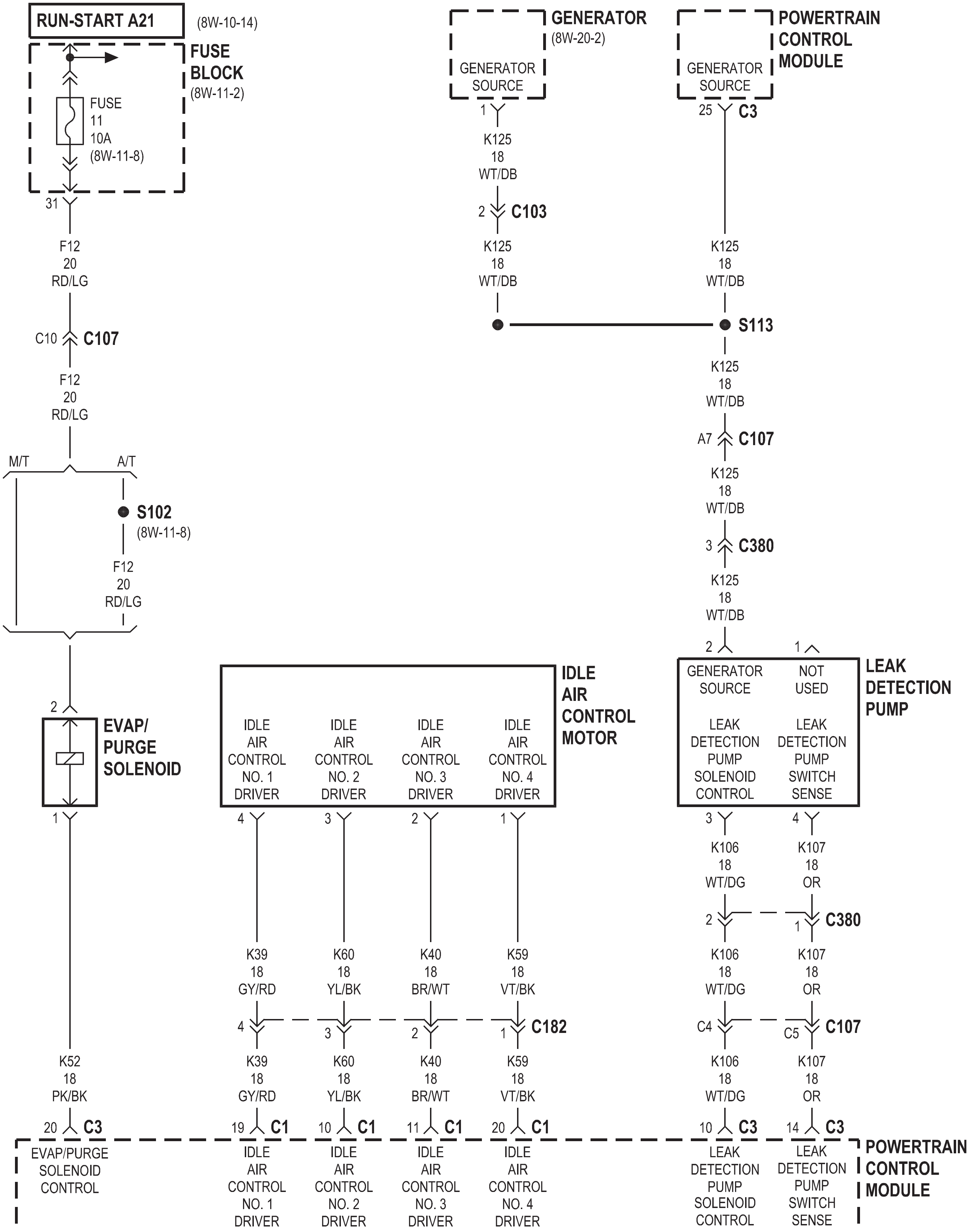
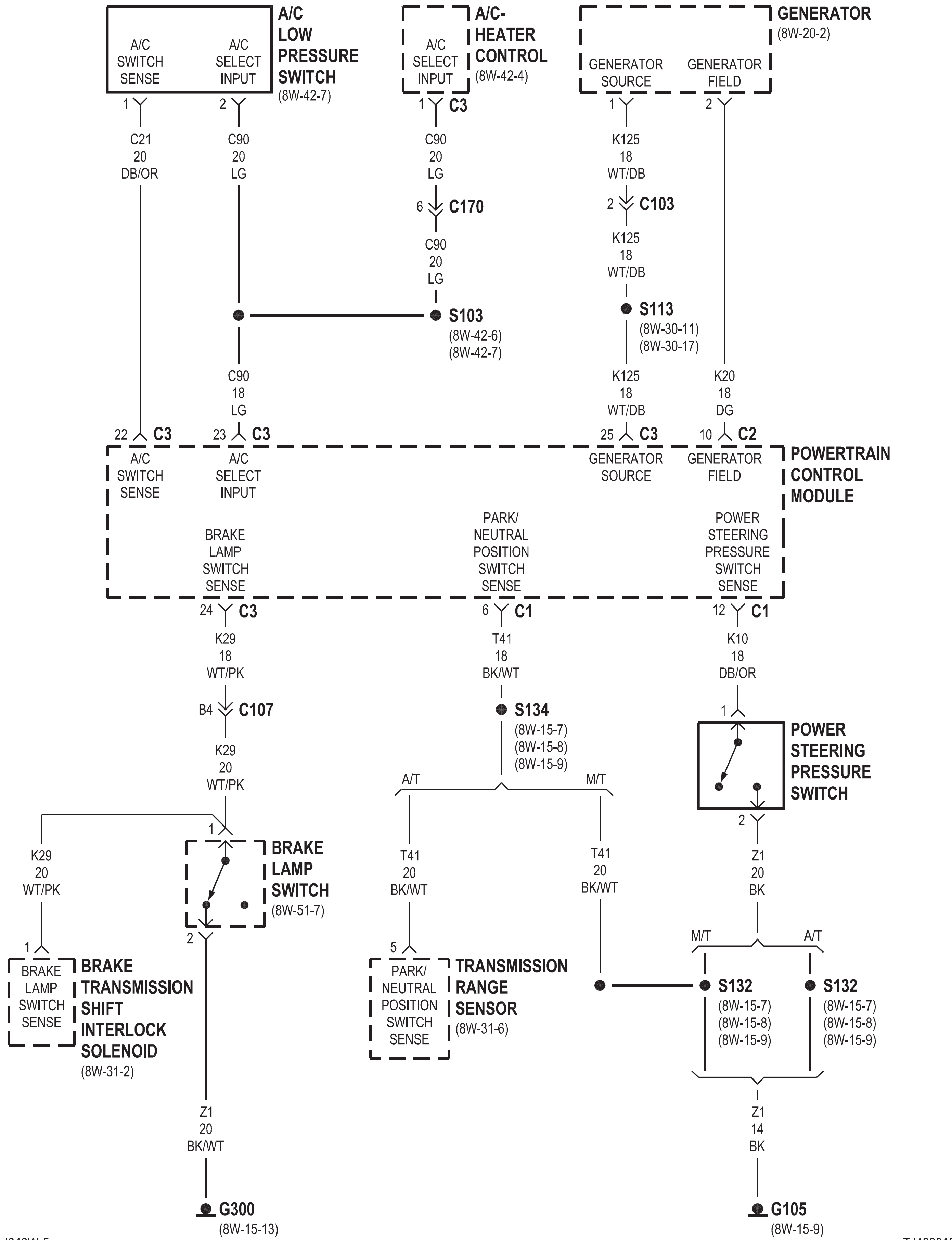
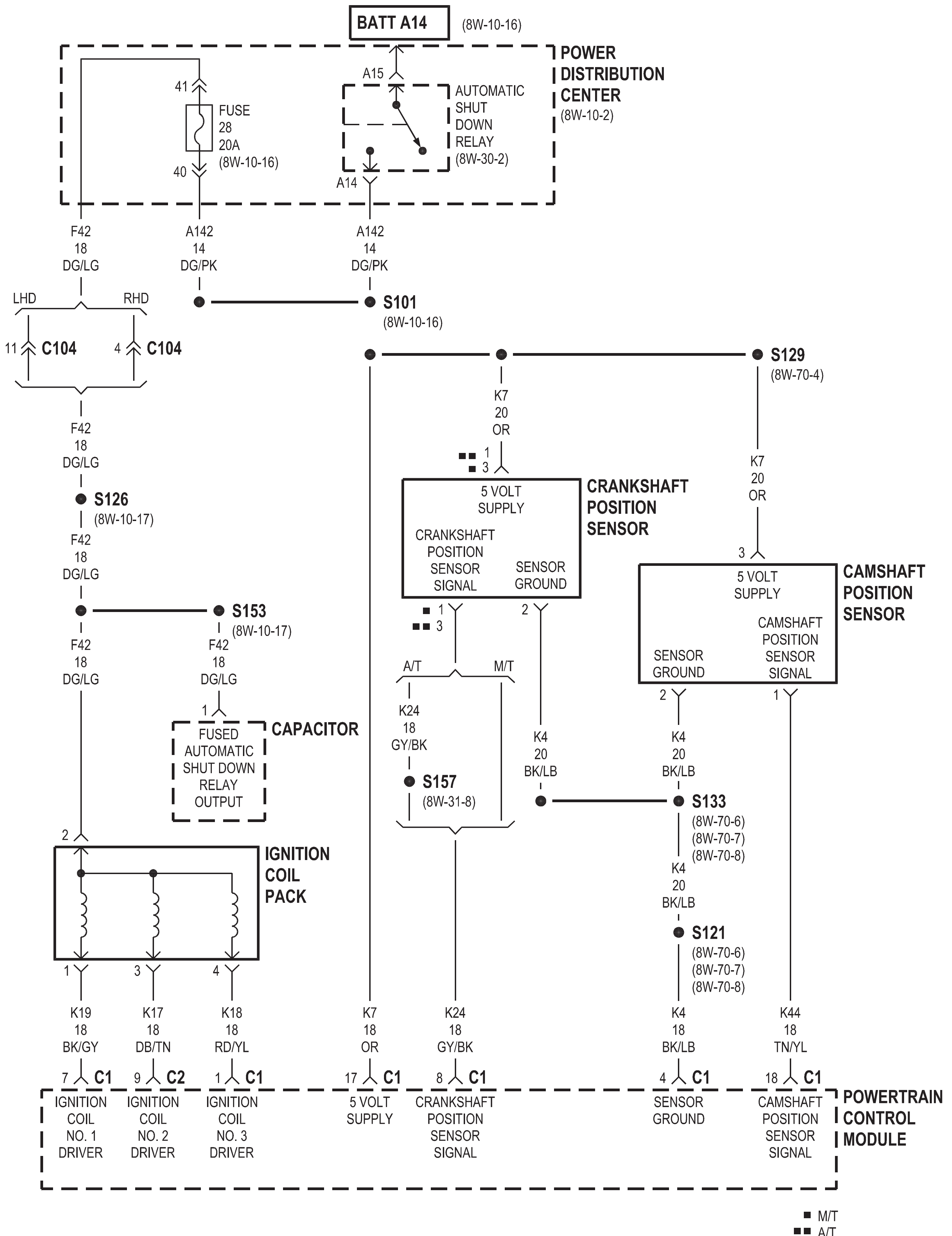
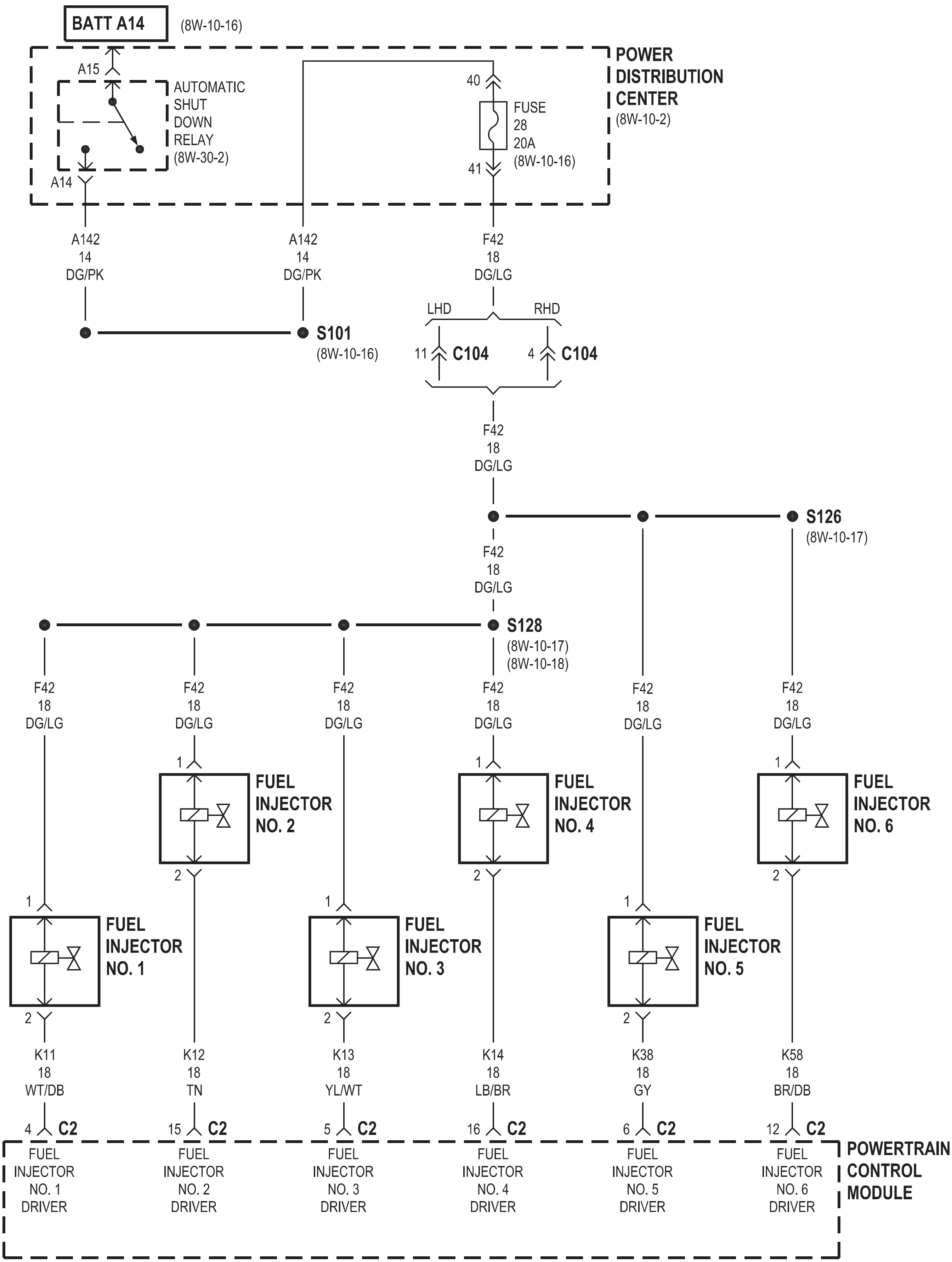
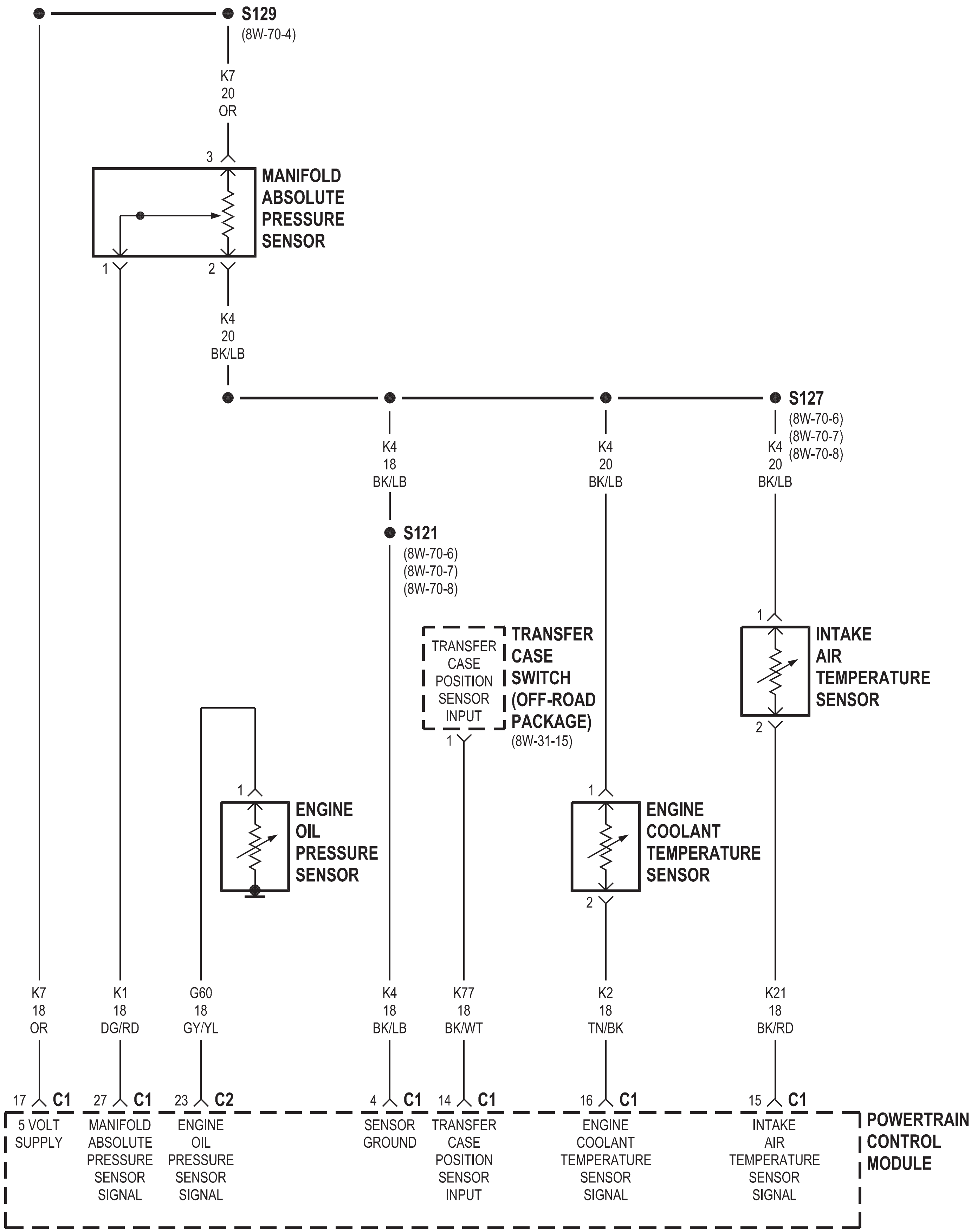

RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
11
10A
(8W-11-8)
31
F12
20
RD/LG
C10
C107
M/T
A/T
S102
(8W-11-8)
EVAP/
PURGE
SOLENOID
K52
18
PK/BK
20 C3
EVAP/PURGE
SOLENOID
CONTROL
GENERATOR
(8W-20-2)
GENERATOR
SOURCE
K125
18
WT/DB
C103
S113
POWERTRAIN
CONTROL
MODULE
25 C3
A7 C107
3 C380
LEAK
DETECTION
PUMP
GENERATOR
SOURCE
NOT
USED
LEAK
DETECTION
PUMP
SOLENOID
CONTROL
LEAK
DETECTION
PUMP
SWITCH
SENSE
K106
18
WT/DG
K107
18
OR
C380
C4
C5
C107
10 C3
14 C3
IDLE
AIR
CONTROL
MOTOR
IDLE
AIR
CONTROL
NO. 1
DRIVER
IDLE
AIR
CONTROL
NO. 2
DRIVER
IDLE
AIR
CONTROL
NO. 3
DRIVER
IDLE
AIR
CONTROL
NO. 4
DRIVER
K39
18
GY/RD
K60
18
YL/BK
K40
18
BR/WT
K59
18
VT/BK
C182
19 C1
10 C1
11 C1
20 C1
POWERTRAIN
CONTROL
MODULE

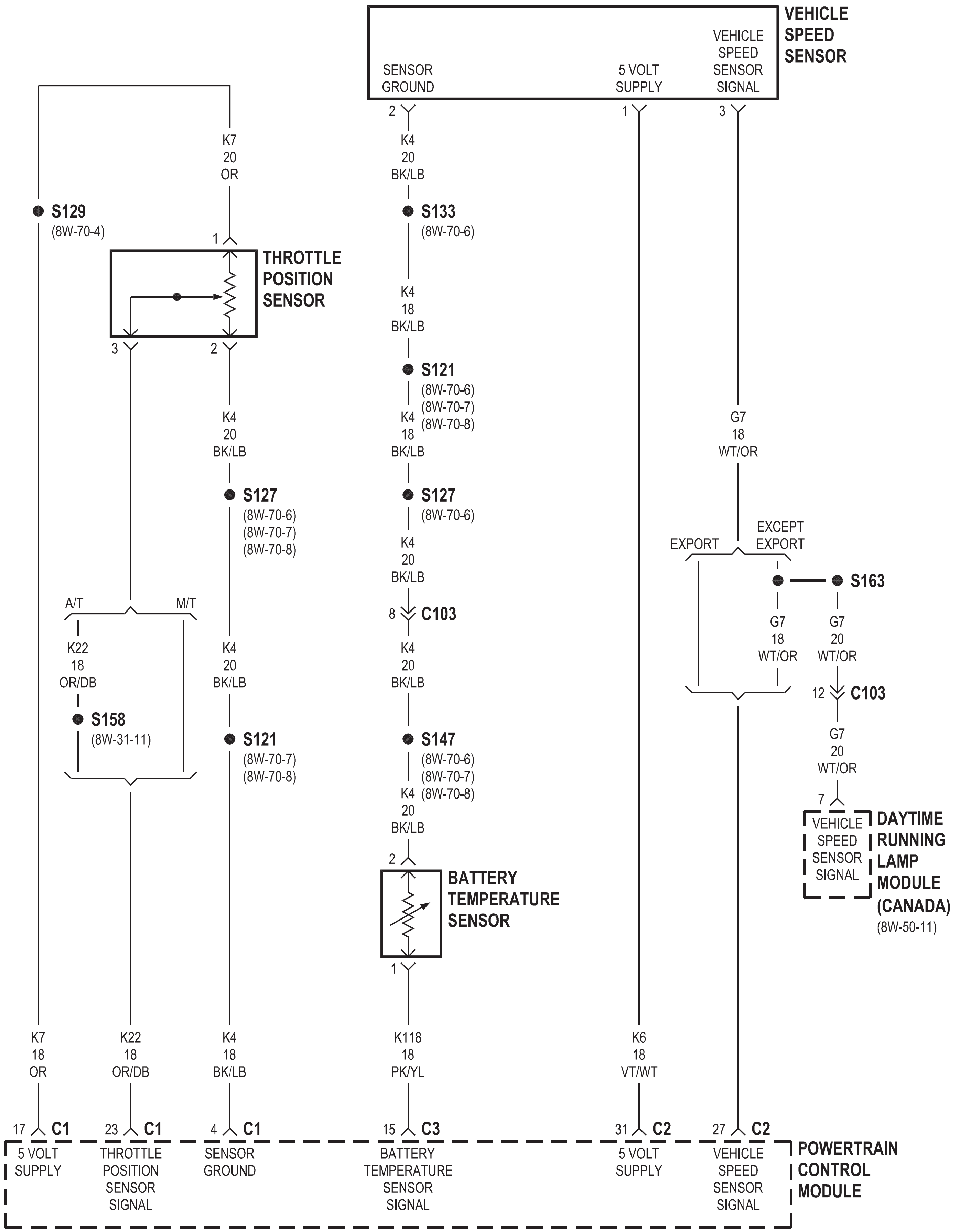
2.4L


A/C LOW PRESSURE SWITCH
(8W-42-7)
A/C SWITCH SENSE
A/C SELECT INPUT
A/C-HEATER CONTROL
(8W-42-4)
GENERATOR
(8W-20-2)
GENERATOR SOURCE
GENERATOR FIELD
C3
C21 20 DB/OR
C90 20 LG
K125 18 WT/DB
C170
C103
S103
(8W-42-6)
(8W-42-7)
S113
(8W-30-11)
(8W-30-17)
C90 18 LG
K20 18 DG
C2
POWERTRAIN CONTROL MODULE
BRAKE LAMP SWITCH SENSE
PARK/ NEUTRAL POSITION SWITCH SENSE
POWER STEERING PRESSURE SWITCH SENSE
C1
K29 18 WT/PK
T41 18 BK/WT
K10 18 DB/OR
C107
S134
(8W-15-7)
(8W-15-8)
(8W-15-9)
K29 20 WT/PK
A/T
M/T
POWER STEERING PRESSURE SWITCH
BRAKE LAMP SWITCH
(8W-51-7)
T41 20 BK/WT
Z1 20 BK
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
(8W-31-2)
TRANSMISSION RANGE SENSOR
(8W-31-6)
S132
Z1 20 BK/WT
Z1 14 BK
G300
(8W-15-13)
G105
(8W-15-9)

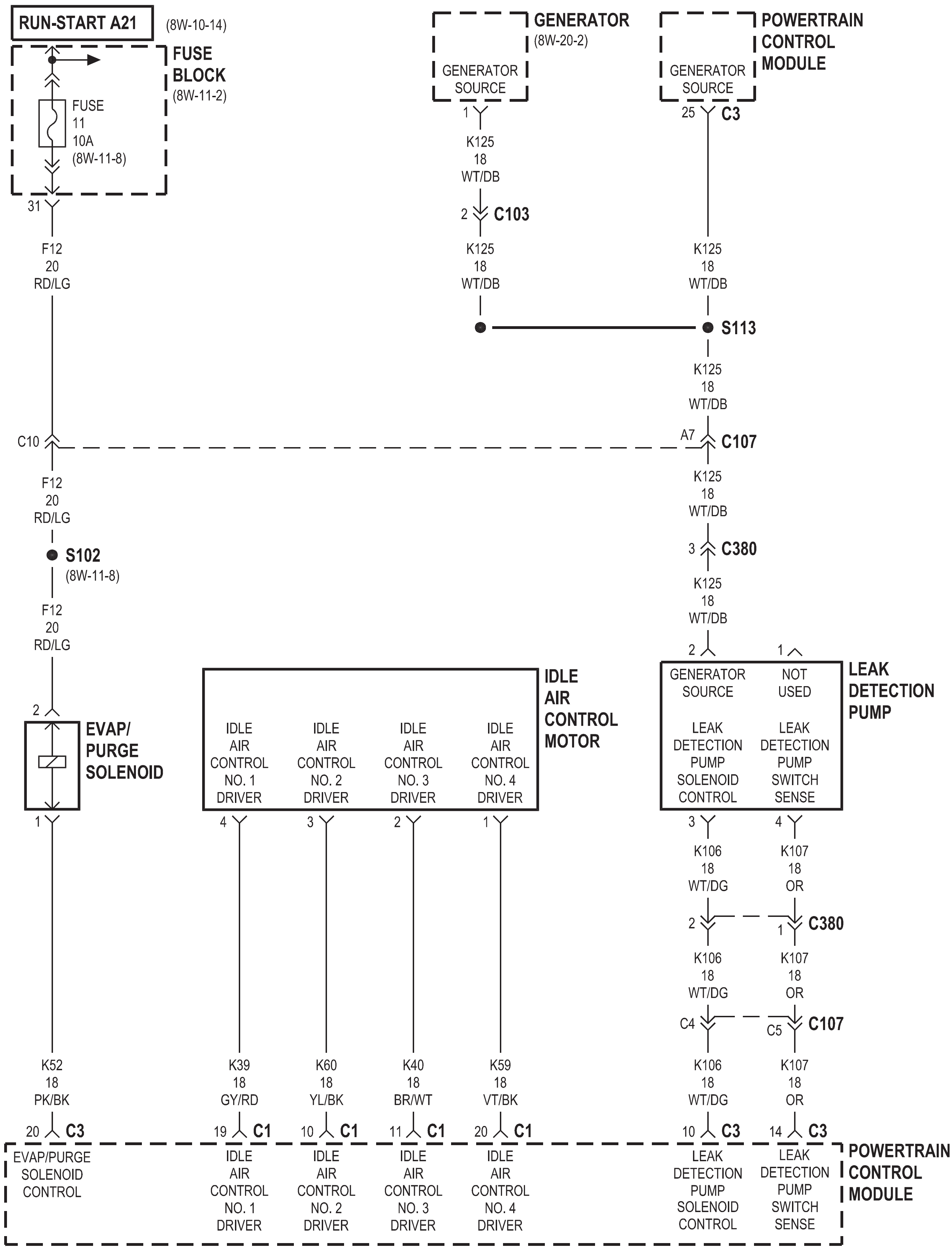

BATT A14
(8W-10-16)
POWER DISTRIBUTION CENTER
(8W-10-2)
41
FUSE 28 20A (8W-10-16)
40
A15
AUTOMATIC SHUT DOWN RELAY (8W-30-2)
A14
F42 18 DG/LG
A142 14 DG/PK
A142 14 DG/PK
LHD
RHD
S101
(8W-10-16)
11 C104
4 C104
S129
(8W-70-4)
K7 20 OR
F42 18 DG/LG
S126
(8W-10-17)
F42 18 DG/LG
S153
(8W-10-17)
F42 18 DG/LG
F42 18 DG/LG
CRANKSHAFT POSITION SENSOR
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
K7 20 OR
CAMSHAFT POSITION SENSOR
5 VOLT SUPPLY
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAPACITOR
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
A/T
M/T
K24 18 GY/BK
S157
(8W-31-8)
K4 20 BK/LB
K4 20 BK/LB
S133
(8W-70-6) (8W-70-7) (8W-70-8)
K4 20 BK/LB
S121
(8W-70-6) (8W-70-7) (8W-70-8)
IGNITION COIL PACK
K19 18 BK/GY
K17 18 DB/TN
K18 18 RD/YL
K7 18 OR
K24 18 GY/BK
K4 18 BK/LB
K44 18 TN/YL
7 C1
9 C2
1 C1
17 C1
8 C1
4 C1
18 C1
IGNITION COIL NO. 1 DRIVER
IGNITION COIL NO. 2 DRIVER
IGNITION COIL NO. 3 DRIVER
5 VOLT SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
M/T
A/T

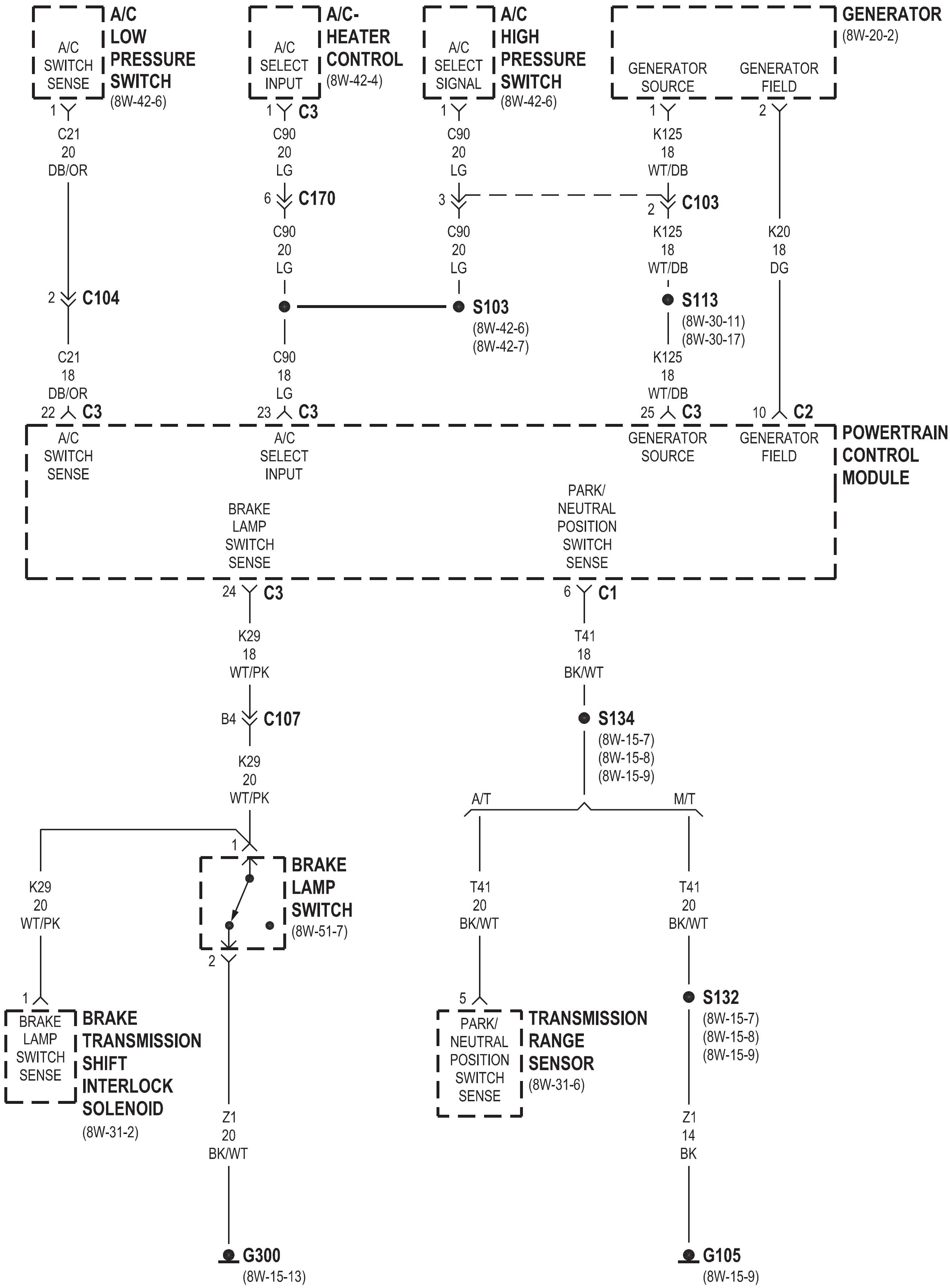

BATT A14
(8W-10-16)
A15
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
A14
POWER
DISTRIBUTION
CENTER
(8W-10-2)
40
FUSE
28
20A
(8W-10-16)
41
A142
14
DG/PK
A142
14
DG/PK
F42
18
DG/LG
S101
(8W-10-16)
LHD
RHD
11
C104
4
C104
F42
18
DG/LG
S126
(8W-10-17)
F42
18
DG/LG
S128
(8W-10-17)
(8W-10-18)
F42
18
DG/LG
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
FUEL
INJECTOR
NO. 5
FUEL
INJECTOR
NO. 6
K11
18
WT/DB
K12
18
TN
K13
18
YL/WT
K14
18
LB/BR
K38
18
GY
K58
18
BR/DB
4 C2
15 C2
5 C2
16 C2
6 C2
12 C2
FUEL
INJECTOR
NO. 1
DRIVER
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 3
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 5
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
POWERTRAIN
CONTROL
MODULE

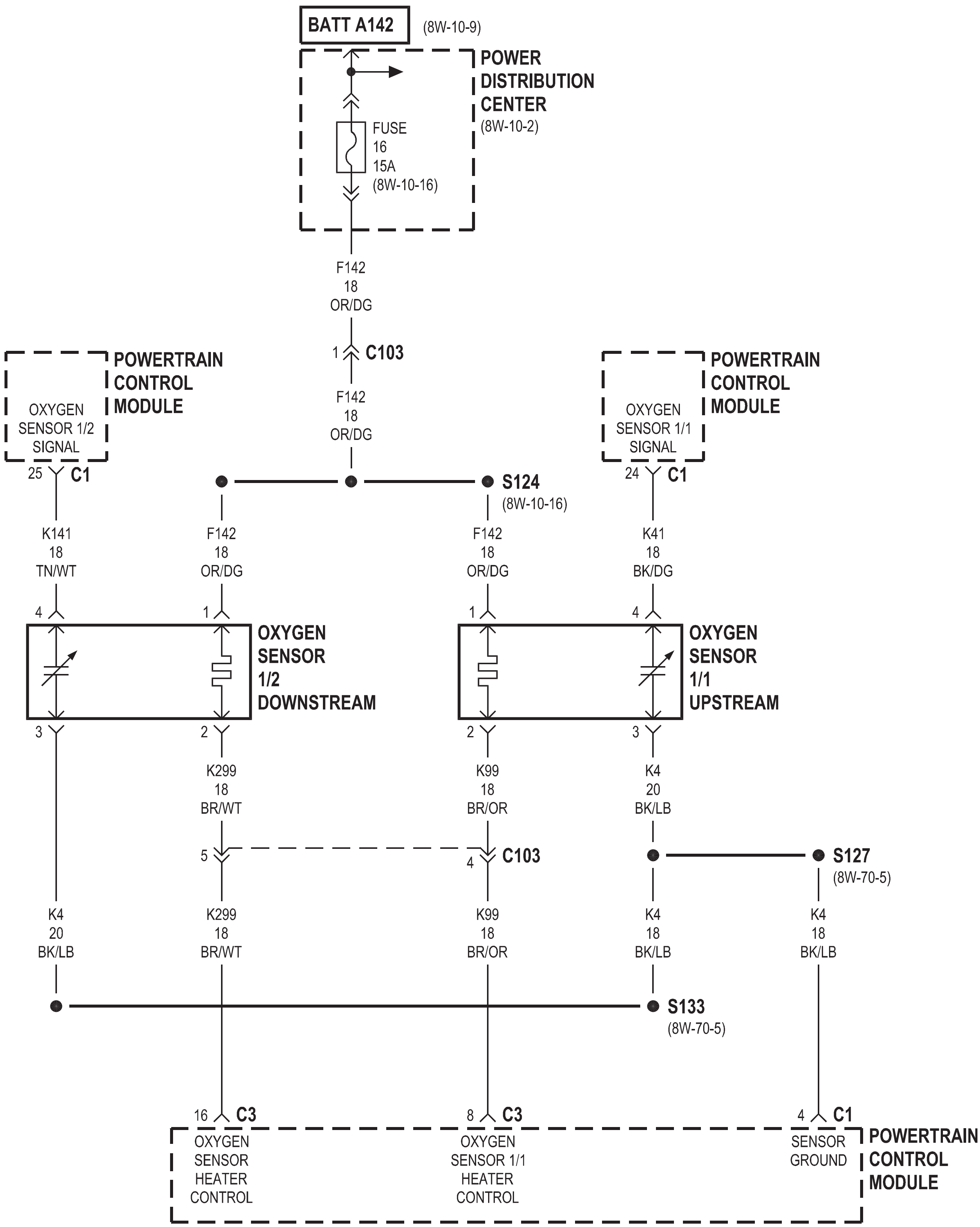

S129
(8W-70-4)
K7
20
OR
3
MANIFOLD ABSOLUTE PRESSURE SENSOR
1
2
K4
20
BK/LB
S127
(8W-70-6)
(8W-70-7)
(8W-70-8)
K4
18
BK/LB
K4
20
BK/LB
K4
20
BK/LB
S121
(8W-70-6)
(8W-70-7)
(8W-70-8)
TRANSFER CASE POSITION SENSOR INPUT
TRANSFER CASE SWITCH (OFF-ROAD PACKAGE)
(8W-31-15)
1
INTAKE AIR TEMPERATURE SENSOR
1
2
ENGINE OIL PRESSURE SENSOR
1
ENGINE COOLANT TEMPERATURE SENSOR
1
2
K7
18
OR
K1
18
DG/RD
G60
18
GY/YL
K4
18
BK/LB
K77
18
BK/WT
K2
18
TN/BK
K21
18
BK/RD
17 C1
27 C1
23 C2
4 C1
14 C1
16 C1
15 C1
5 VOLT SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
ENGINE OIL PRESSURE SENSOR SIGNAL
SENSOR GROUND
TRANSFER CASE POSITION SENSOR INPUT
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
INTAKE AIR TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

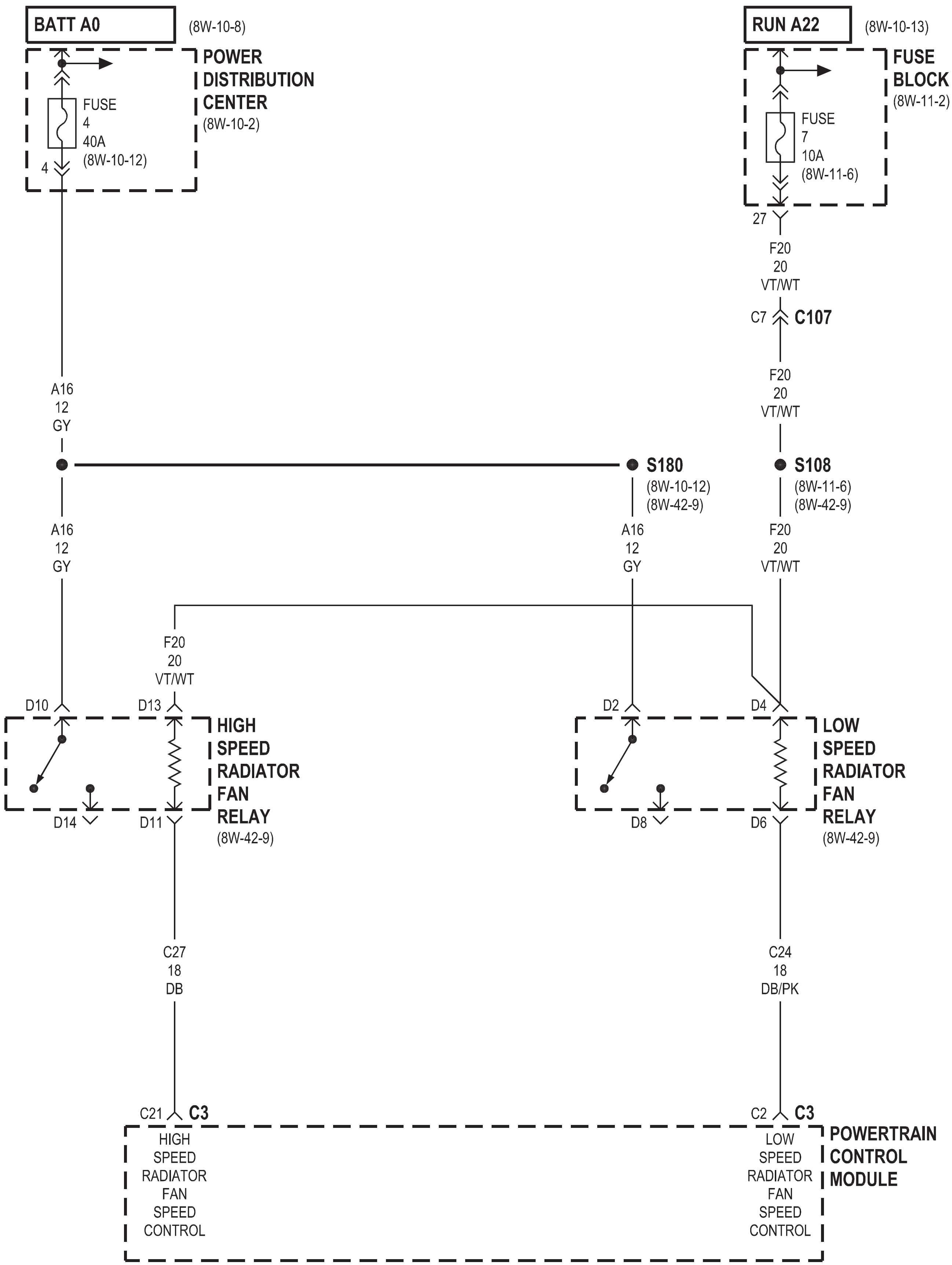

VEHICLE SPEED SENSOR
SENSOR GROUND
5 VOLT SUPPLY
VEHICLE SPEED SENSOR SIGNAL
K7 20 OR
K4 20 BK/LB
S129 (8W-70-4)
S133 (8W-70-6)
THROTTLE POSITION SENSOR
K4 18 BK/LB
S121 (8W-70-6) (8W-70-7) (8W-70-8)
K4 18 BK/LB
K4 20 BK/LB
G7 18 WT/OR
S127 (8W-70-6) (8W-70-7) (8W-70-8)
S127 (8W-70-6)
K4 20 BK/LB
EXPORT
EXCEPT EXPORT
S163
A/T
M/T
C103
K22 18 OR/DB
K4 20 BK/LB
K4 20 BK/LB
G7 18 WT/OR
G7 20 WT/OR
C103
S158 (8W-31-11)
S121 (8W-70-7) (8W-70-8)
S147 (8W-70-6) (8W-70-7) (8W-70-8)
G7 20 WT/OR
K4 20 BK/LB
VEHICLE SPEED SENSOR SIGNAL
DAYTIME RUNNING LAMP MODULE (CANADA) (8W-50-11)
BATTERY TEMPERATURE SENSOR
K7 18 OR
K22 18 OR/DB
K4 18 BK/LB
K118 18 PK/YL
K6 18 VT/WT
C1
C1
C1
C3
C2
C2
5 VOLT SUPPLY
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
5 VOLT SUPPLY
VEHICLE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

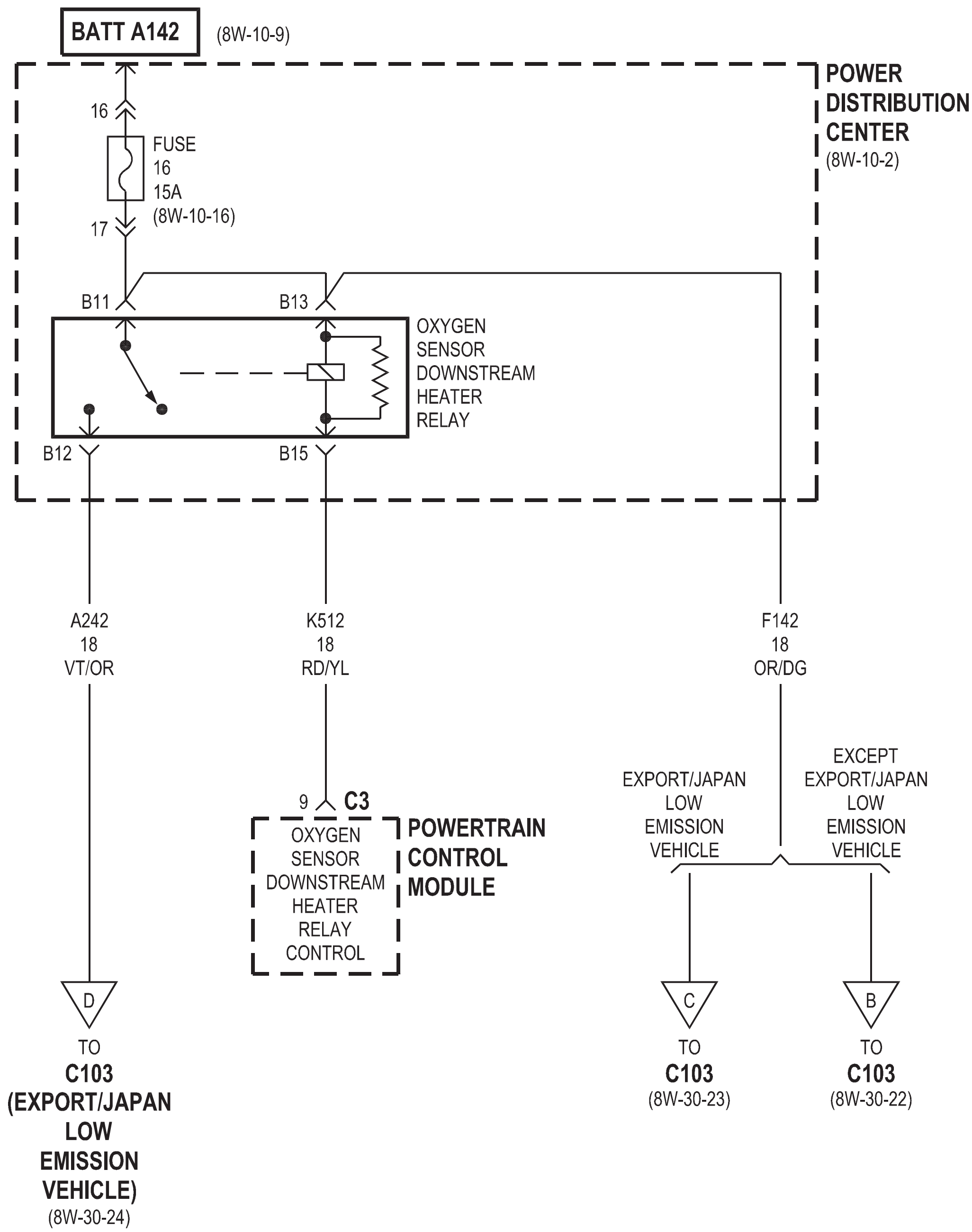
4.0L


RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
11
10A
(8W-11-8)
31
F12
20
RD/LG
C10
S102
(8W-11-8)
2
EVAP/ PURGE SOLENOID
1
K52
18
PK/BK
20 C3
GENERATOR
(8W-20-2)
GENERATOR SOURCE
1
K125
18
WT/DB
2 C103
S113
POWERTRAIN CONTROL MODULE
GENERATOR SOURCE
25 C3
A7 C107
3 C380
LEAK DETECTION PUMP
GENERATOR SOURCE
NOT USED
LEAK DETECTION PUMP SOLENOID CONTROL
LEAK DETECTION PUMP SWITCH SENSE
K106
18
WT/DG
K107
18
OR
2 C380 1
C4 C107 C5
10 C3
14 C3
IDLE AIR CONTROL MOTOR
IDLE AIR CONTROL NO. 1 DRIVER
IDLE AIR CONTROL NO. 2 DRIVER
IDLE AIR CONTROL NO. 3 DRIVER
IDLE AIR CONTROL NO. 4 DRIVER
K39 18 GY/RD
K60 18 YL/BK
K40 18 BR/WT
K59 18 VT/BK
19 C1
10 C1
11 C1
20 C1
POWERTRAIN CONTROL MODULE
EVAP/PURGE SOLENOID CONTROL

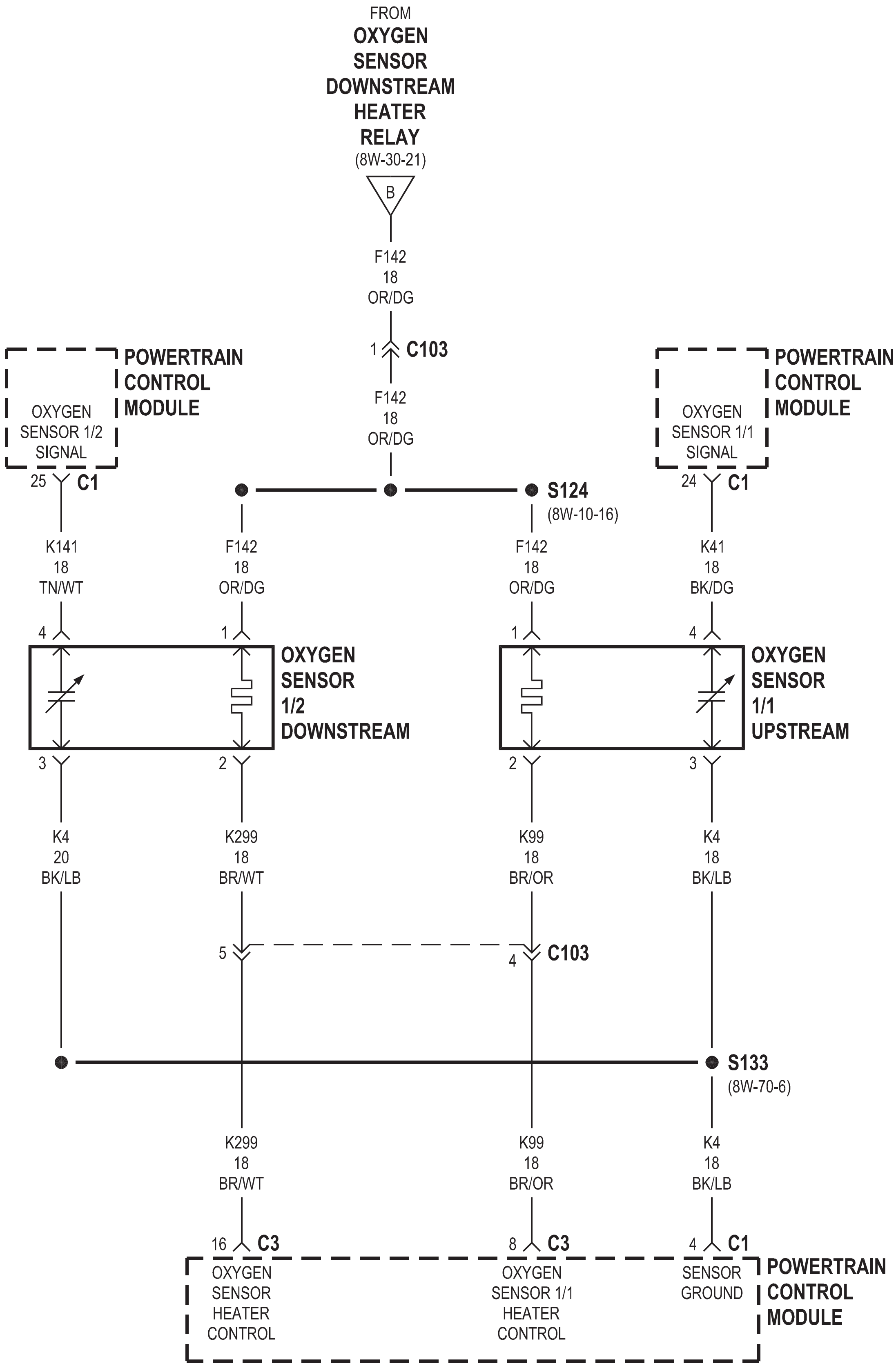

A/C LOW PRESSURE SWITCH
(8W-42-6)
A/C SWITCH SENSE
A/C- HEATER CONTROL
(8W-42-4)
A/C SELECT INPUT
A/C HIGH PRESSURE SWITCH
(8W-42-6)
A/C SELECT SIGNAL
GENERATOR
(8W-20-2)
GENERATOR SOURCE
GENERATOR FIELD
C21 20 DB/OR
C3
C90 20 LG
K125 18 WT/DB
C170
C103
K20 18 DG
C104
S103
(8W-42-6)
(8W-42-7)
S113
(8W-30-11)
(8W-30-17)
C21 18 DB/OR
C90 18 LG
C2
POWERTRAIN CONTROL MODULE
BRAKE LAMP SWITCH SENSE
PARK/ NEUTRAL POSITION SWITCH SENSE
C1
K29 18 WT/PK
T41 18 BK/WT
C107
S134
(8W-15-7)
(8W-15-8)
(8W-15-9)
K29 20 WT/PK
A/T
M/T
BRAKE LAMP SWITCH
(8W-51-7)
T41 20 BK/WT
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
(8W-31-2)
TRANSMISSION RANGE SENSOR
(8W-31-6)
S132
Z1 20 BK/WT
Z1 14 BK
G300
(8W-15-13)
G105
(8W-15-9)


BATT A142
(8W-10-9)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
16
15A
(8W-10-16)
F142
18
OR/DG
1
C103
F142
18
OR/DG
POWERTRAIN
CONTROL
MODULE
OXYGEN
SENSOR 1/2
SIGNAL
25
C1
POWERTRAIN
CONTROL
MODULE
OXYGEN
SENSOR 1/1
SIGNAL
24
C1
S124
(8W-10-16)
K141
18
TN/WT
F142
18
OR/DG
F142
18
OR/DG
K41
18
BK/DG
OXYGEN
SENSOR
1/2
DOWNSTREAM
OXYGEN
SENSOR
1/1
UPSTREAM
K299
18
BR/WT
K99
18
BR/OR
K4
20
BK/LB
5
4
C103
S127
(8W-70-5)
K4
20
BK/LB
K299
18
BR/WT
K99
18
BR/OR
K4
18
BK/LB
K4
18
BK/LB
S133
(8W-70-5)
16
C3
8
C3
4
C1
OXYGEN
SENSOR
HEATER
CONTROL
OXYGEN
SENSOR 1/1
HEATER
CONTROL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE

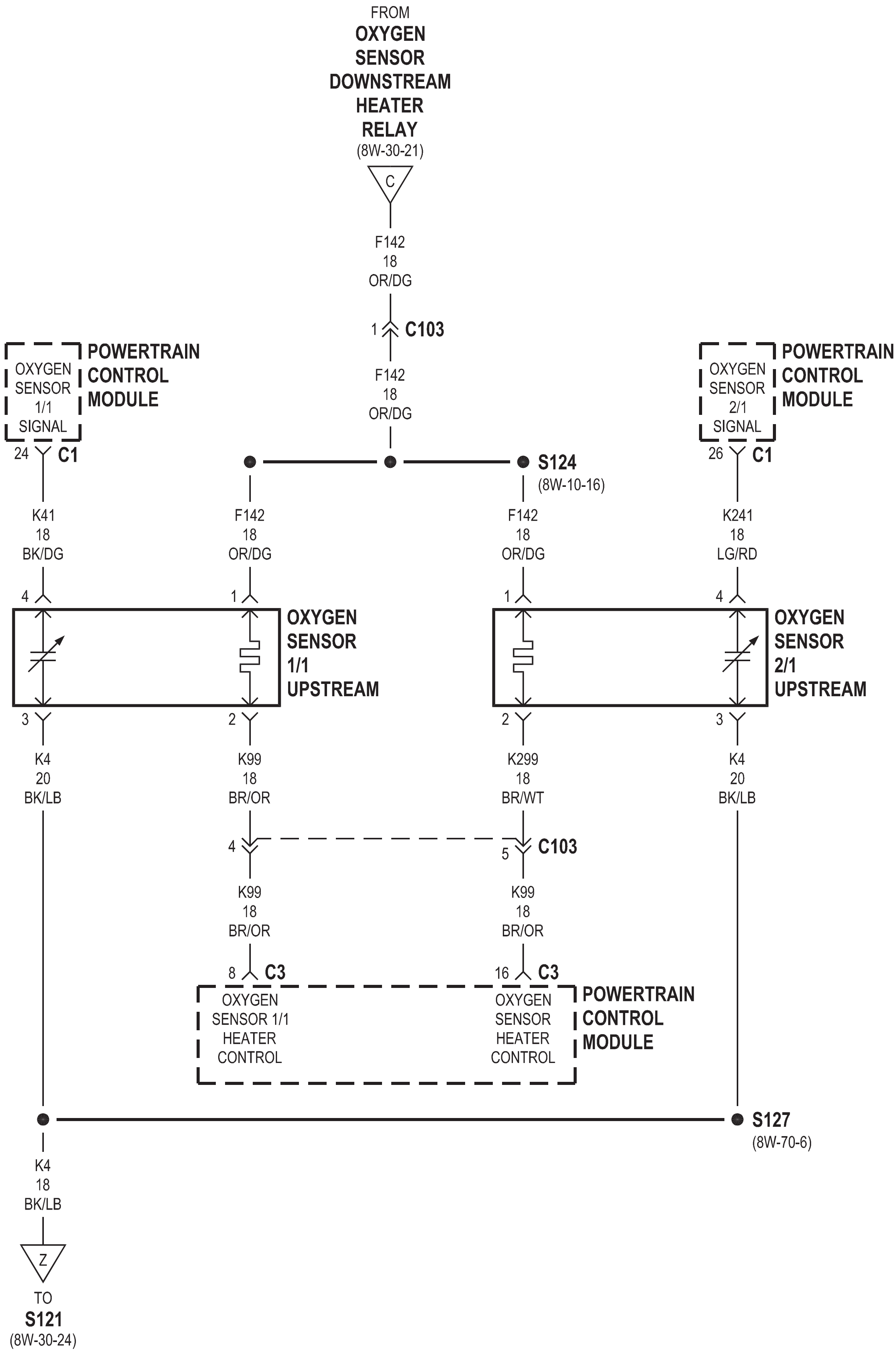

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
4
40A
(8W-10-12)
4
RUN A22
(8W-10-13)
FUSE
BLOCK
(8W-11-2)
FUSE
7
10A
(8W-11-6)
27
F20
20
VT/WT
C7
C107
F20
20
VT/WT
A16
12
GY
S180
(8W-10-12)
(8W-42-9)
S108
(8W-11-6)
(8W-42-9)
A16
12
GY
A16
12
GY
F20
20
VT/WT
F20
20
VT/WT
D10
D13
HIGH
SPEED
RADIATOR
FAN
RELAY
(8W-42-9)
D14
D11
D2
D4
LOW
SPEED
RADIATOR
FAN
RELAY
(8W-42-9)
D8
D6
C27
18
DB
C24
18
DB/PK
C21
C3
C2
C3
HIGH
SPEED
RADIATOR
FAN
SPEED
CONTROL
LOW
SPEED
RADIATOR
FAN
SPEED
CONTROL
POWERTRAIN
CONTROL
MODULE


BATT A142
(8W-10-9)
16
FUSE
16
15A
(8W-10-16)
17
POWER
DISTRIBUTION
CENTER
(8W-10-2)
B11
B13
OXYGEN
SENSOR
DOWNSTREAM
HEATER
RELAY
B12
B15
A242
18
VT/OR
K512
18
RD/YL
F142
18
OR/DG
9
C3
OXYGEN
SENSOR
DOWNSTREAM
HEATER
RELAY
CONTROL
POWERTRAIN
CONTROL
MODULE
EXPORT/JAPAN
LOW
EMISSION
VEHICLE
EXCEPT
EXPORT/JAPAN
LOW
EMISSION
VEHICLE
D
TO
C103
(EXPORT/JAPAN
LOW
EMISSION
VEHICLE)
(8W-30-24)
C
TO
C103
(8W-30-23)
B
TO
C103
(8W-30-22)

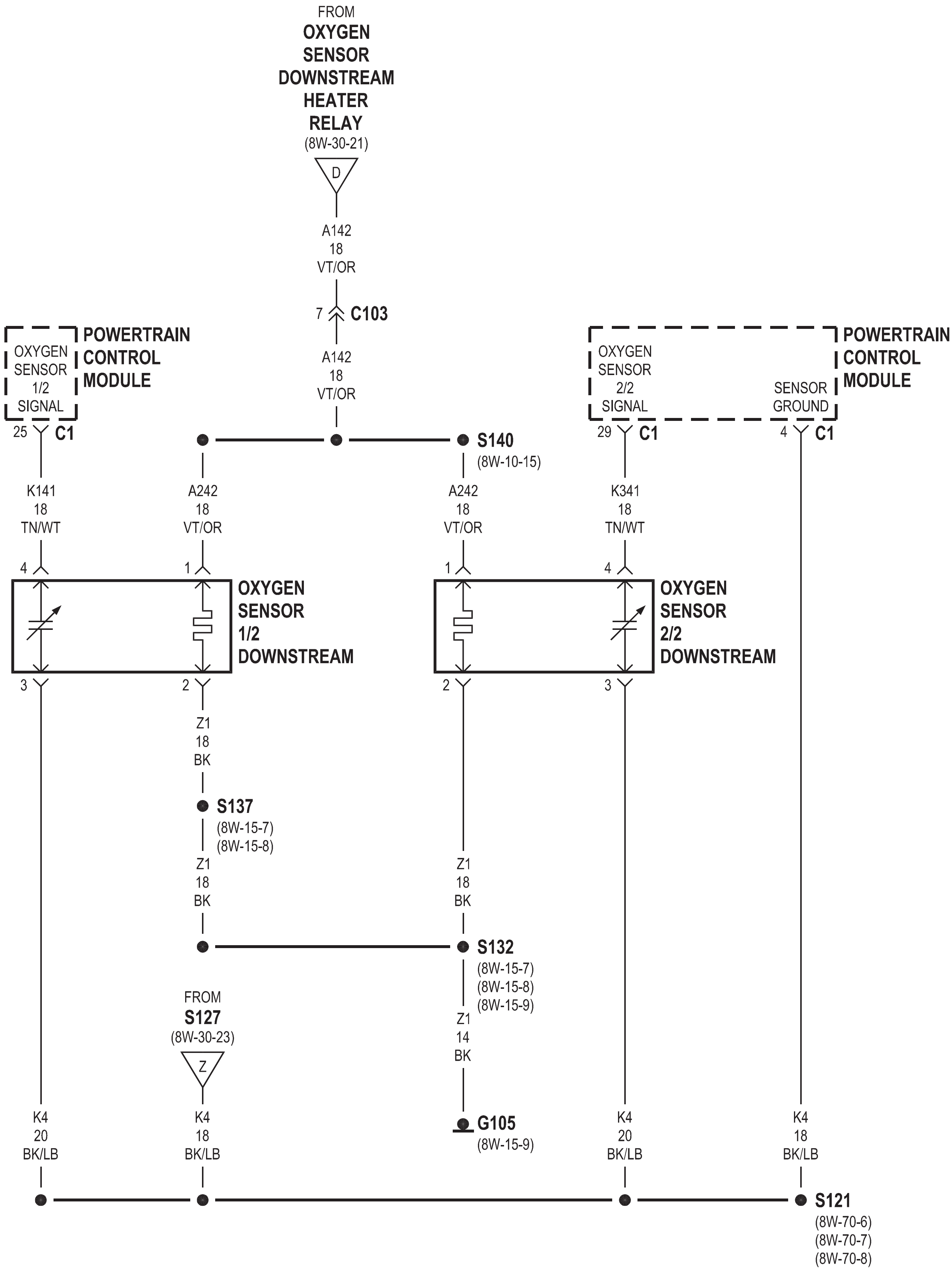
4.0L EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE



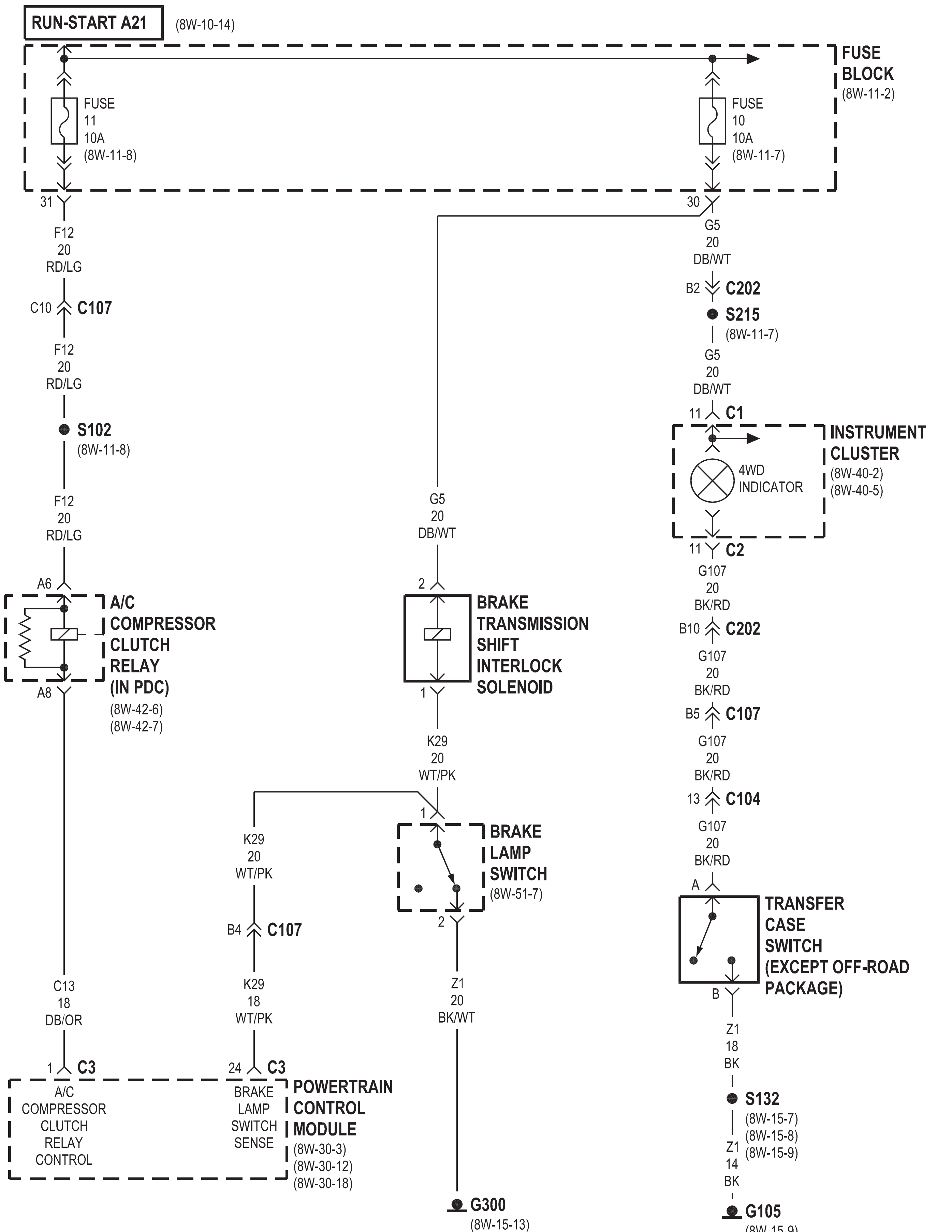
4.0L EXPORT/JAPAN LOW EMISSION VEHICLE



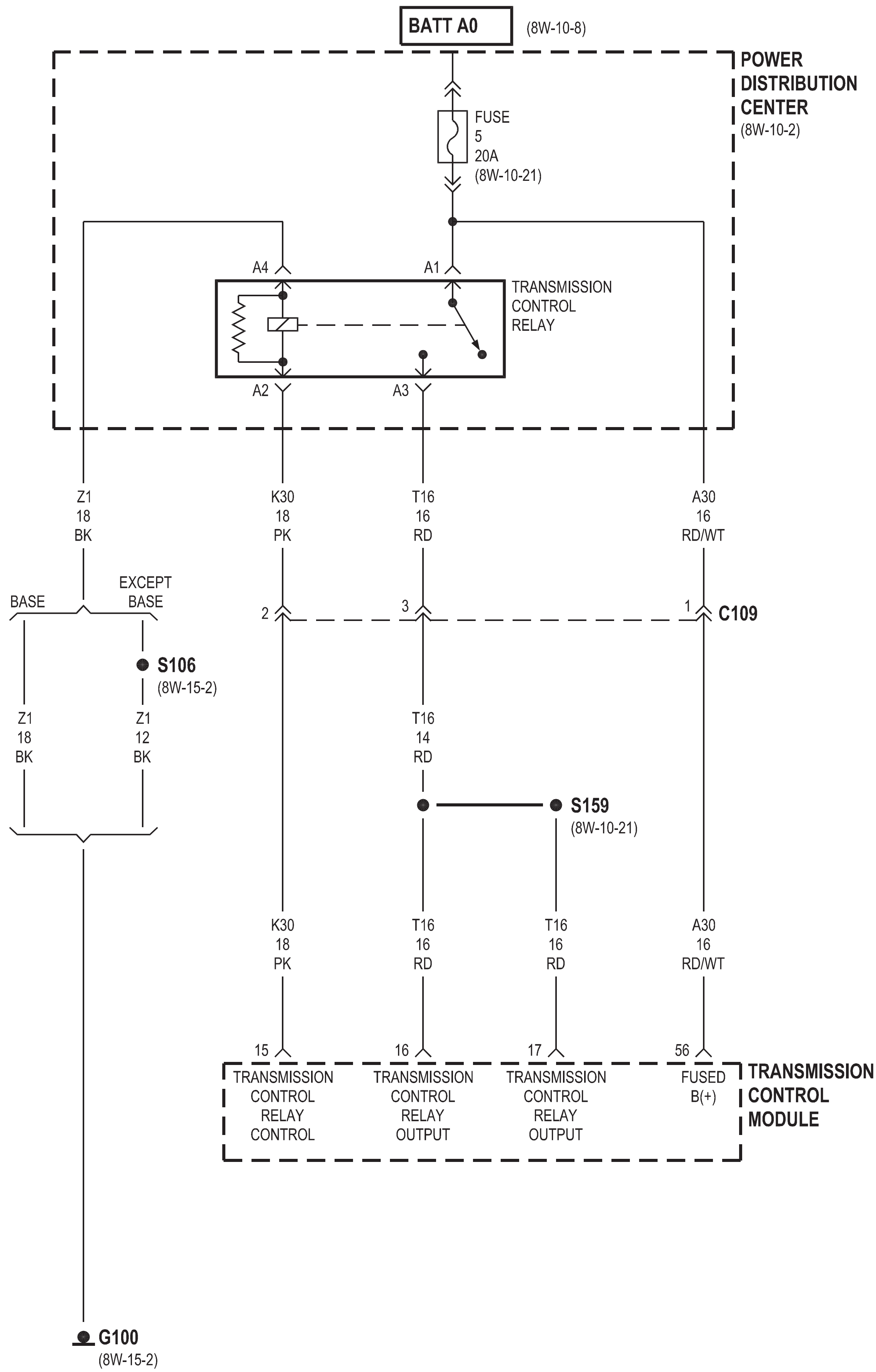
4.0L EXPORT/JAPAN LOW EMISSION VEHICLE

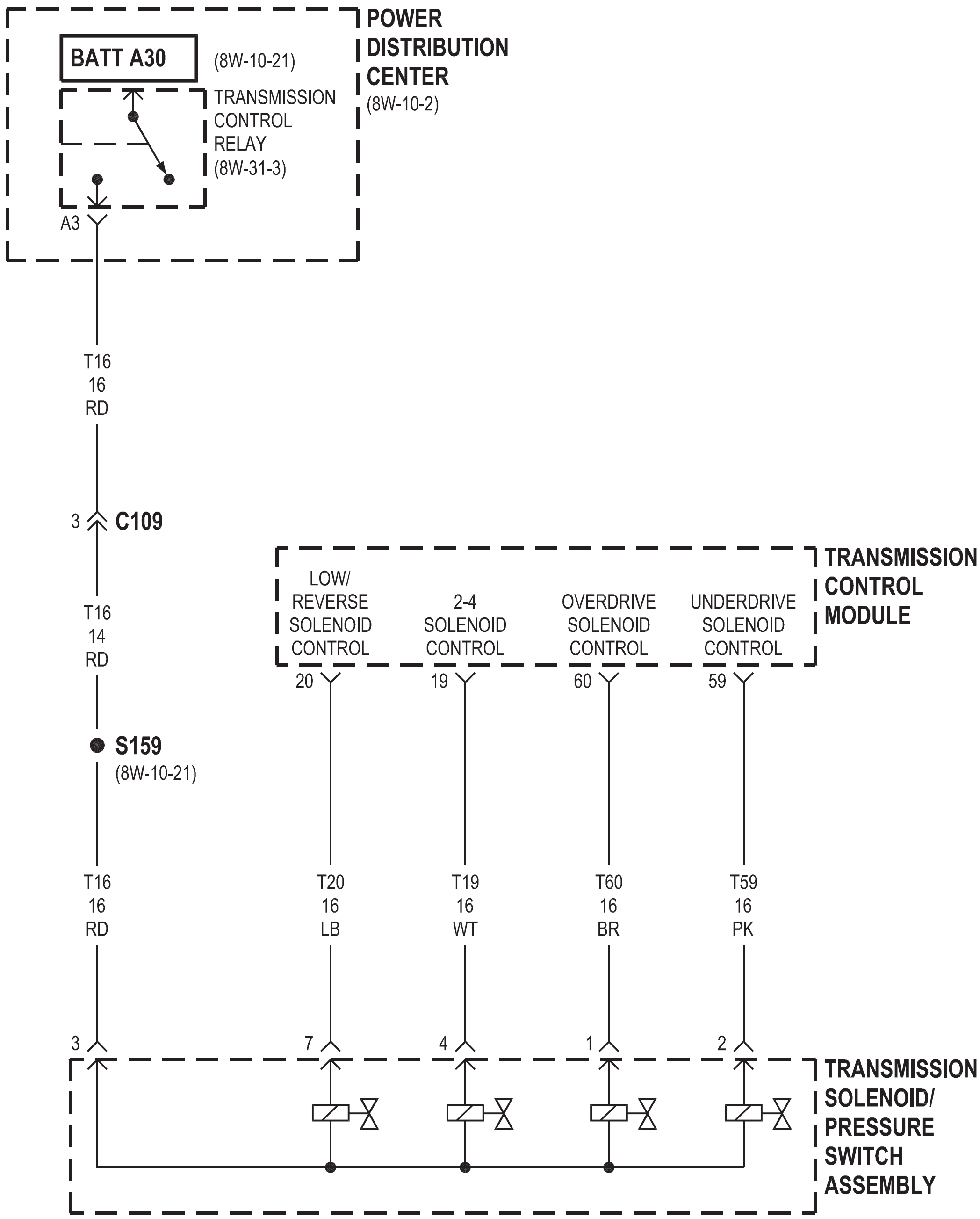


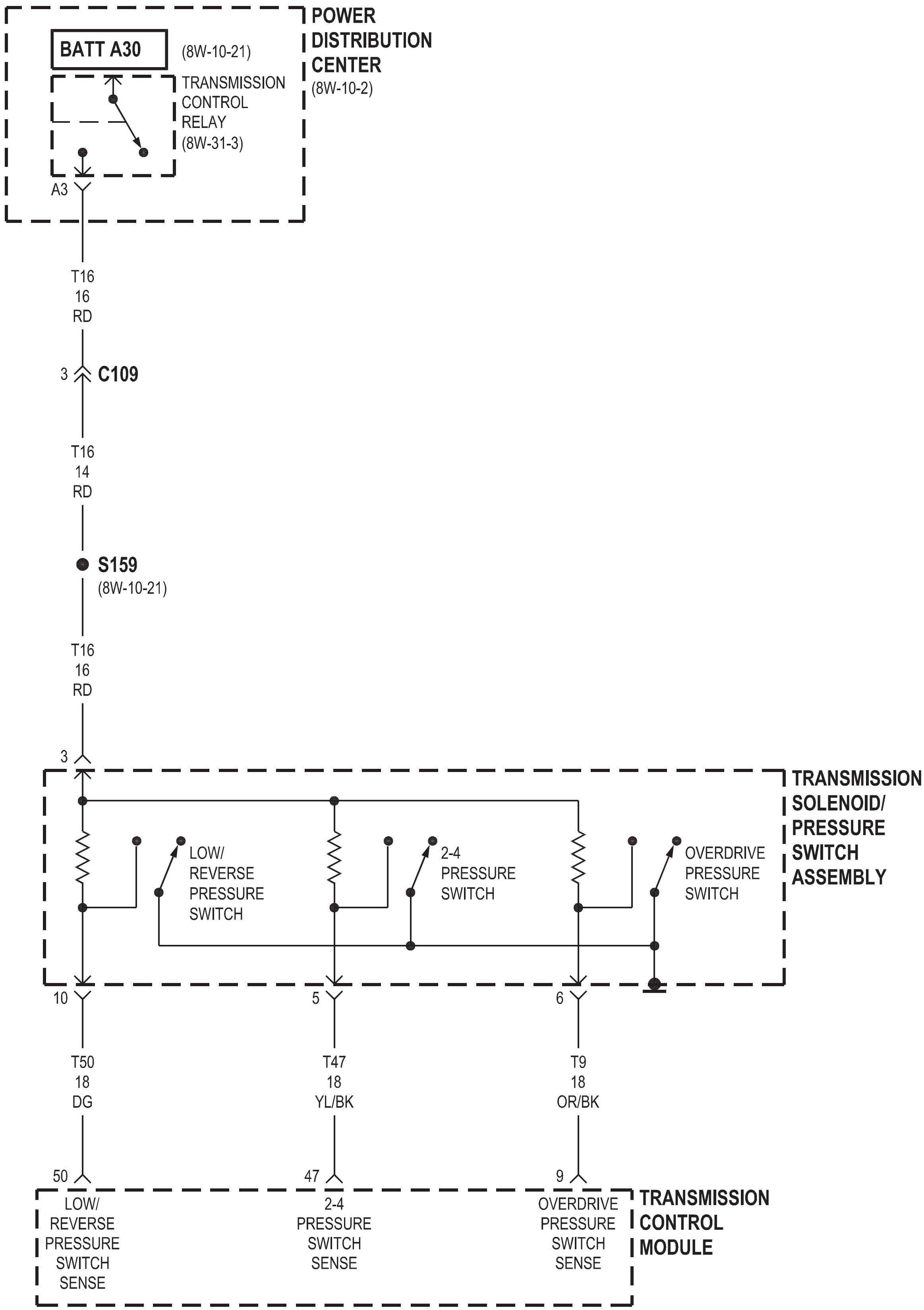
8W-31 TRANSMISSION CONTROL SYSTEM

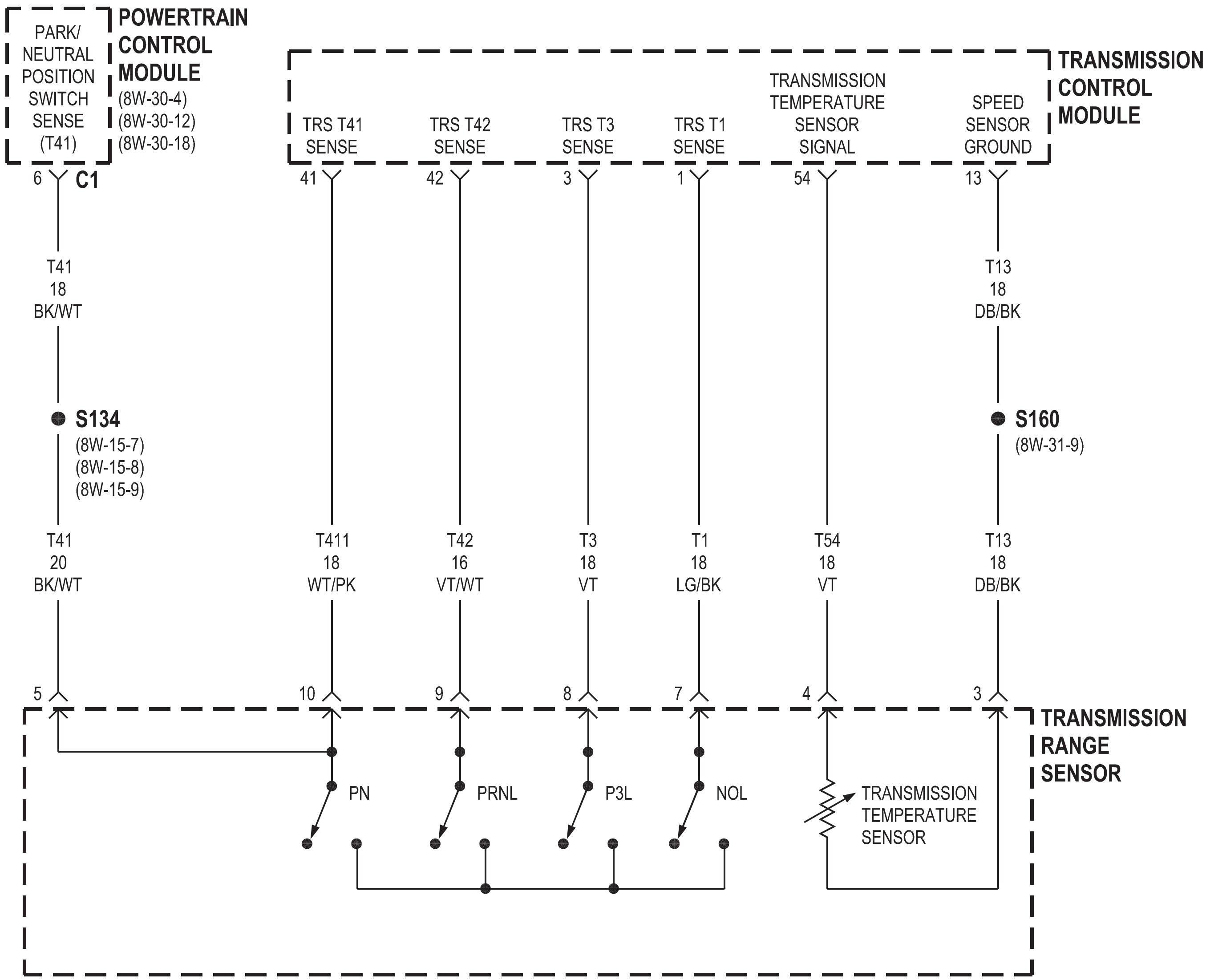


RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 11 10A (8W-11-8)
FUSE 10 10A (8W-11-7)
31
30
F12 20 RD/LG
G5 20 DB/WT
C10 C107
B2 C202
S215
(8W-11-7)
S102
(8W-11-8)
11 C1
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-5)
4WD INDICATOR
11 C2
G107 20 BK/RD
B10 C202
B5 C107
13 C104
A6
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-6)
(8W-42-7)
A8
2
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
1
K29 20 WT/PK
BRAKE LAMP SWITCH
(8W-51-7)
B4 C107
K29 18 WT/PK
Z1 20 BK/WT
A
TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE)
B
Z1 18 BK
S132
(8W-15-7)
(8W-15-8)
(8W-15-9)
Z1 14 BK
C13 18 DB/OR
1 C3
24 C3
A/C COMPRESSOR CLUTCH RELAY CONTROL
BRAKE LAMP SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-12)
(8W-30-18)
G300
(8W-15-13)
G105
(8W-15-9)

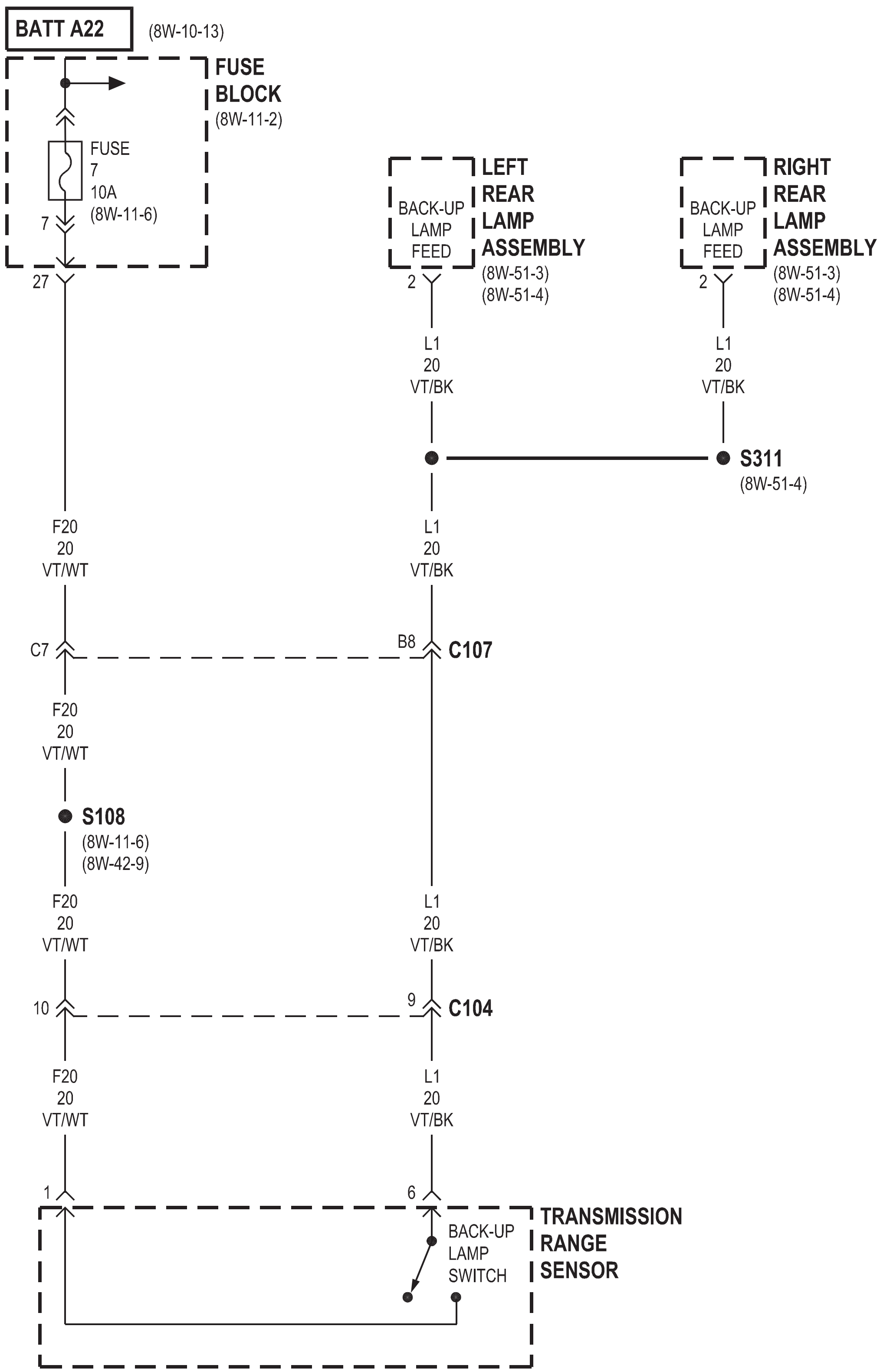

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
5
20A
(8W-10-21)
A4
A1
TRANSMISSION
CONTROL
RELAY
A2
A3
Z1
18
BK
K30
18
PK
T16
16
RD
A30
16
RD/WT
BASE
EXCEPT
BASE
2
3
1
C109
S106
(8W-15-2)
Z1
18
BK
Z1
12
BK
T16
14
RD
S159
(8W-10-21)
K30
18
PK
T16
16
RD
T16
16
RD
A30
16
RD/WT
15
16
17
56
TRANSMISSION
CONTROL
RELAY
CONTROL
TRANSMISSION
CONTROL
RELAY
OUTPUT
TRANSMISSION
CONTROL
RELAY
OUTPUT
FUSED
B(+)
TRANSMISSION
CONTROL
MODULE
G100
(8W-15-2)

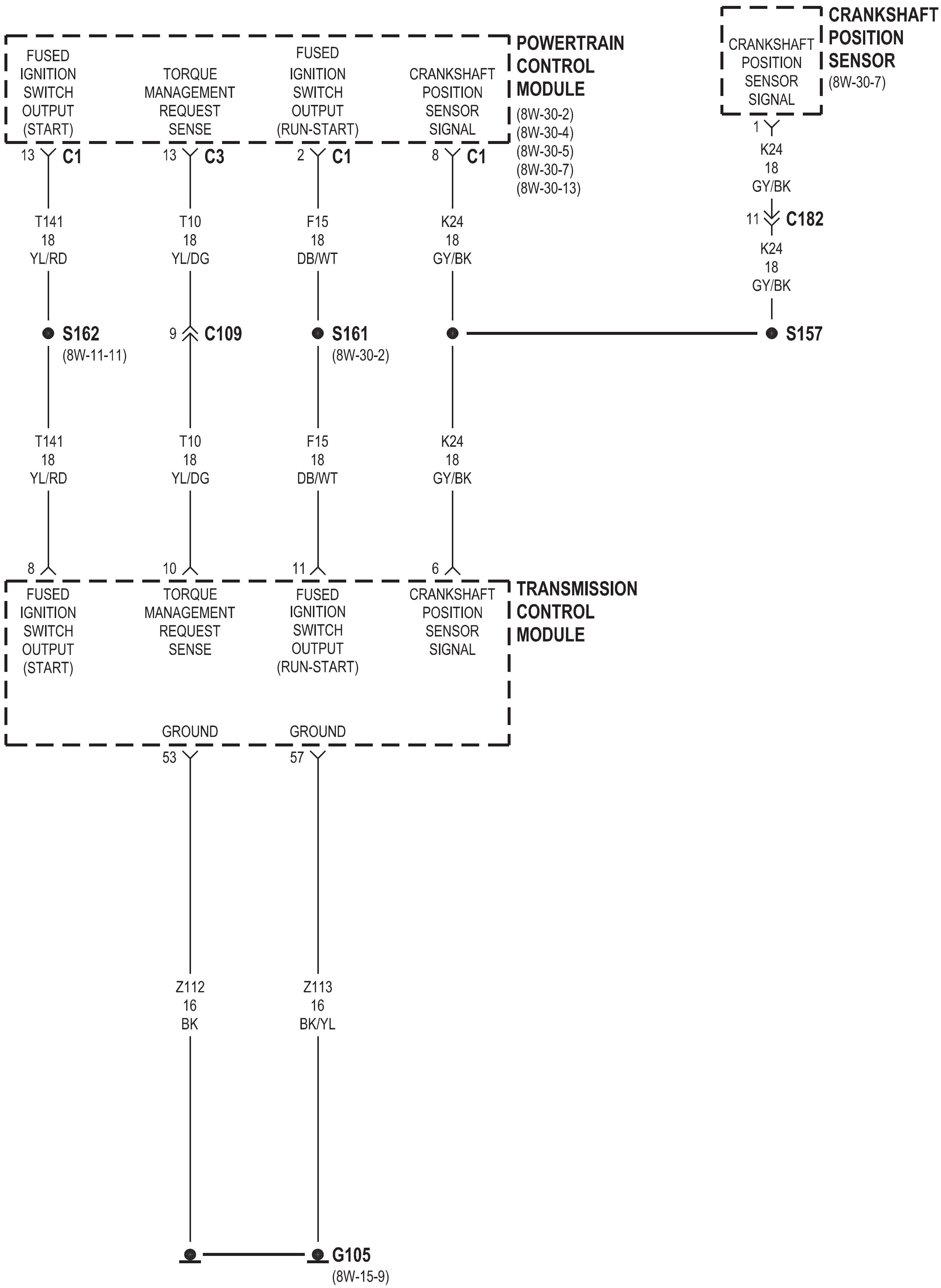

POWER DISTRIBUTION CENTER
(8W-10-2)
BATT A30
(8W-10-21)
TRANSMISSION CONTROL RELAY
(8W-31-3)
A3
T16
16
RD
3
C109
T16
14
RD
S159
(8W-10-21)
T16
16
RD
TRANSMISSION CONTROL MODULE
LOW/ REVERSE SOLENOID CONTROL
2-4 SOLENOID CONTROL
OVERDRIVE SOLENOID CONTROL
UNDERDRIVE SOLENOID CONTROL
20
19
60
59
T20
16
LB
T19
16
WT
T60
16
BR
T59
16
PK
3
7
4
1
2
TRANSMISSION SOLENOID/ PRESSURE SWITCH ASSEMBLY

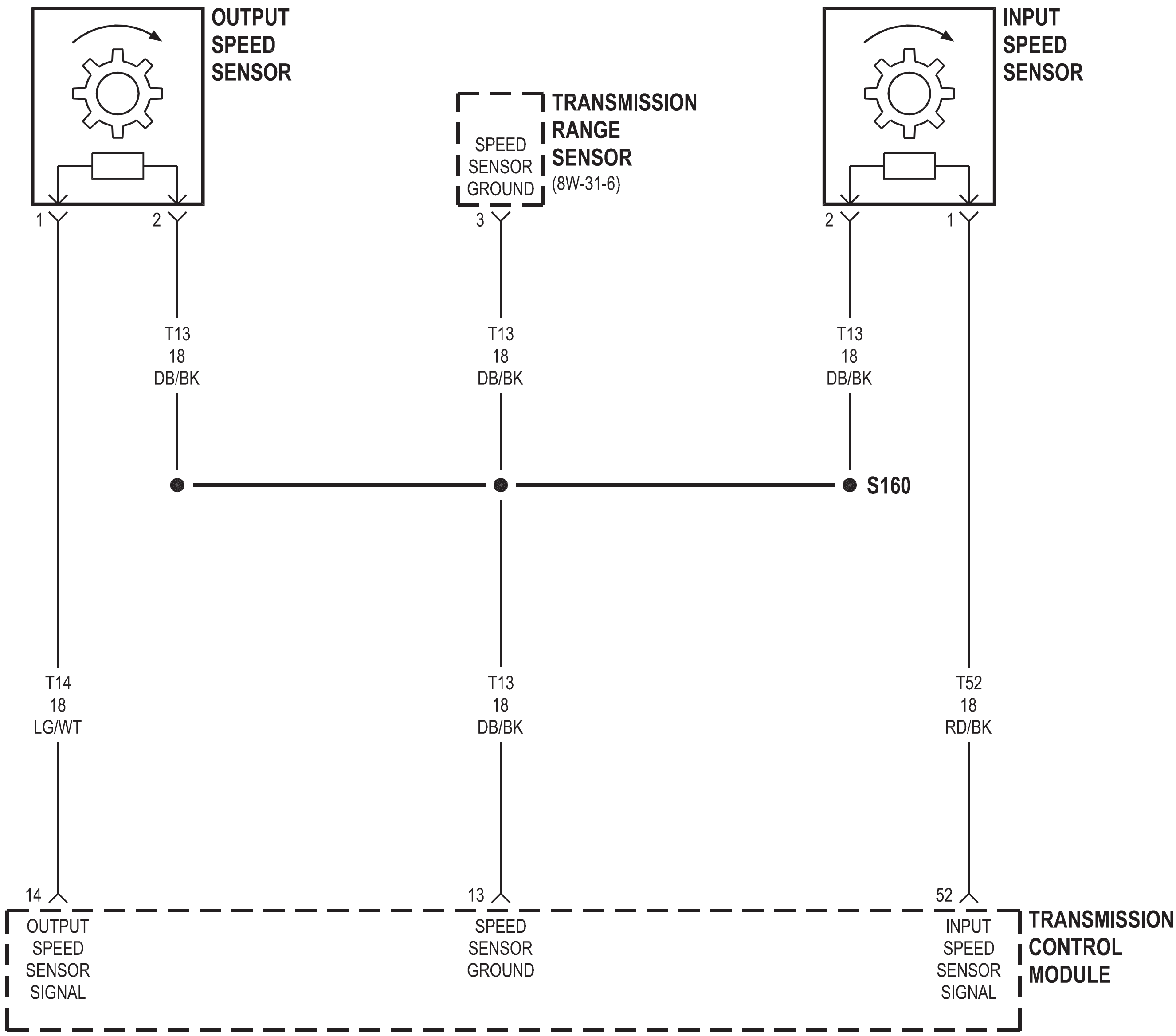

POWER DISTRIBUTION CENTER
(8W-10-2)
BATT A30
(8W-10-21)
TRANSMISSION CONTROL RELAY
(8W-31-3)
A3
T16
16
RD
3
C109
T16
14
RD
S159
(8W-10-21)
T16
16
RD
3
TRANSMISSION SOLENOID/ PRESSURE SWITCH ASSEMBLY
LOW/ REVERSE PRESSURE SWITCH
2-4 PRESSURE SWITCH
OVERDRIVE PRESSURE SWITCH
10
5
6
T50
18
DG
T47
18
YL/BK
T9
18
OR/BK
50
47
9
TRANSMISSION CONTROL MODULE
LOW/ REVERSE PRESSURE SWITCH SENSE
2-4 PRESSURE SWITCH SENSE
OVERDRIVE PRESSURE SWITCH SENSE

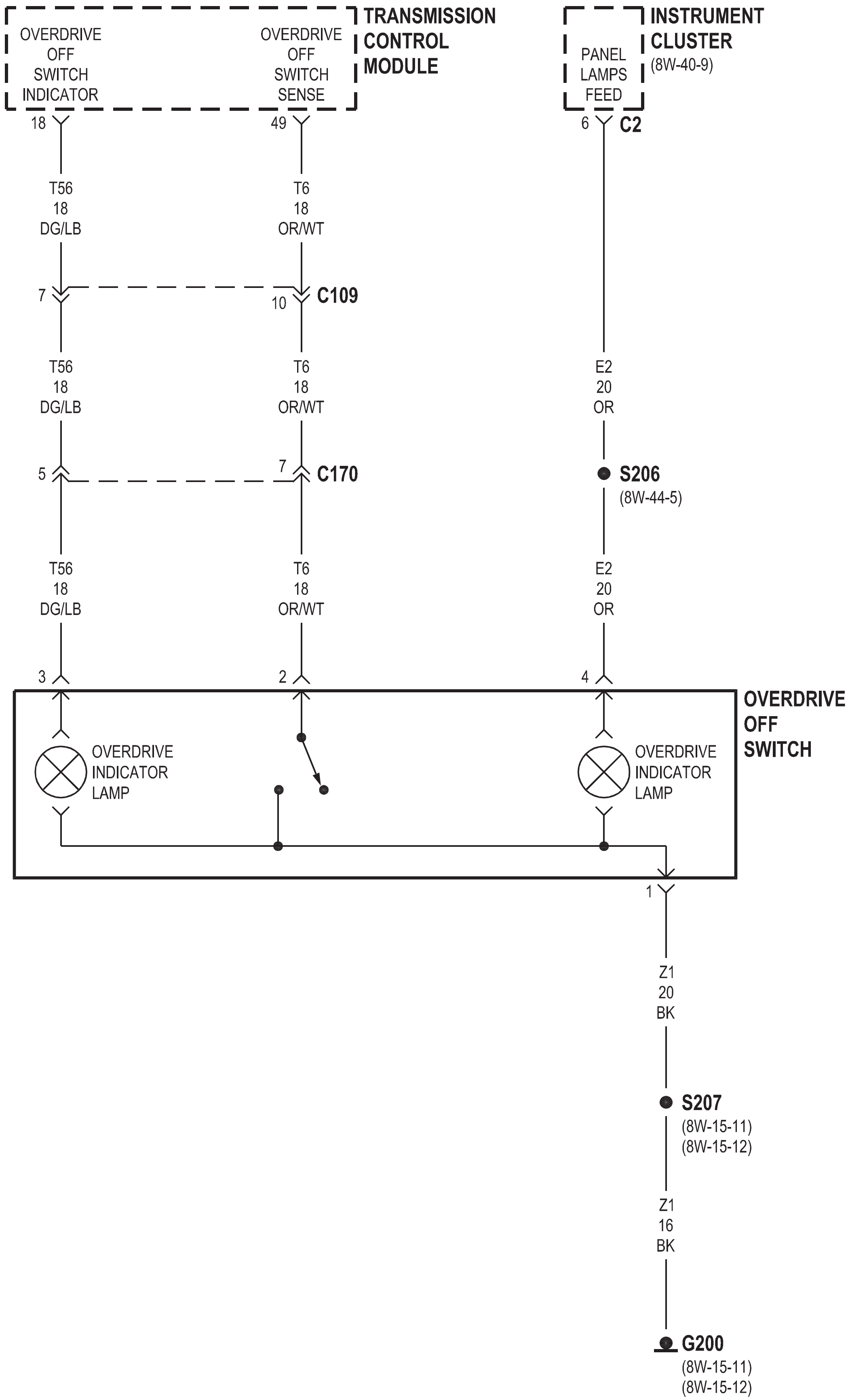


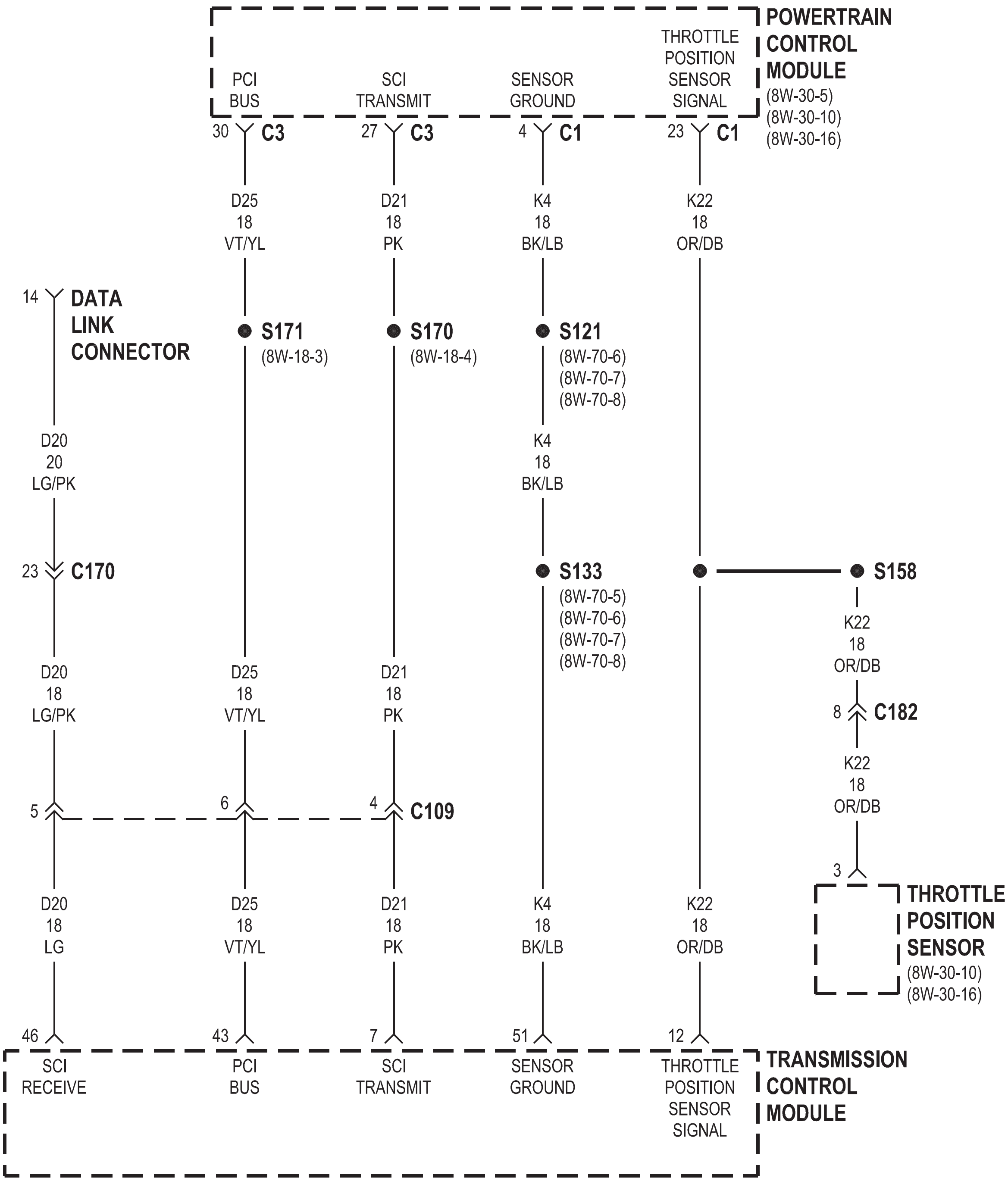
PARK/ NEUTRAL POSITION SWITCH SENSE (T41)
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-12)
(8W-30-18)
TRANSMISSION CONTROL MODULE
TRS T41 SENSE
TRS T42 SENSE
TRS T3 SENSE
TRS T1 SENSE
TRANSMISSION TEMPERATURE SENSOR SIGNAL
SPEED SENSOR GROUND
6
C1
41
42
3
1
54
13
T41 18 BK/WT
T13 18 DB/BK
S134
(8W-15-7)
(8W-15-8)
(8W-15-9)
S160
(8W-31-9)
T41 20 BK/WT
T411 18 WT/PK
T42 16 VT/WT
T3 18 VT
T1 18 LG/BK
T54 18 VT
T13 18 DB/BK
5
10
9
8
7
4
3
TRANSMISSION RANGE SENSOR
PN
PRNL
P3L
NOL
TRANSMISSION TEMPERATURE SENSOR


BATT A22
(8W-10-13)
FUSE
BLOCK
(8W-11-2)
FUSE
7
10A
(8W-11-6)
7
27
LEFT
REAR
LAMP
ASSEMBLY
BACK-UP
LAMP
FEED
(8W-51-3)
(8W-51-4)
2
RIGHT
REAR
LAMP
ASSEMBLY
BACK-UP
LAMP
FEED
(8W-51-3)
(8W-51-4)
2
L1
20
VT/BK
S311
(8W-51-4)
F20
20
VT/WT
C7
B8
C107
S108
(8W-11-6)
(8W-42-9)
10
9
C104
1
6
BACK-UP
LAMP
SWITCH
TRANSMISSION
RANGE
SENSOR

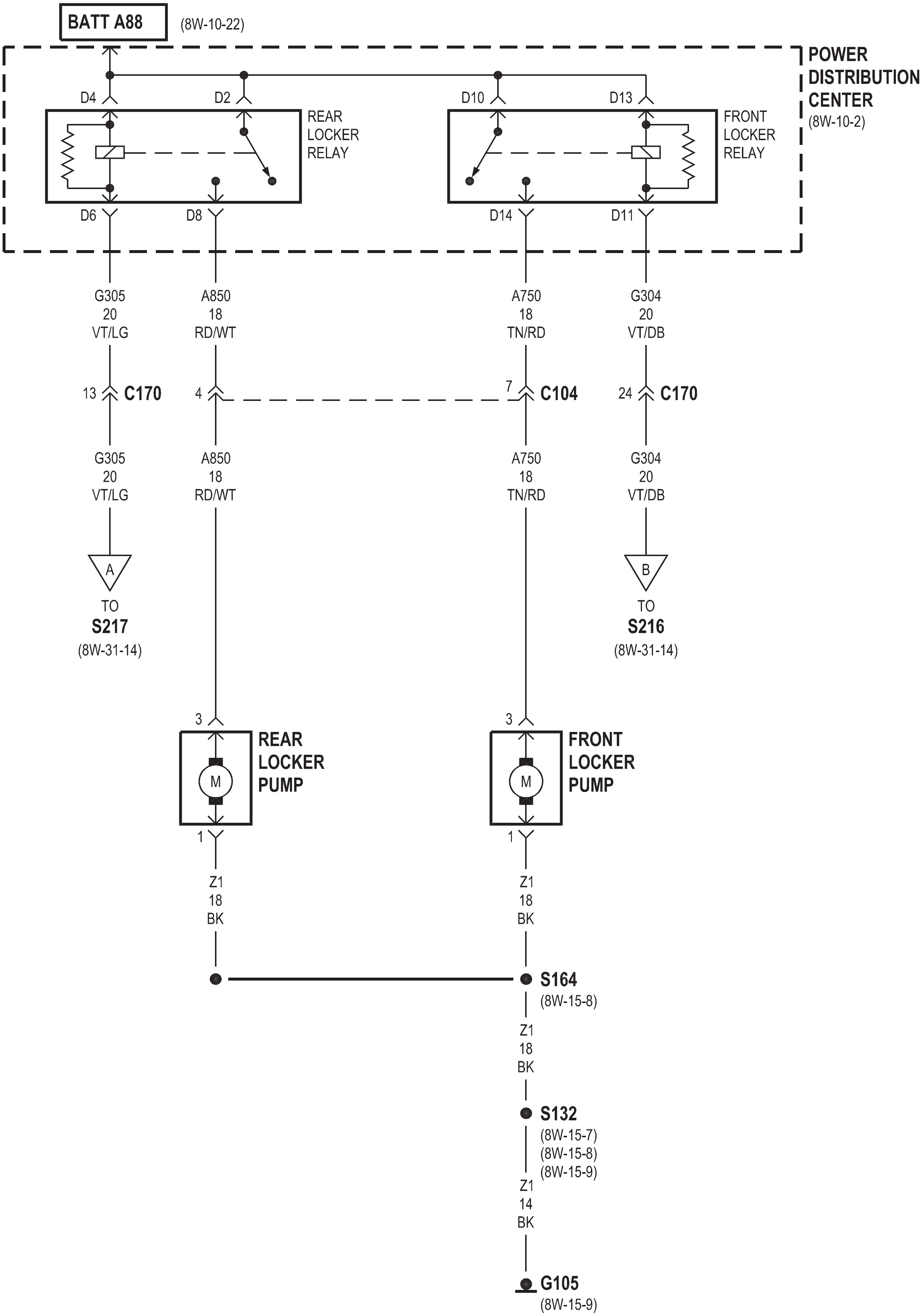

POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-4)
(8W-30-5)
(8W-30-7)
(8W-30-13)
FUSED IGNITION SWITCH OUTPUT (START)
TORQUE MANAGEMENT REQUEST SENSE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
CRANKSHAFT POSITION SENSOR SIGNAL
13 C1
13 C3
2 C1
8 C1
CRANKSHAFT POSITION SENSOR
(8W-30-7)
CRANKSHAFT POSITION SENSOR SIGNAL
1
K24 18 GY/BK
11 C182
K24 18 GY/BK
T141 18 YL/RD
T10 18 YL/DG
F15 18 DB/WT
K24 18 GY/BK
S162
(8W-11-11)
9 C109
S161
(8W-30-2)
S157
T141 18 YL/RD
T10 18 YL/DG
F15 18 DB/WT
K24 18 GY/BK
8
10
11
6
TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (START)
TORQUE MANAGEMENT REQUEST SENSE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
CRANKSHAFT POSITION SENSOR SIGNAL
GROUND
GROUND
53
57
Z112 16 BK
Z113 16 BK/YL
G105
(8W-15-9)

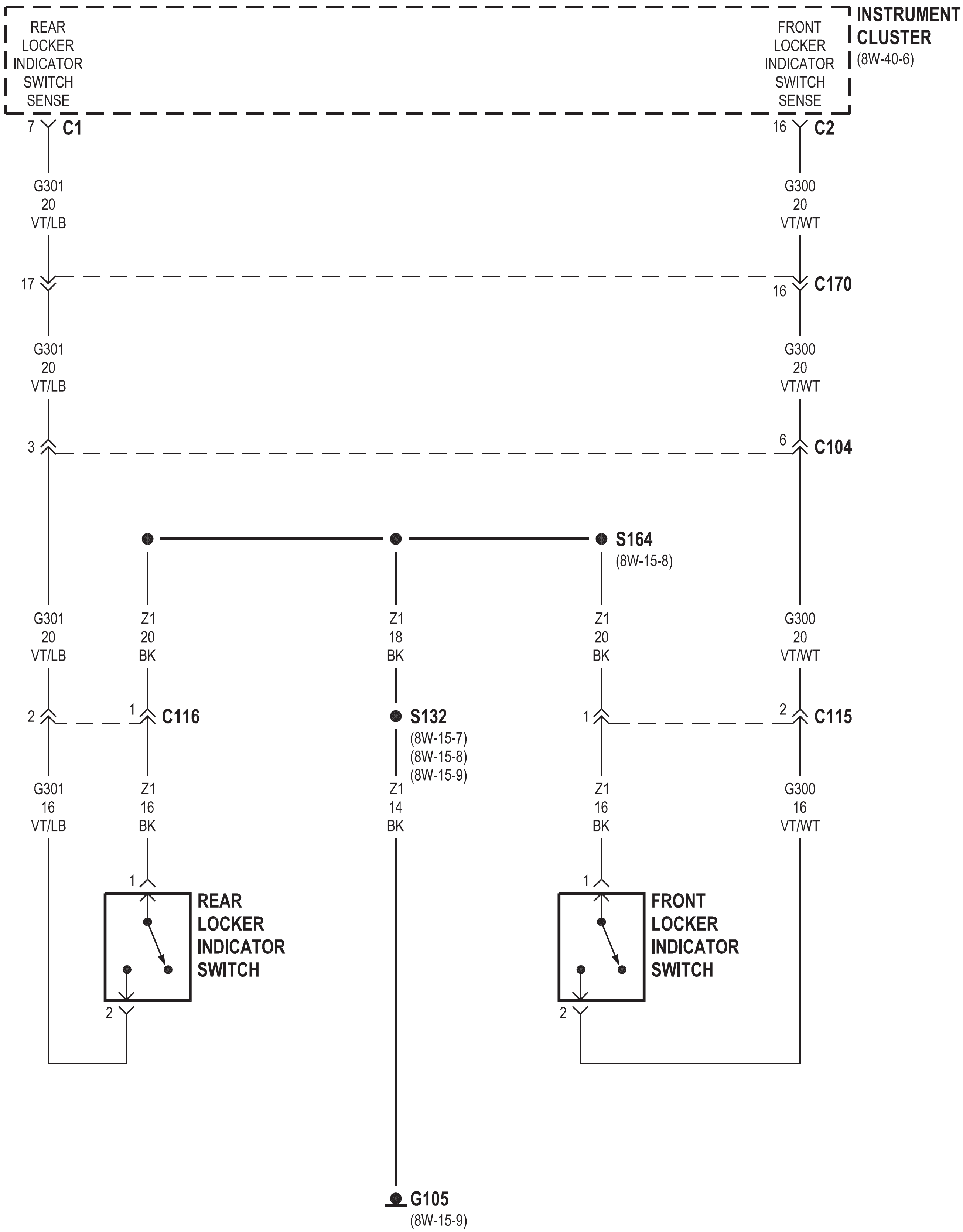

OUTPUT
SPEED
SENSOR
1
2
TRANSMISSION
RANGE
SENSOR
(8W-31-6)
SPEED
SENSOR
GROUND
3
INPUT
SPEED
SENSOR
2
1
T13
18
DB/BK
T13
18
DB/BK
T13
18
DB/BK
S160
T14
18
LG/WT
T13
18
DB/BK
T52
18
RD/BK
14
13
52
OUTPUT
SPEED
SENSOR
SIGNAL
SPEED
SENSOR
GROUND
INPUT
SPEED
SENSOR
SIGNAL
TRANSMISSION
CONTROL
MODULE


TRANSMISSION CONTROL MODULE
OVERDRIVE OFF SWITCH INDICATOR
OVERDRIVE OFF SWITCH SENSE
18
49
INSTRUMENT CLUSTER
(8W-40-9)
PANEL LAMPS FEED
6
C2
T56 18 DG/LB
T6 18 OR/WT
7
10
C109
T56 18 DG/LB
T6 18 OR/WT
E2 20 OR
5
7
C170
S206
(8W-44-5)
T56 18 DG/LB
T6 18 OR/WT
E2 20 OR
3
2
4
OVERDRIVE OFF SWITCH
OVERDRIVE INDICATOR LAMP
OVERDRIVE INDICATOR LAMP
1
Z1 20 BK
S207
(8W-15-11)
(8W-15-12)
Z1 16 BK
G200
(8W-15-11)
(8W-15-12)

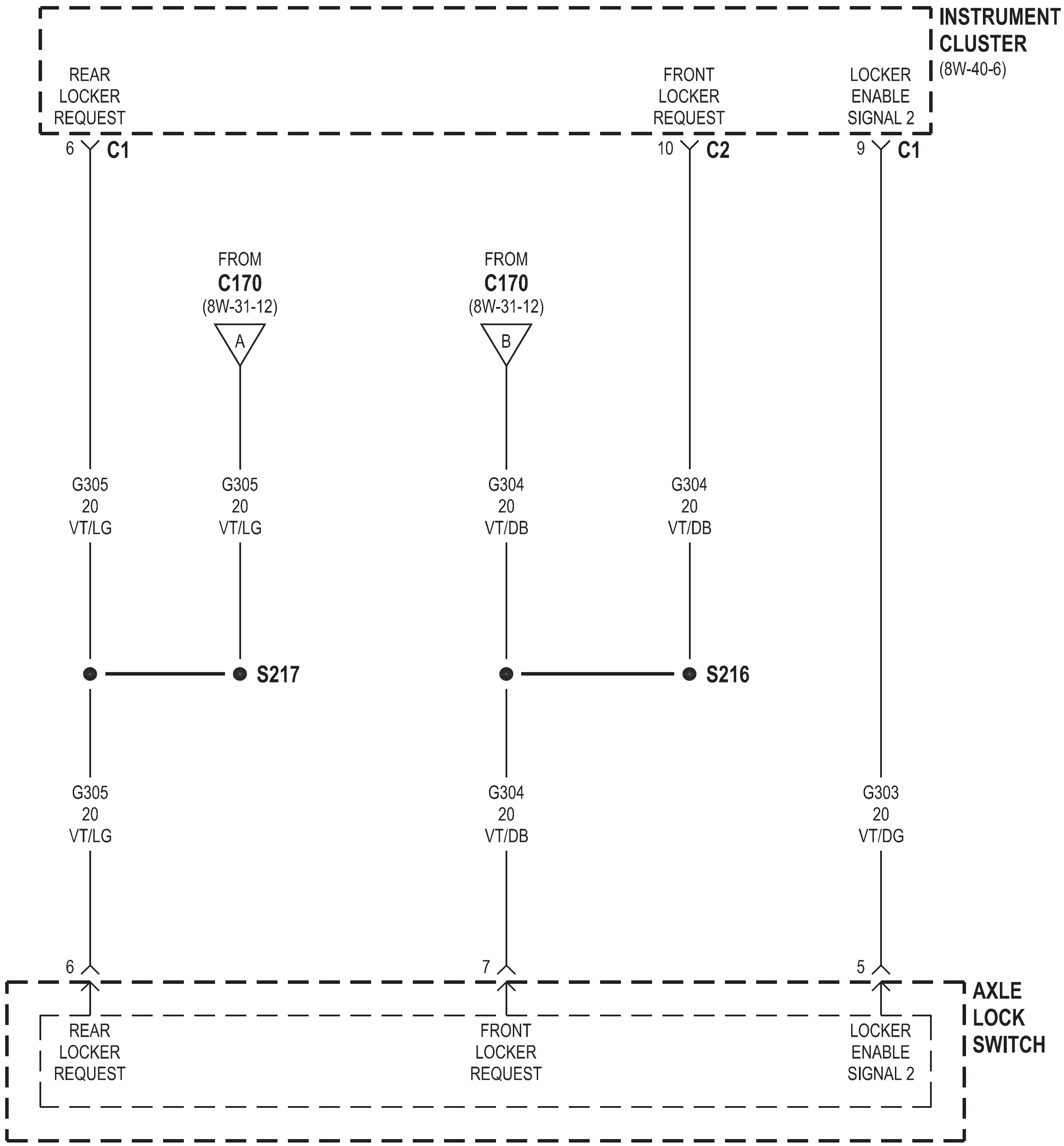

POWERTRAIN CONTROL MODULE
(8W-30-5)
(8W-30-10)
(8W-30-16)
PCI BUS
SCI TRANSMIT
SENSOR GROUND
THROTTLE POSITION SENSOR SIGNAL
30 C3
27 C3
4 C1
23 C1
D25 18 VT/YL
D21 18 PK
K4 18 BK/LB
K22 18 OR/DB
14 DATA LINK CONNECTOR
S171 (8W-18-3)
S170 (8W-18-4)
S121 (8W-70-6) (8W-70-7) (8W-70-8)
D20 20 LG/PK
K4 18 BK/LB
23 C170
S133 (8W-70-5) (8W-70-6) (8W-70-7) (8W-70-8)
S158
D20 18 LG/PK
D25 18 VT/YL
D21 18 PK
K22 18 OR/DB
8 C182
K22 18 OR/DB
5
6
4 C109
3
THROTTLE POSITION SENSOR
(8W-30-10)
(8W-30-16)
D20 18 LG
D25 18 VT/YL
D21 18 PK
K4 18 BK/LB
K22 18 OR/DB
46
43
7
51
12
SCI RECEIVE
PCI BUS
SCI TRANSMIT
SENSOR GROUND
THROTTLE POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE

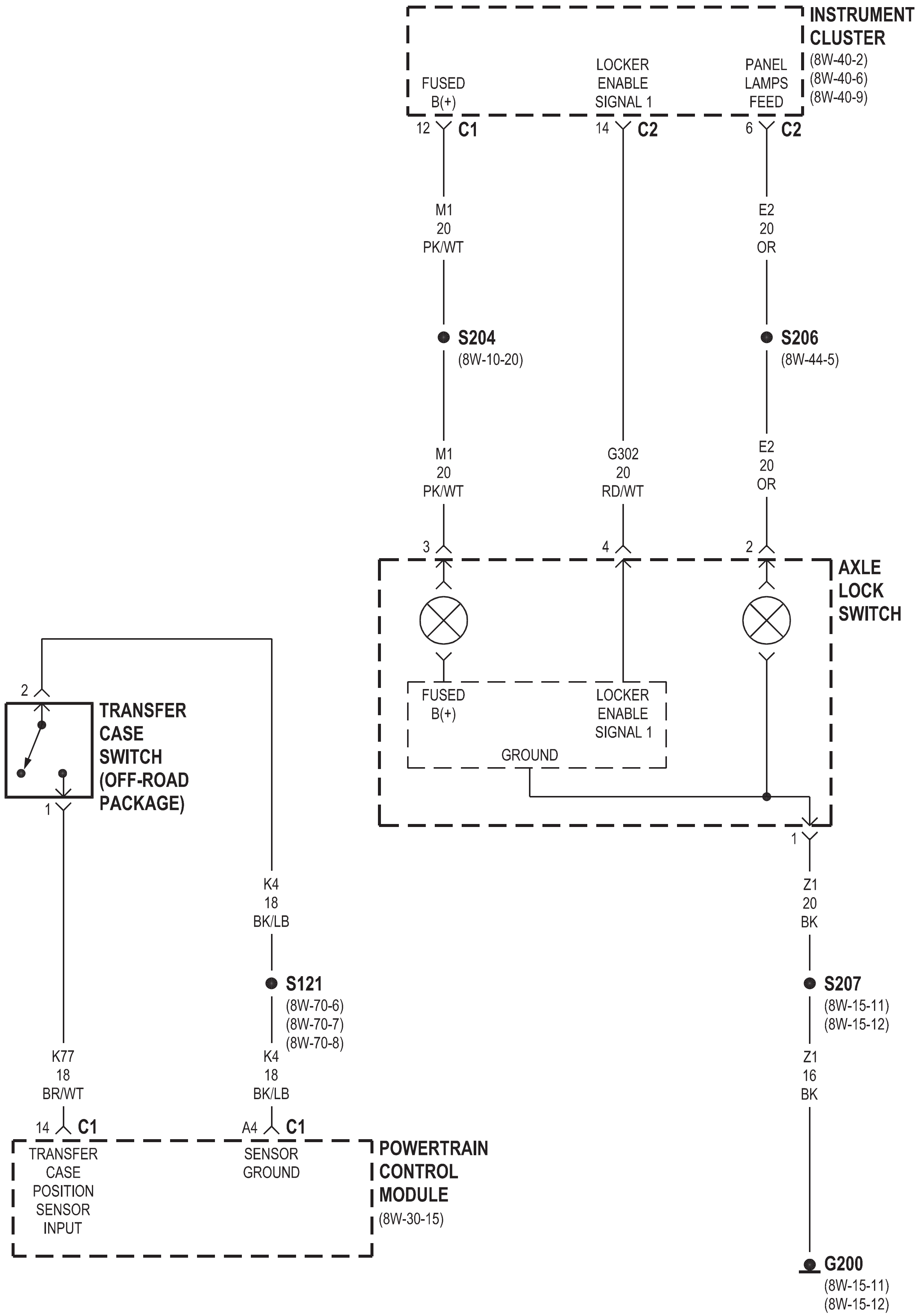
OFF-ROAD PACKAGE



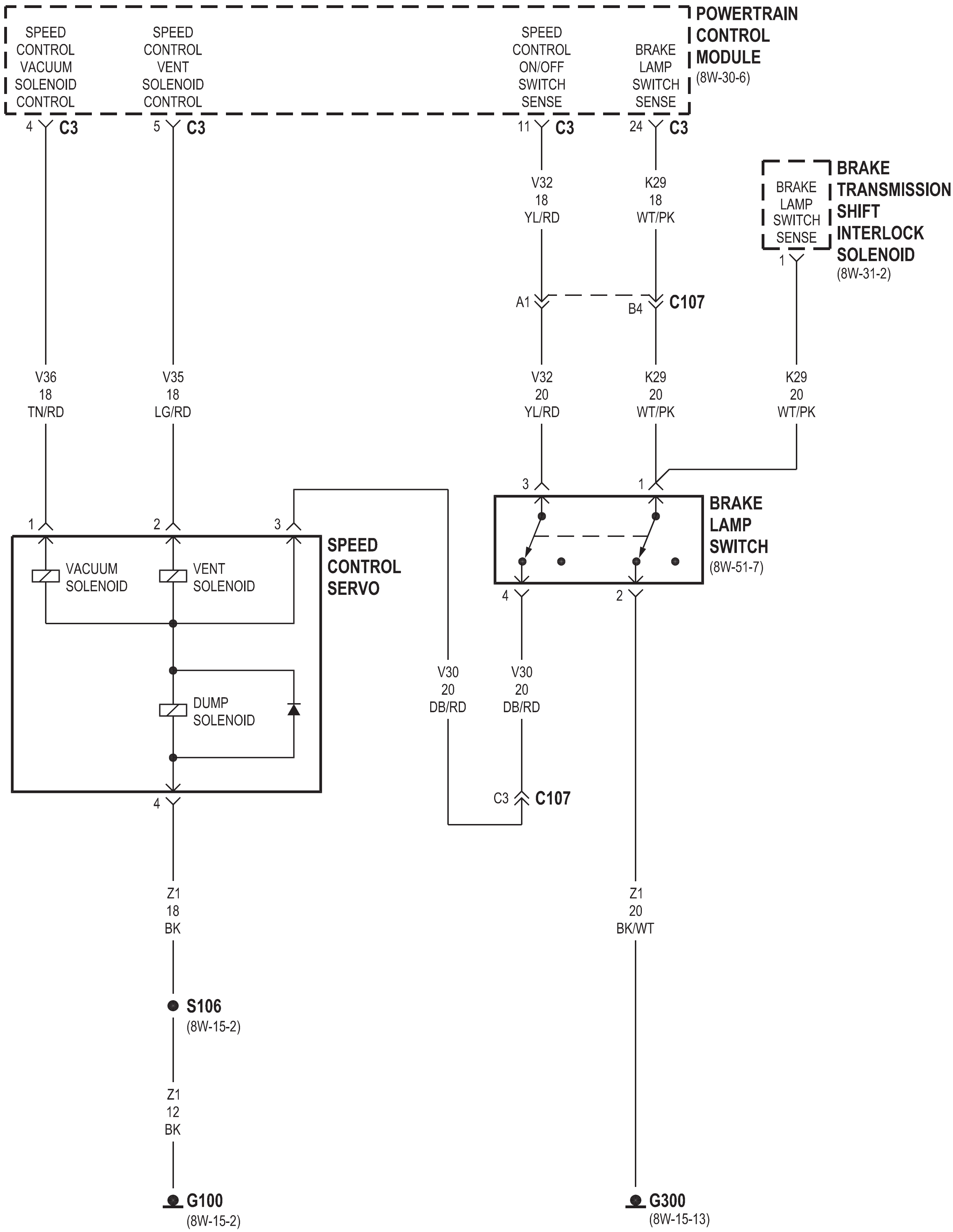

INSTRUMENT CLUSTER
(8W-40-6)
REAR LOCKER INDICATOR SWITCH SENSE
FRONT LOCKER INDICATOR SWITCH SENSE
7
C1
16
C2
G301
20
VT/LB
G300
20
VT/WT
17
16
C170
3
6
C104
S164
(8W-15-8)
Z1
20
BK
Z1
18
BK
G300
20
VT/WT
2
1
C116
S132
(8W-15-7)
(8W-15-8)
(8W-15-9)
C115
G301
16
VT/LB
Z1
16
BK
Z1
14
BK
G300
16
VT/WT
REAR LOCKER INDICATOR SWITCH
FRONT LOCKER INDICATOR SWITCH
G105
(8W-15-9)

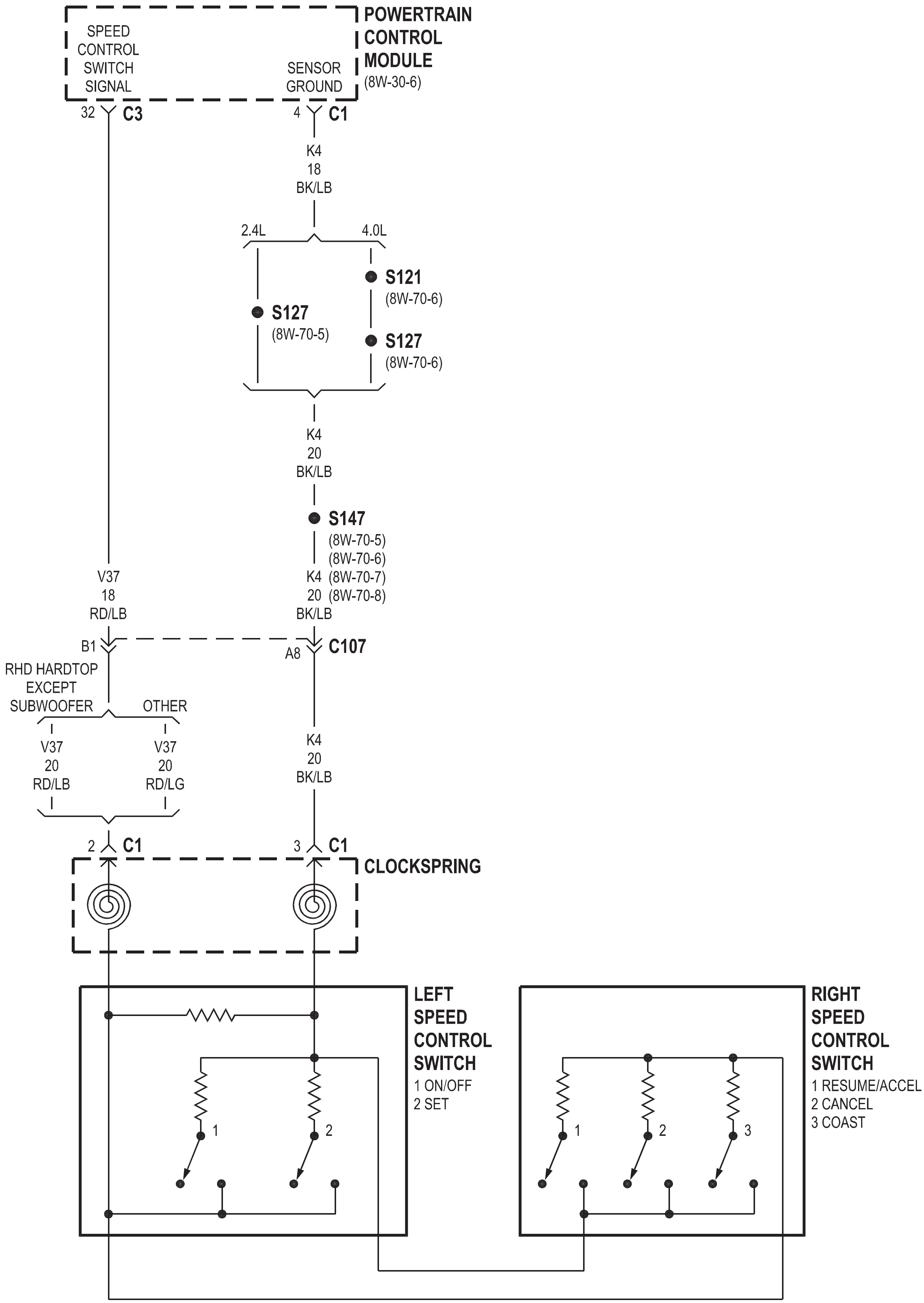
OFF-ROAD PACKAGE




INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-6)
(8W-40-9)
FUSED B(+)
LOCKER ENABLE SIGNAL 1
PANEL LAMPS FEED
12 C1
14 C2
6 C2
M1 20 PK/WT
E2 20 OR
S204
(8W-10-20)
S206
(8W-44-5)
M1 20 PK/WT
G302 20 RD/WT
E2 20 OR
3
4
2
AXLE LOCK SWITCH
FUSED B(+)
LOCKER ENABLE SIGNAL 1
GROUND
1
Z1 20 BK
S207
(8W-15-11)
(8W-15-12)
Z1 16 BK
G200
(8W-15-11)
(8W-15-12)
2
TRANSFER CASE SWITCH (OFF-ROAD PACKAGE)
1
K4 18 BK/LB
S121
(8W-70-6)
(8W-70-7)
(8W-70-8)
K77 18 BR/WT
K4 18 BK/LB
14 C1
A4 C1
TRANSFER CASE POSITION SENSOR INPUT
SENSOR GROUND
POWERTRAIN CONTROL MODULE
(8W-30-15)

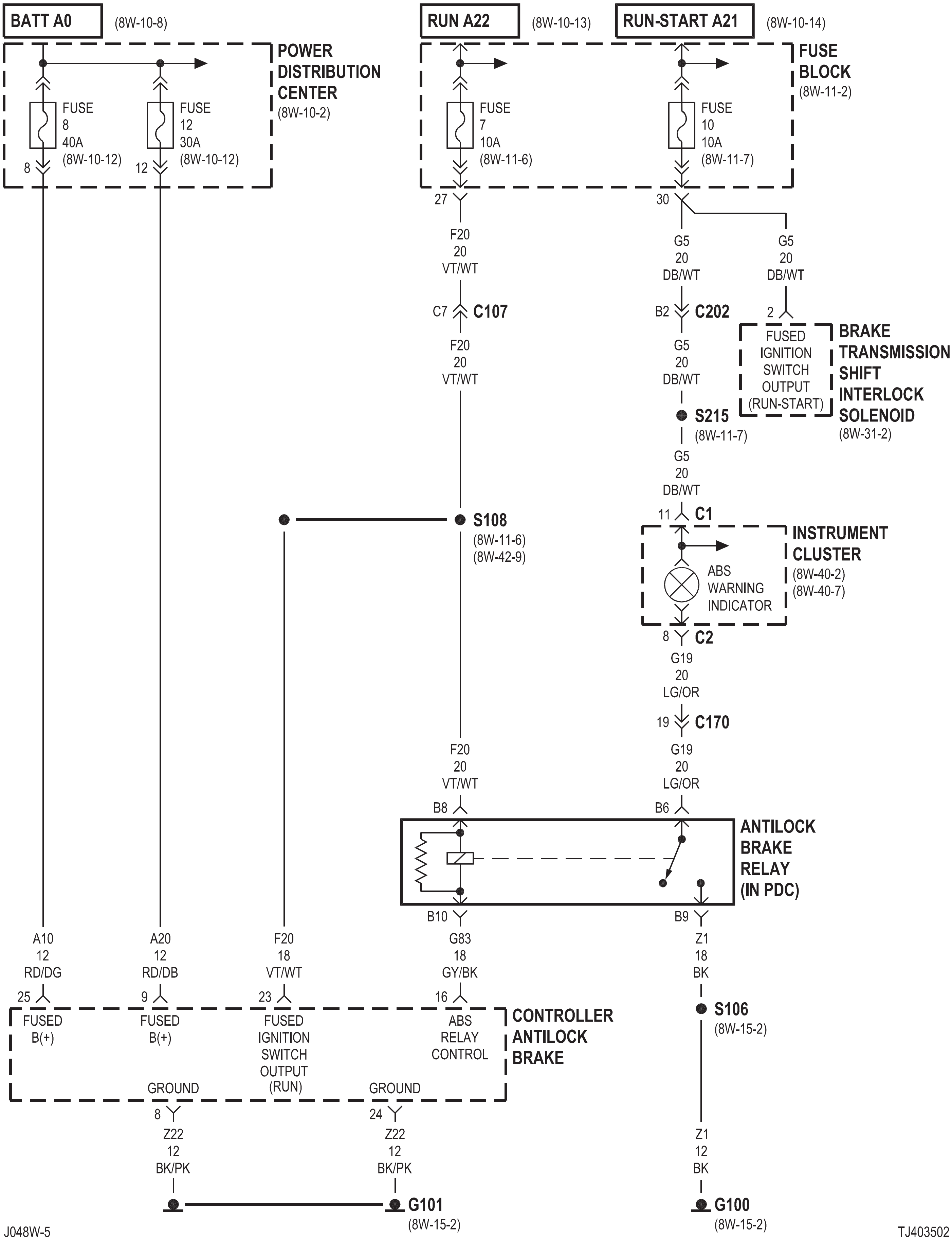
8W-33 VEHICLE SPEED CONTROL


POWERTRAIN CONTROL MODULE
(8W-30-6)
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL ON/OFF SWITCH SENSE
BRAKE LAMP SWITCH SENSE
4 C3
5 C3
11 C3
24 C3
V32 18 YL/RD
K29 18 WT/PK
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
(8W-31-2)
BRAKE LAMP SWITCH SENSE
1
A1
B4
C107
V36 18 TN/RD
V35 18 LG/RD
V32 20 YL/RD
K29 20 WT/PK
K29 20 WT/PK
3
1
BRAKE LAMP SWITCH
(8W-51-7)
1
2
3
SPEED CONTROL SERVO
VACUUM SOLENOID
VENT SOLENOID
DUMP SOLENOID
4
2
V30 20 DB/RD
V30 20 DB/RD
C3
C107
4
Z1 18 BK
Z1 20 BK/WT
S106
(8W-15-2)
Z1 12 BK
G100
(8W-15-2)
G300
(8W-15-13)

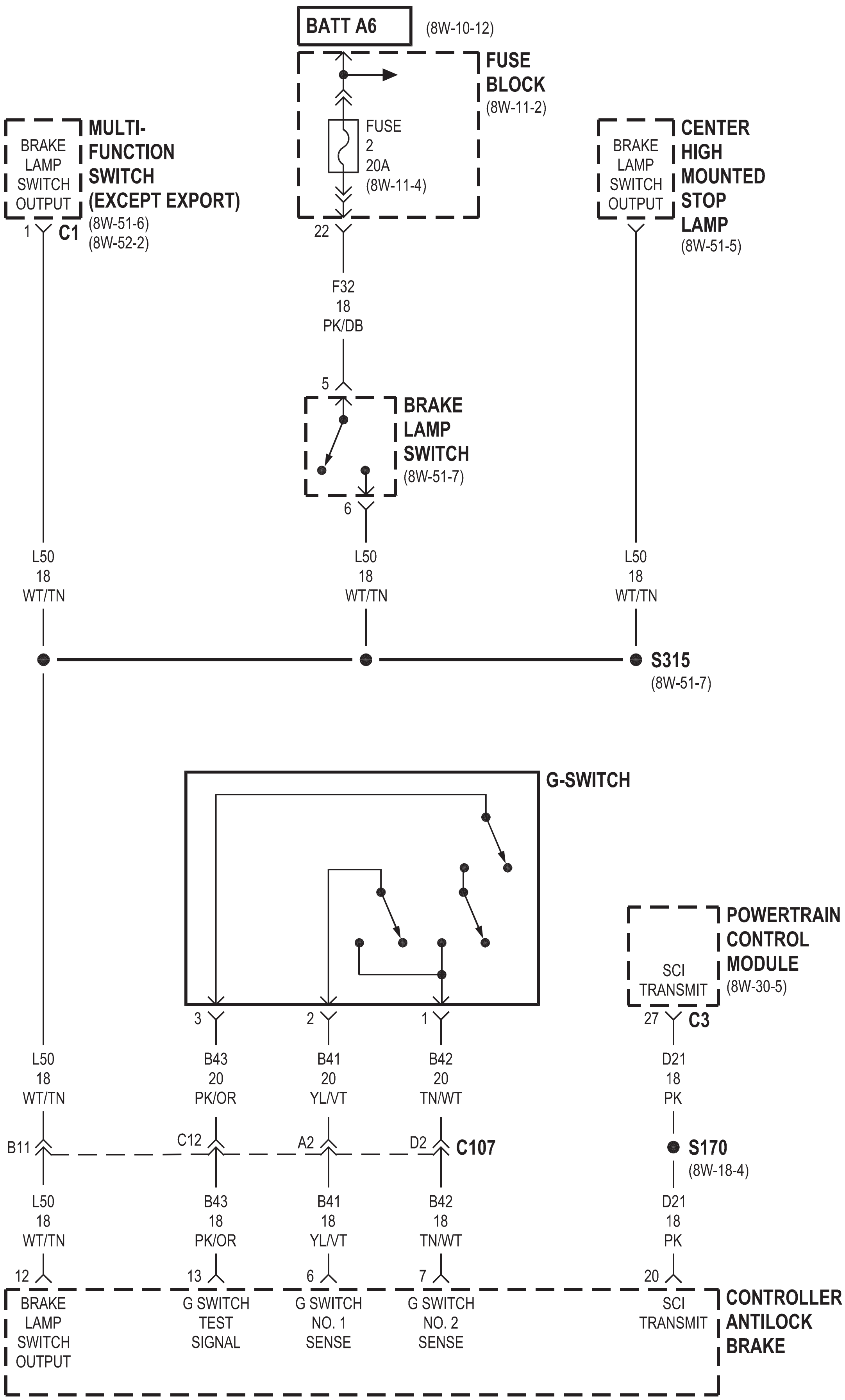


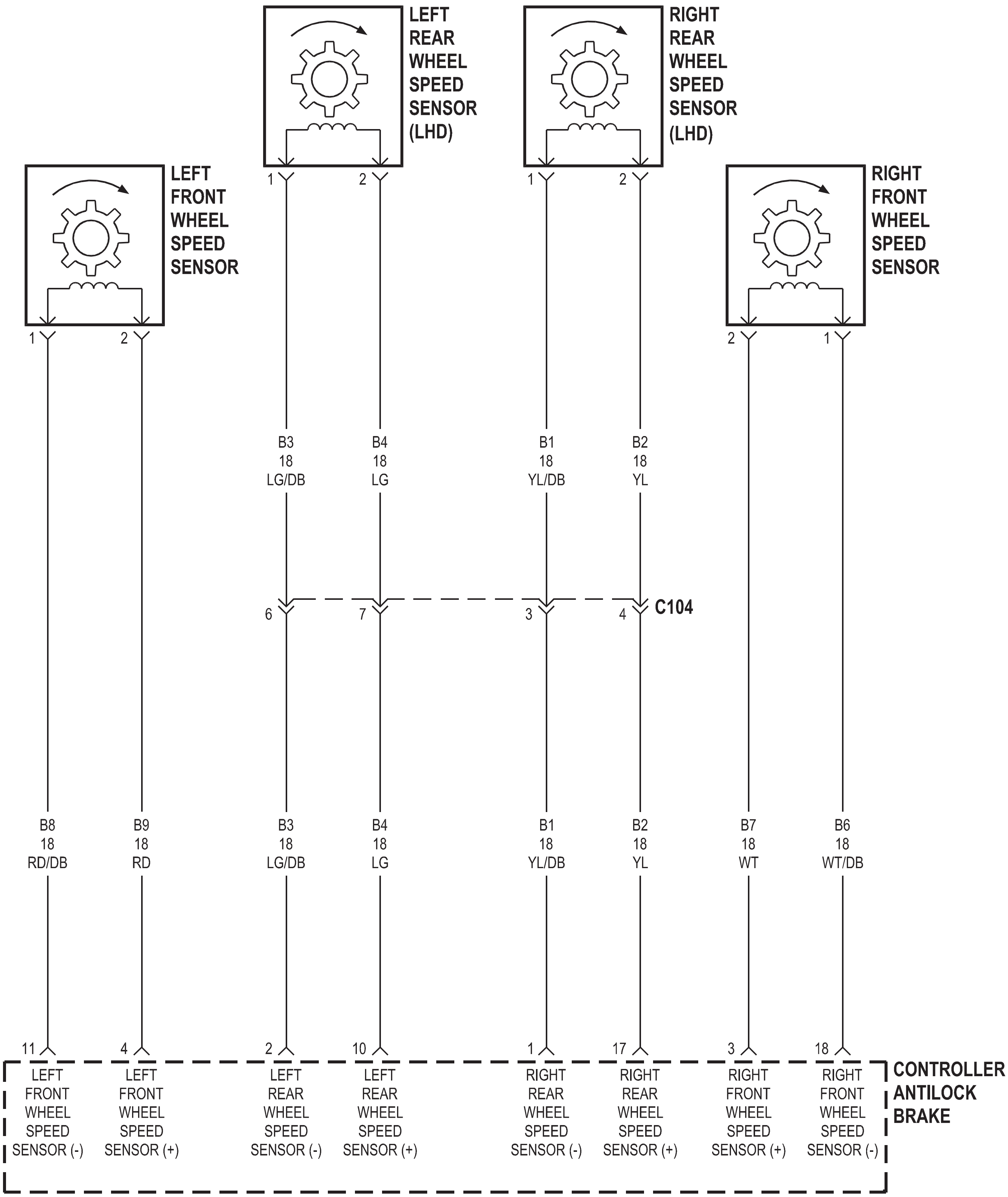
POWERTRAIN CONTROL MODULE
(8W-30-6)
SPEED CONTROL SWITCH SIGNAL
SENSOR GROUND
32 C3
4 C1
K4 18 BK/LB
2.4L
4.0L
S121 (8W-70-6)
S127 (8W-70-5)
S127 (8W-70-6)
K4 20 BK/LB
S147 (8W-70-5) (8W-70-6) (8W-70-7) (8W-70-8)
V37 18 RD/LB
K4 20 BK/LB
B1
A8
C107
RHD HARDTOP EXCEPT SUBWOOFER
OTHER
V37 20 RD/LB
V37 20 RD/LG
K4 20 BK/LB
2 C1
3 C1
CLOCKSPRING
LEFT SPEED CONTROL SWITCH
1 ON/OFF
2 SET
RIGHT SPEED CONTROL SWITCH
1 RESUME/ACCEL
2 CANCEL
3 COAST

8W-35 ANTILOCK BRAKES

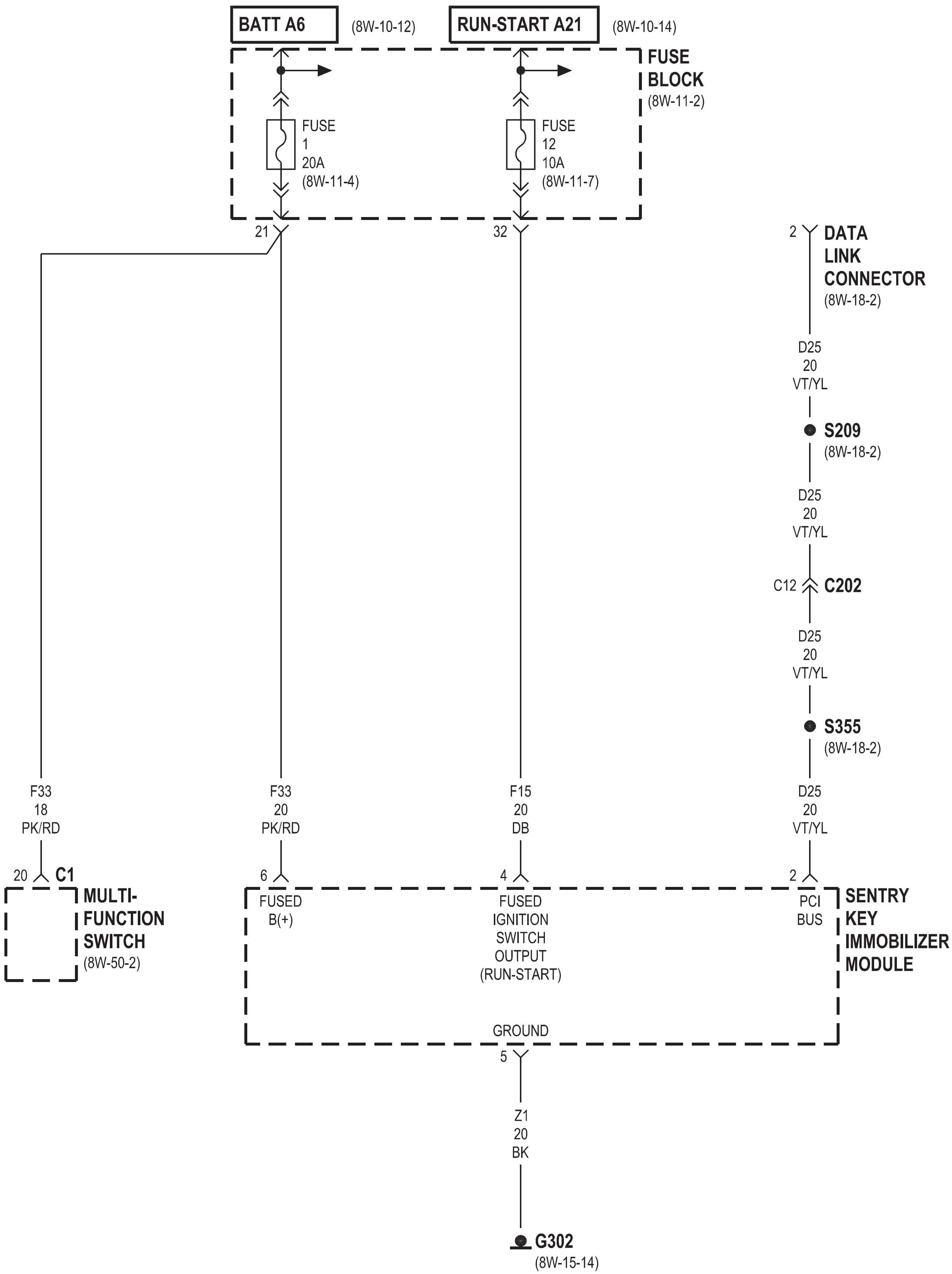


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 8 40A (8W-10-12)
FUSE 12 30A (8W-10-12)
8
12
RUN A22
(8W-10-13)
RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 7 10A (8W-11-6)
FUSE 10 10A (8W-11-7)
27
30
F20 20 VT/WT
G5 20 DB/WT
G5 20 DB/WT
C7
C107
B2
C202
2
FUSED IGNITION SWITCH OUTPUT (RUN-START)
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
(8W-31-2)
F20 20 VT/WT
G5 20 DB/WT
S215
(8W-11-7)
G5 20 DB/WT
S108
(8W-11-6)
(8W-42-9)
11
C1
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-7)
ABS WARNING INDICATOR
8
C2
G19 20 LG/OR
19
C170
F20 20 VT/WT
G19 20 LG/OR
B8
B6
ANTILOCK BRAKE RELAY (IN PDC)
B10
B9
A10 12 RD/DG
A20 12 RD/DB
F20 18 VT/WT
G83 18 GY/BK
Z1 18 BK
25
9
23
16
S106
(8W-15-2)
FUSED B(+)
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN)
ABS RELAY CONTROL
CONTROLLER ANTILOCK BRAKE
GROUND
GROUND
8
24
Z22 12 BK/PK
Z22 12 BK/PK
Z1 12 BK
G101
(8W-15-2)
G100
(8W-15-2)

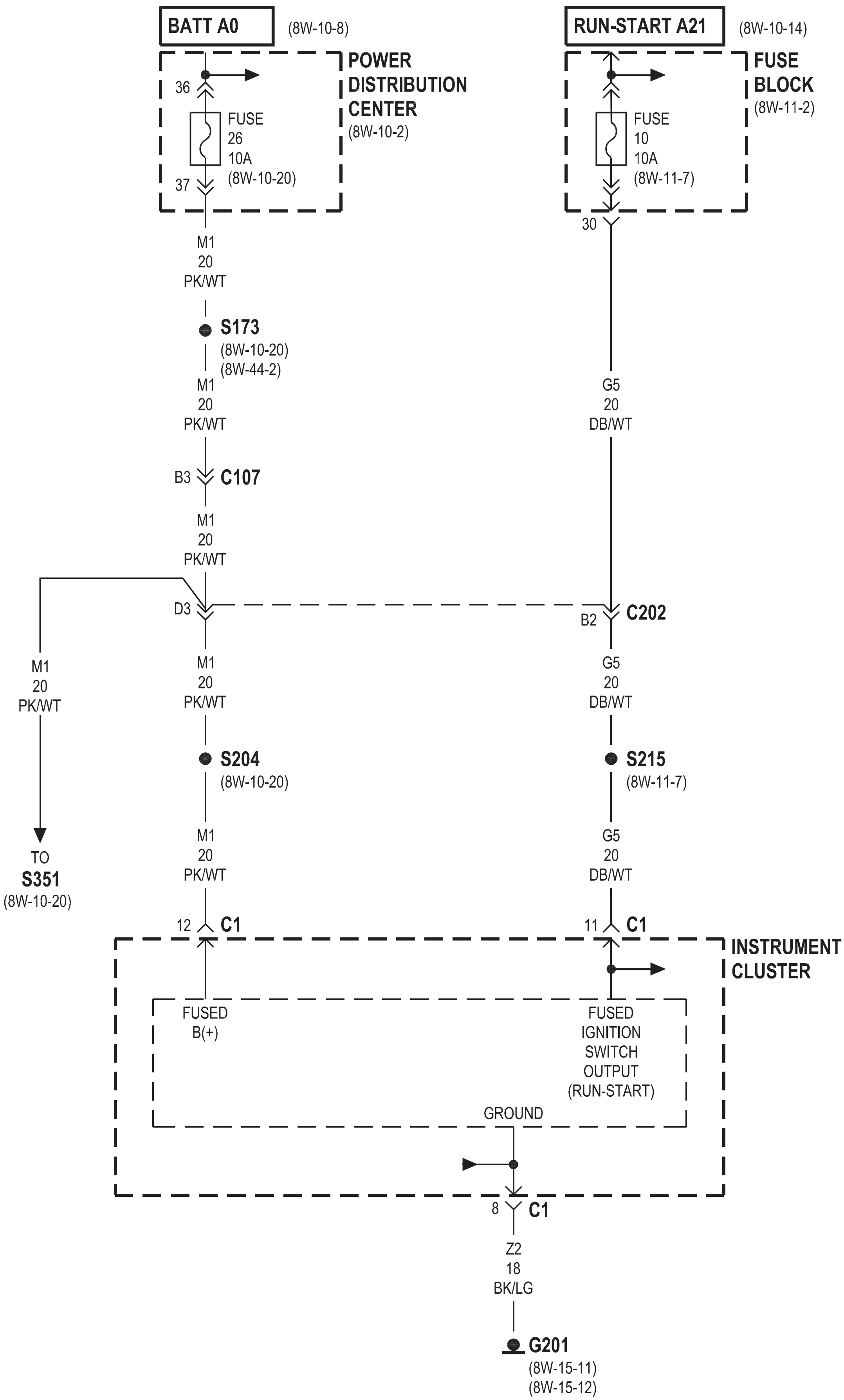

BATT A6
(8W-10-12)
FUSE
BLOCK
(8W-11-2)
FUSE
2
20A
(8W-11-4)
22
F32
18
PK/DB
BRAKE
LAMP
SWITCH
OUTPUT
MULTI-
FUNCTION
SWITCH
(EXCEPT EXPORT)
(8W-51-6)
(8W-52-2)
1
C1
BRAKE
LAMP
SWITCH
OUTPUT
CENTER
HIGH
MOUNTED
STOP
LAMP
(8W-51-5)
5
BRAKE
LAMP
SWITCH
(8W-51-7)
6
L50
18
WT/TN
L50
18
WT/TN
L50
18
WT/TN
S315
(8W-51-7)
G-SWITCH
POWERTRAIN
CONTROL
MODULE
(8W-30-5)
SCI
TRANSMIT
27
C3
3
2
1
L50
18
WT/TN
B43
20
PK/OR
B41
20
YL/VT
B42
20
TN/WT
D21
18
PK
B11
C12
A2
D2
C107
S170
(8W-18-4)
L50
18
WT/TN
B43
18
PK/OR
B41
18
YL/VT
B42
18
TN/WT
D21
18
PK
12
13
6
7
20
BRAKE
LAMP
SWITCH
OUTPUT
G SWITCH
TEST
SIGNAL
G SWITCH
NO. 1
SENSE
G SWITCH
NO. 2
SENSE
SCI
TRANSMIT
CONTROLLER
ANTILOCK
BRAKE

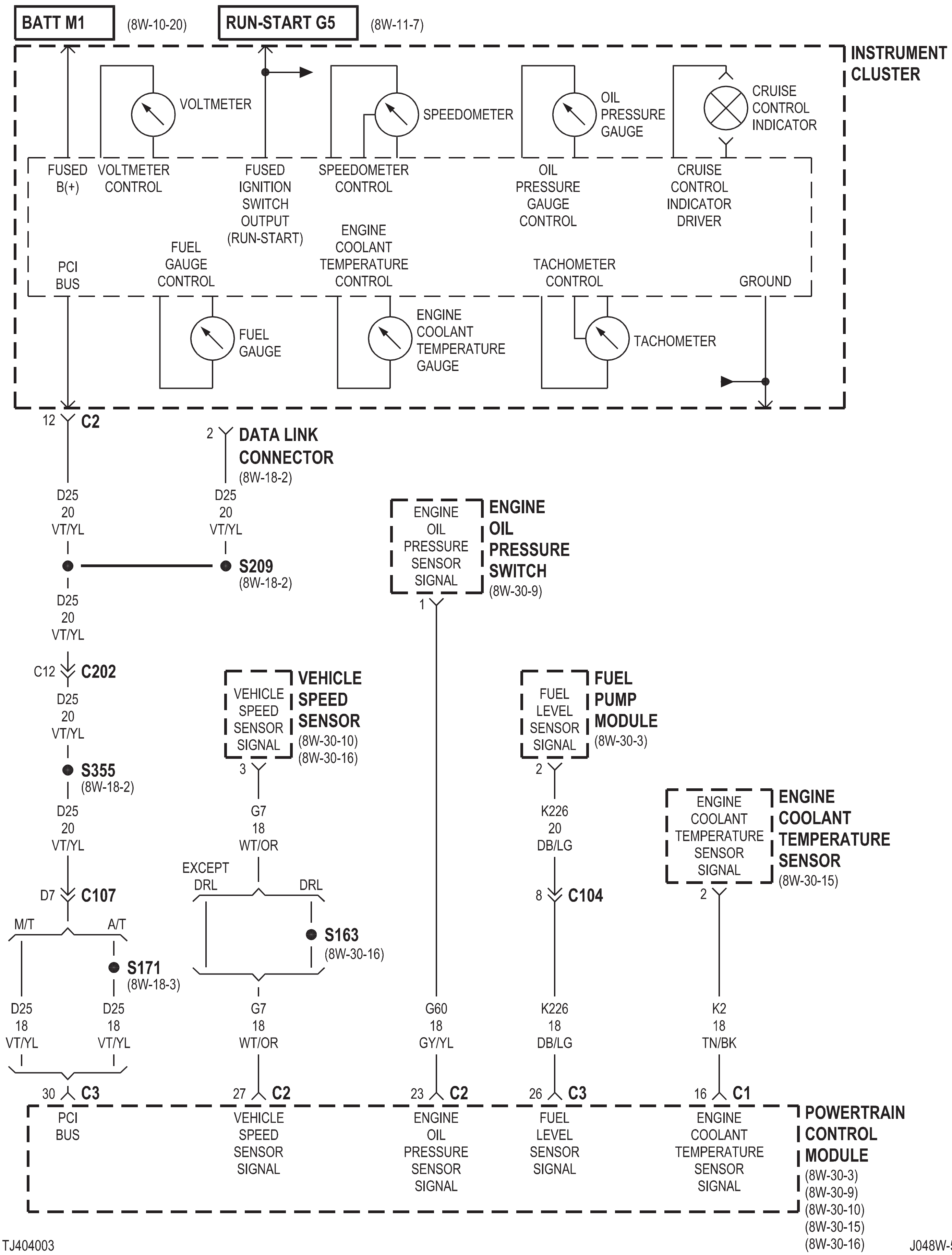

LEFT REAR WHEEL SPEED SENSOR (LHD)
RIGHT REAR WHEEL SPEED SENSOR (LHD)
LEFT FRONT WHEEL SPEED SENSOR
RIGHT FRONT WHEEL SPEED SENSOR
B3 18 LG/DB
B4 18 LG
B1 18 YL/DB
B2 18 YL
C104
B8 18 RD/DB
B9 18 RD
B7 18 WT
B6 18 WT/DB
LEFT FRONT WHEEL SPEED SENSOR (-)
LEFT FRONT WHEEL SPEED SENSOR (+)
LEFT REAR WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (+)
RIGHT REAR WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (-)
CONTROLLER ANTILOCK BRAKE

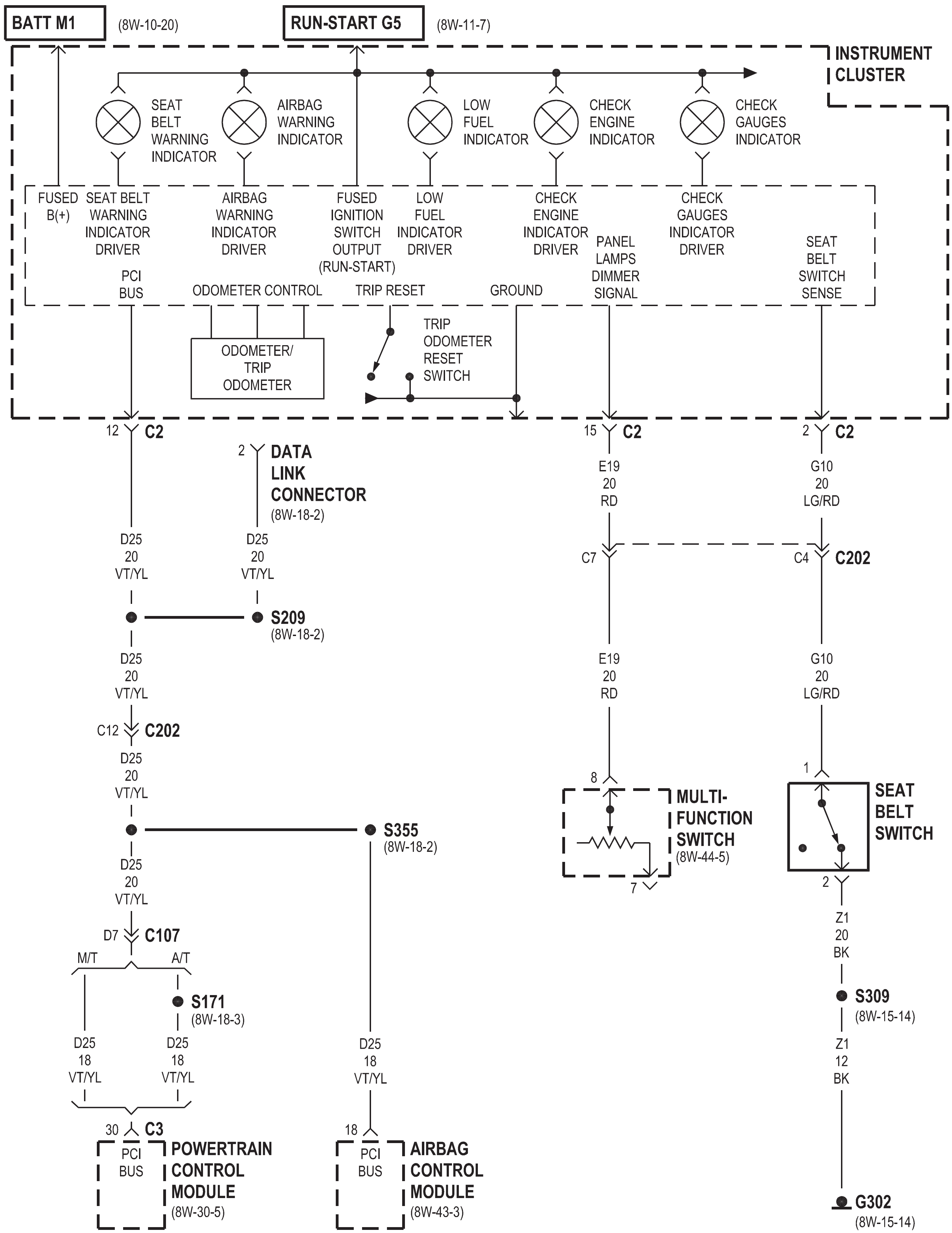
8W-39 VEHICLE THEFT SECURITY SYSTEM


BATT A6
(8W-10-12)
RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 1 20A (8W-11-4)
FUSE 12 10A (8W-11-7)
21
32
2
DATA LINK CONNECTOR
(8W-18-2)
D25 20 VT/YL
S209
(8W-18-2)
D25 20 VT/YL
C12
C202
D25 20 VT/YL
S355
(8W-18-2)
F33 18 PK/RD
F33 20 PK/RD
F15 20 DB
D25 20 VT/YL
20
C1
MULTI-FUNCTION SWITCH
(8W-50-2)
6
4
2
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PCI BUS
SENTRY KEY IMMOBILIZER MODULE
GROUND
5
Z1 20 BK
G302
(8W-15-14)

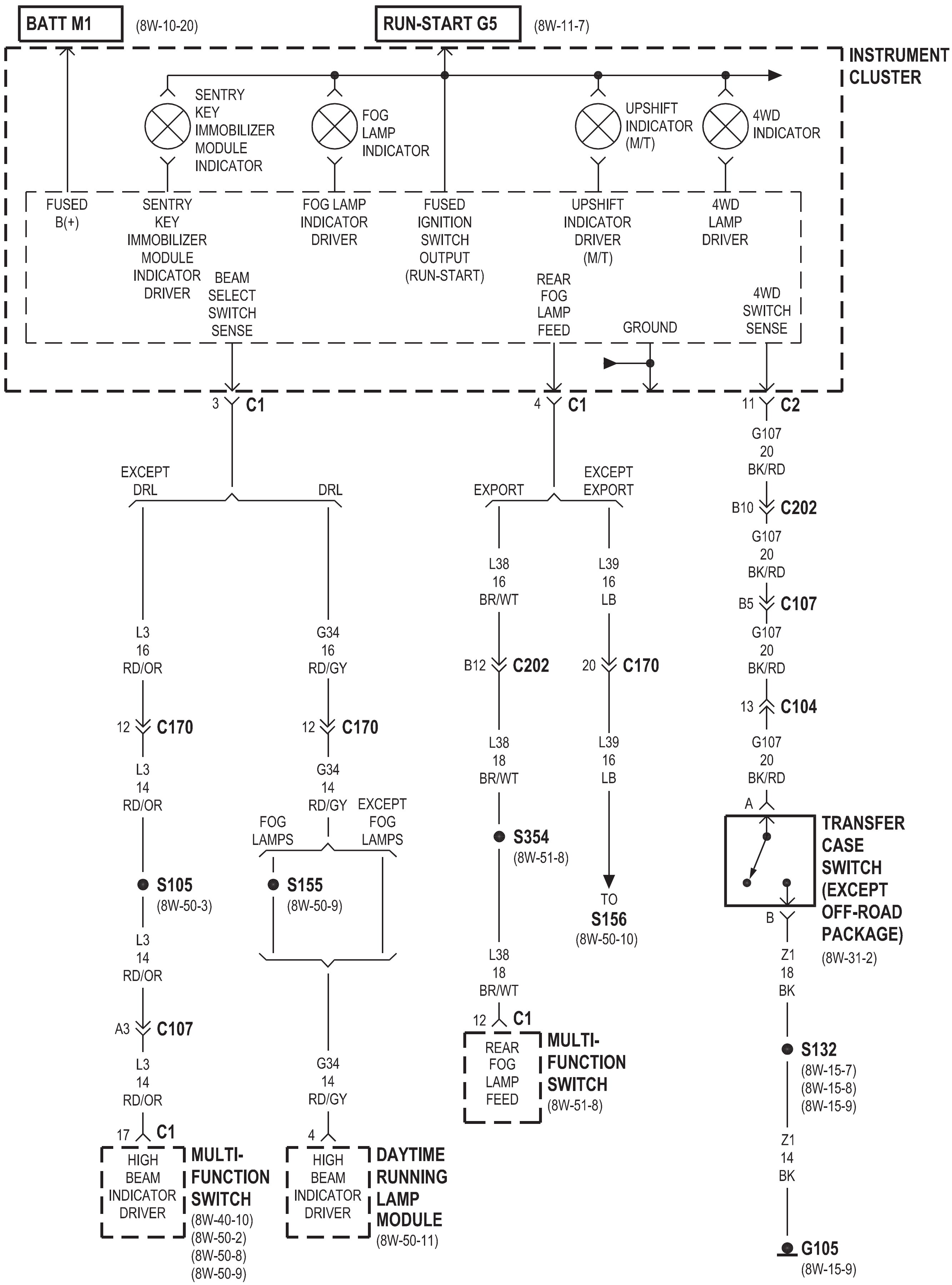
8W-40 INSTRUMENT CLUSTER


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
36
FUSE
26
10A
(8W-10-20)
37
RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
10
10A
(8W-11-7)
30
M1
20
PK/WT
S173
(8W-10-20)
(8W-44-2)
G5
20
DB/WT
B3
C107
D3
B2
C202
S204
(8W-10-20)
S215
(8W-11-7)
TO
S351
(8W-10-20)
12
C1
11
C1
INSTRUMENT CLUSTER
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
GROUND
8
C1
Z2
18
BK/LG
G201
(8W-15-11)
(8W-15-12)

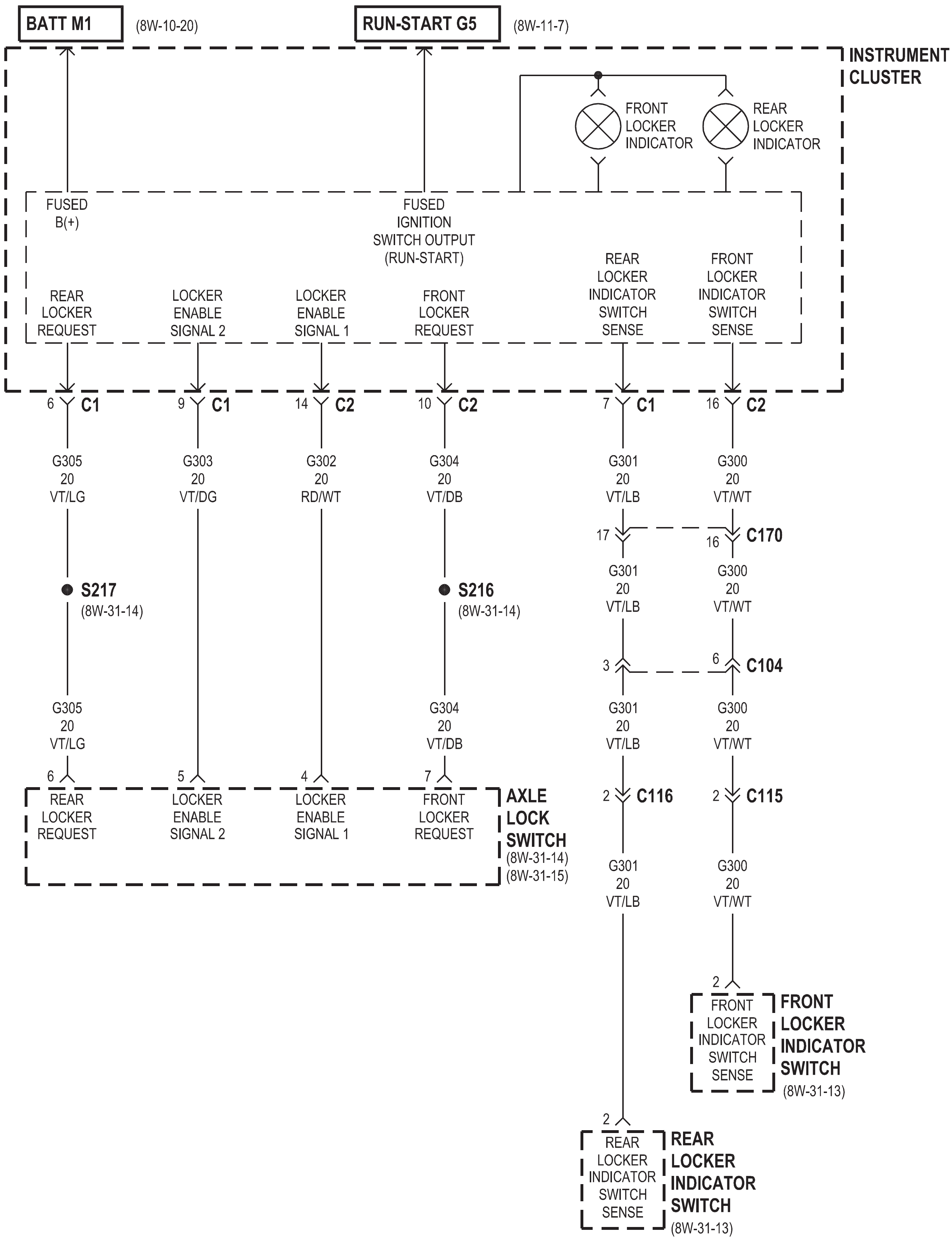

BATT M1
(8W-10-20)
RUN-START G5
(8W-11-7)
INSTRUMENT CLUSTER
VOLTMETER
SPEEDOMETER
OIL PRESSURE GAUGE
CRUISE CONTROL INDICATOR
FUSED B(+)
VOLTMETER CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
SPEEDOMETER CONTROL
OIL PRESSURE GAUGE CONTROL
CRUISE CONTROL INDICATOR DRIVER
PCI BUS
FUEL GAUGE CONTROL
ENGINE COOLANT TEMPERATURE CONTROL
TACHOMETER CONTROL
GROUND
FUEL GAUGE
ENGINE COOLANT TEMPERATURE GAUGE
TACHOMETER
12 C2
2 DATA LINK CONNECTOR
(8W-18-2)
D25 20 VT/YL
D25 20 VT/YL
S209
(8W-18-2)
D25 20 VT/YL
C12 C202
D25 20 VT/YL
S355
(8W-18-2)
D25 20 VT/YL
D7 C107
M/T
A/T
S171
(8W-18-3)
D25 18 VT/YL
D25 18 VT/YL
ENGINE OIL PRESSURE SENSOR SIGNAL
ENGINE OIL PRESSURE SWITCH
(8W-30-9)
1
VEHICLE SPEED SENSOR SIGNAL
VEHICLE SPEED SENSOR
(8W-30-10)
(8W-30-16)
3
G7 18 WT/OR
EXCEPT DRL
DRL
S163
(8W-30-16)
G7 18 WT/OR
G60 18 GY/YL
FUEL LEVEL SENSOR SIGNAL
FUEL PUMP MODULE
(8W-30-3)
2
K226 20 DB/LG
8 C104
K226 18 DB/LG
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-15)
2
K2 18 TN/BK
30 C3
27 C2
23 C2
26 C3
16 C1
PCI BUS
VEHICLE SPEED SENSOR SIGNAL
ENGINE OIL PRESSURE SENSOR SIGNAL
FUEL LEVEL SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-9)
(8W-30-10)
(8W-30-15)
(8W-30-16)

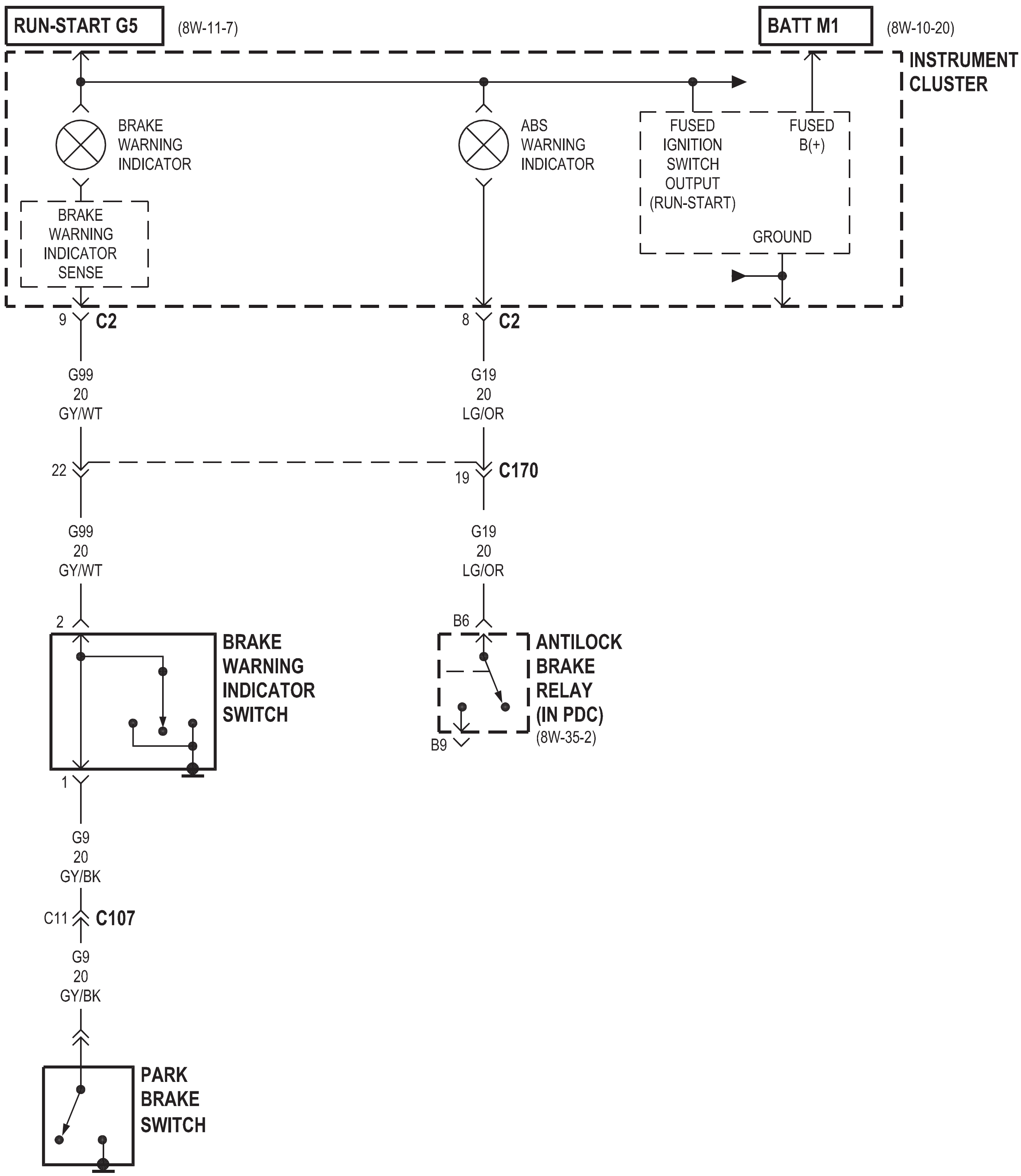


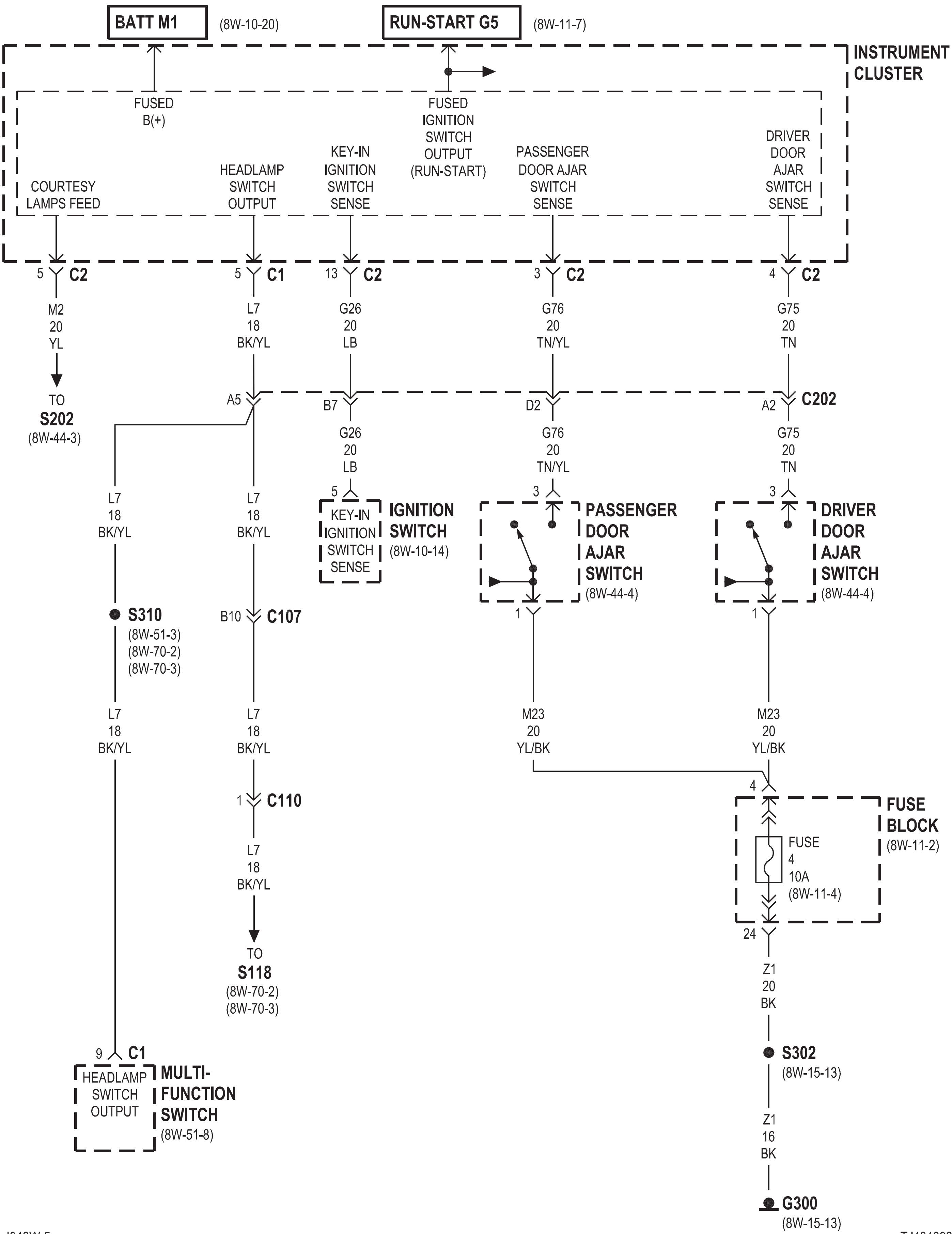
BATT M1
(8W-10-20)
RUN-START G5
(8W-11-7)
INSTRUMENT CLUSTER
SEAT BELT WARNING INDICATOR
AIRBAG WARNING INDICATOR
LOW FUEL INDICATOR
CHECK ENGINE INDICATOR
CHECK GAUGES INDICATOR
FUSED B(+)
SEAT BELT WARNING INDICATOR DRIVER
AIRBAG WARNING INDICATOR DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN-START)
LOW FUEL INDICATOR DRIVER
CHECK ENGINE INDICATOR DRIVER
PANEL LAMPS DIMMER SIGNAL
CHECK GAUGES INDICATOR DRIVER
SEAT BELT SWITCH SENSE
PCI BUS
ODOMETER CONTROL
TRIP RESET
GROUND
ODOMETER/ TRIP ODOMETER
TRIP ODOMETER RESET SWITCH
12
C2
15
C2
2
C2
2
DATA LINK CONNECTOR
(8W-18-2)
E19 20 RD
G10 20 LG/RD
D25 20 VT/YL
D25 20 VT/YL
C7
C4
C202
S209
(8W-18-2)
D25 20 VT/YL
E19 20 RD
G10 20 LG/RD
C12
C202
D25 20 VT/YL
8
MULTI-FUNCTION SWITCH
(8W-44-5)
7
1
SEAT BELT SWITCH
2
S355
(8W-18-2)
D25 20 VT/YL
D7
C107
M/T
A/T
S171
(8W-18-3)
Z1 20 BK
S309
(8W-15-14)
D25 18 VT/YL
D25 18 VT/YL
D25 18 VT/YL
Z1 12 BK
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-5)
18
PCI BUS
AIRBAG CONTROL MODULE
(8W-43-3)
G302
(8W-15-14)


BATT M1
(8W-10-20)
RUN-START G5
(8W-11-7)
INSTRUMENT CLUSTER
SENTRY KEY IMMOBILIZER MODULE INDICATOR
FOG LAMP INDICATOR
UPSHIFT INDICATOR (M/T)
4WD INDICATOR
FUSED B(+)
SENTRY KEY IMMOBILIZER MODULE INDICATOR DRIVER
FOG LAMP INDICATOR DRIVER
FUSED IGNITION SWITCH OUTPUT (RUN-START)
UPSHIFT INDICATOR DRIVER (M/T)
4WD LAMP DRIVER
BEAM SELECT SWITCH SENSE
REAR FOG LAMP FEED
GROUND
4WD SWITCH SENSE
3 C1
4 C1
11 C2
EXCEPT DRL
DRL
EXPORT
EXCEPT EXPORT
G107 20 BK/RD
B10 C202
G107 20 BK/RD
B5 C107
G107 20 BK/RD
13 C104
G107 20 BK/RD
L38 16 BR/WT
L39 16 LB
B12 C202
20 C170
L3 16 RD/OR
G34 16 RD/GY
12 C170
12 C170
L38 18 BR/WT
L39 16 LB
L3 14 RD/OR
G34 14 RD/GY
FOG LAMPS
EXCEPT FOG LAMPS
S354
(8W-51-8)
TO S156
(8W-50-10)
A
B
TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE)
(8W-31-2)
S105
(8W-50-3)
S155
(8W-50-9)
L3 14 RD/OR
L38 18 BR/WT
Z1 18 BK
12 C1
REAR FOG LAMP FEED
MULTI-FUNCTION SWITCH
(8W-51-8)
A3 C107
S132
(8W-15-7)
(8W-15-8)
(8W-15-9)
L3 14 RD/OR
G34 14 RD/GY
Z1 14 BK
17 C1
4
HIGH BEAM INDICATOR DRIVER
MULTI-FUNCTION SWITCH
(8W-40-10)
(8W-50-2)
(8W-50-8)
(8W-50-9)
HIGH BEAM INDICATOR DRIVER
DAYTIME RUNNING LAMP MODULE
(8W-50-11)
G105
(8W-15-9)

OFF-ROAD PACKAGE

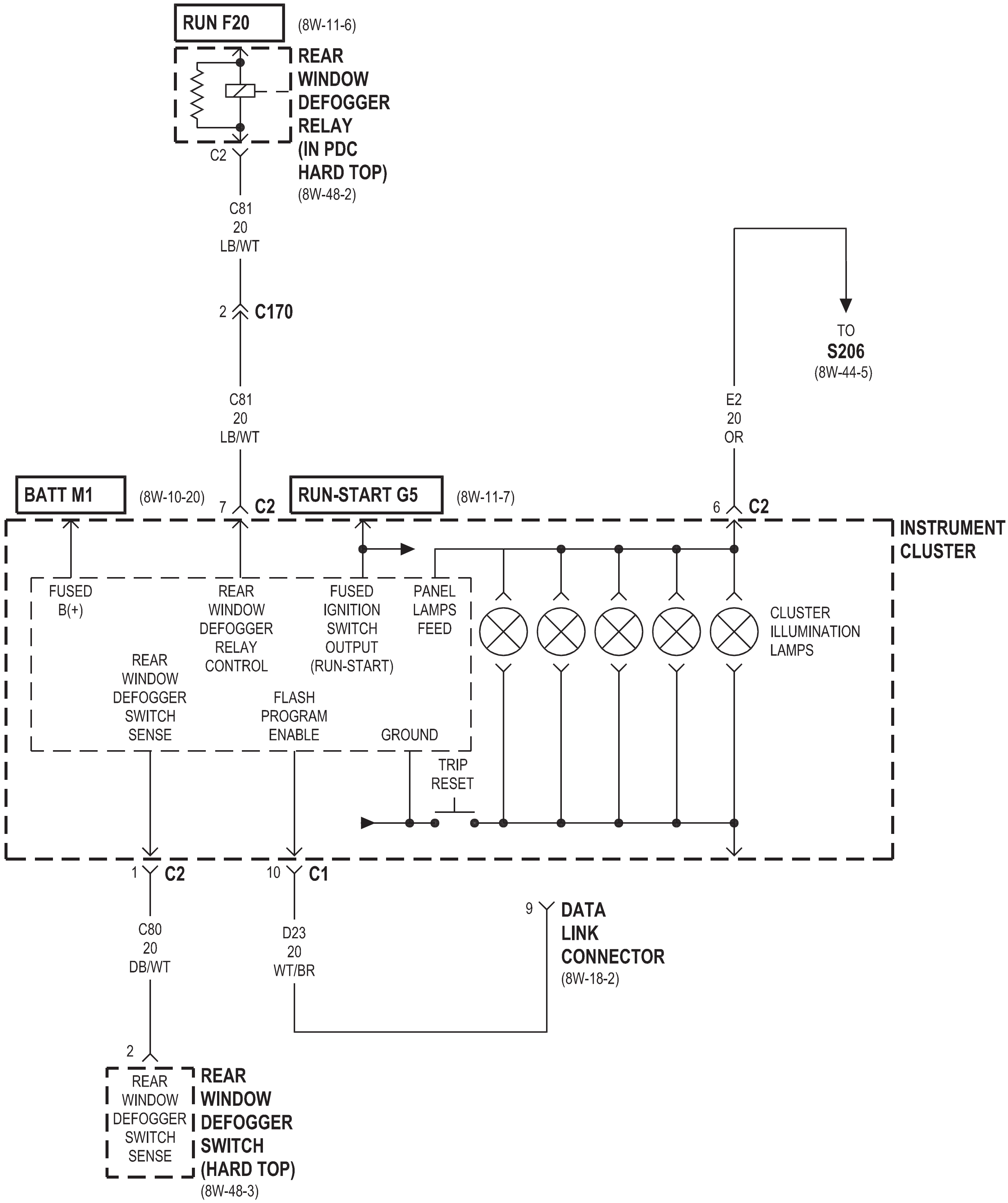


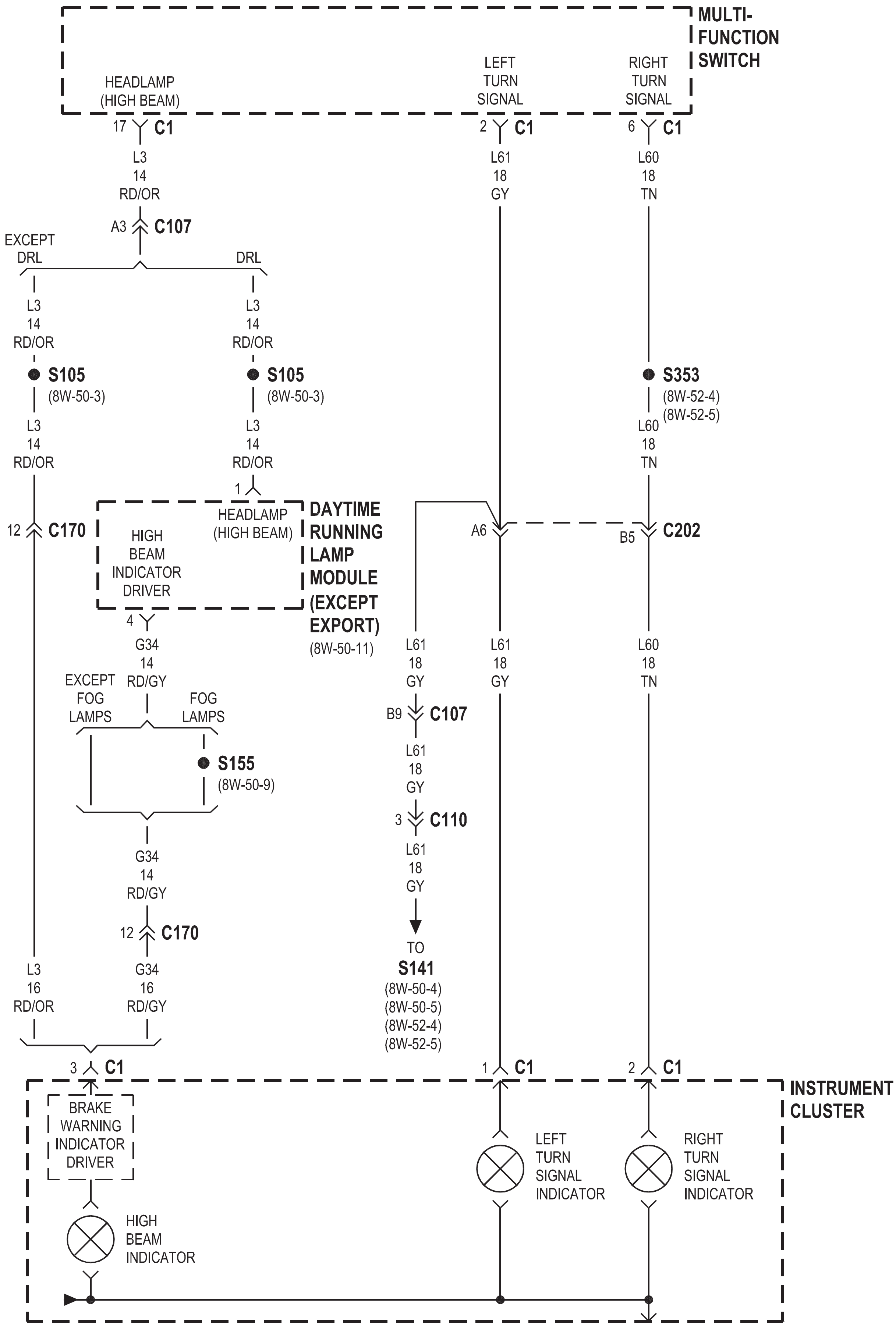

RUN-START G5
(8W-11-7)
BATT M1
(8W-10-20)
INSTRUMENT CLUSTER
BRAKE WARNING INDICATOR
ABS WARNING INDICATOR
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED B(+)
GROUND
BRAKE WARNING INDICATOR SENSE
9
C2
8
C2
G99
20
GY/WT
G19
20
LG/OR
22
19
C170
G99
20
GY/WT
G19
20
LG/OR
2
B6
BRAKE WARNING INDICATOR SWITCH
ANTILOCK BRAKE RELAY (IN PDC)
(8W-35-2)
B9
1
G9
20
GY/BK
C11
C107
G9
20
GY/BK
PARK BRAKE SWITCH



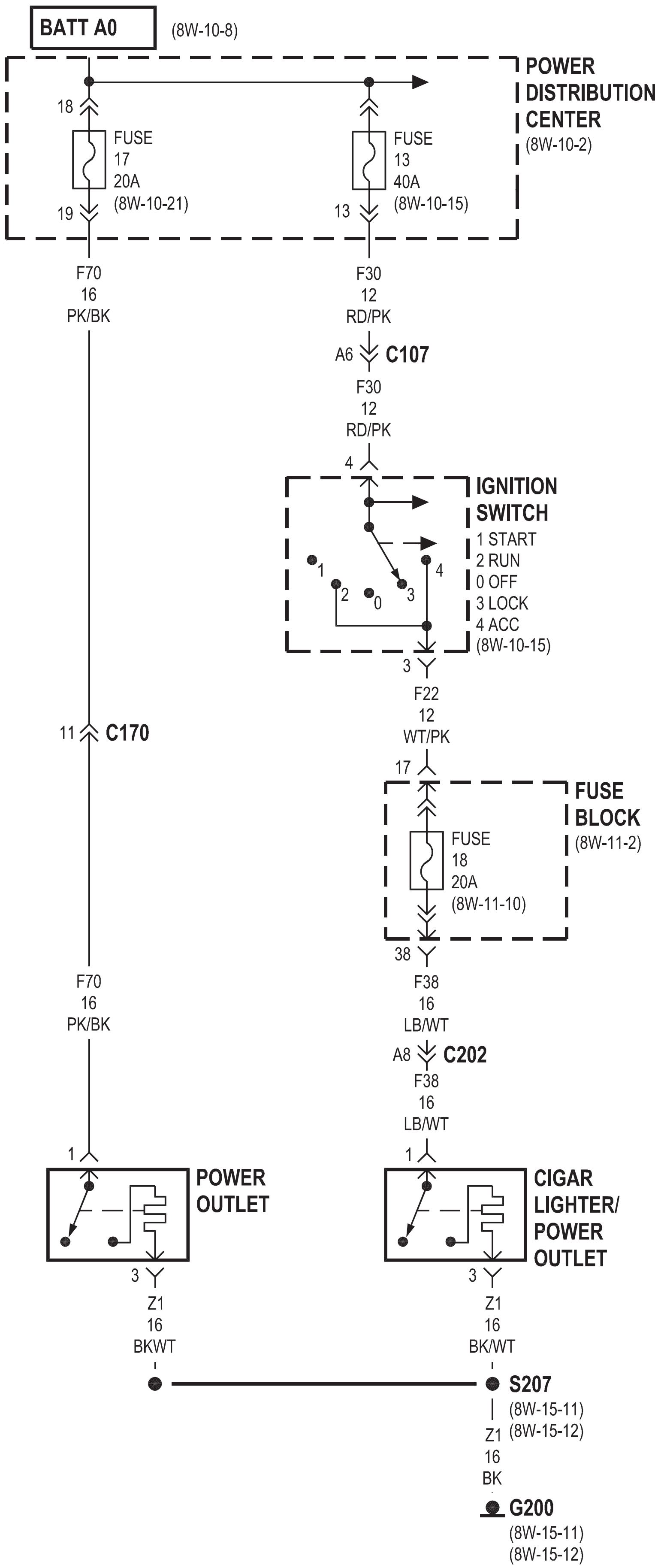
J048W-5

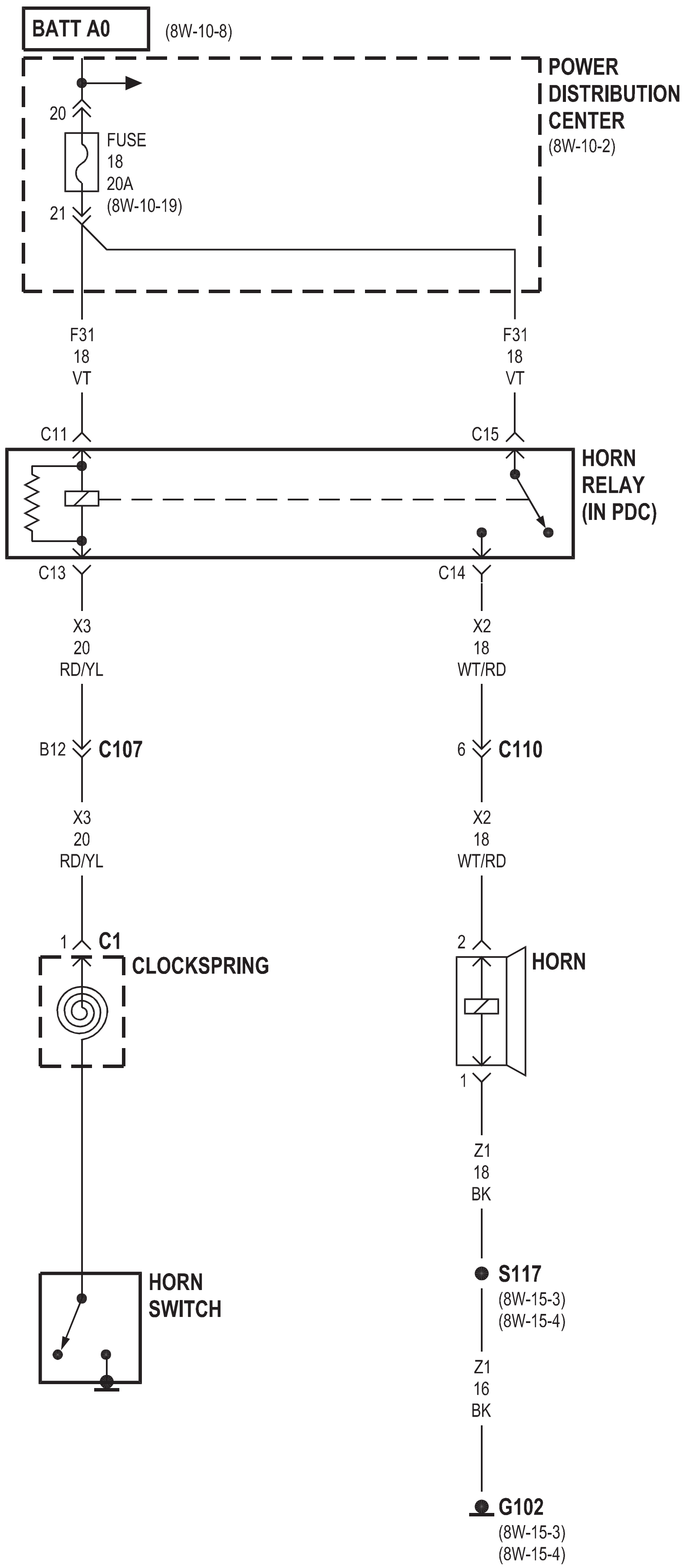
TJ404008


RUN F20
(8W-11-6)
REAR WINDOW DEFOGGER RELAY (IN PDC HARD TOP)
(8W-48-2)
C2
C81
20
LB/WT
2
C170
C81
20
LB/WT
TO
S206
(8W-44-5)
E2
20
OR
BATT M1
(8W-10-20)
7
C2
RUN-START G5
(8W-11-7)
6
C2
INSTRUMENT CLUSTER
FUSED B(+)
REAR WINDOW DEFOGGER RELAY CONTROL
FUSED IGNITION SWITCH OUTPUT (RUN-START)
PANEL LAMPS FEED
CLUSTER ILLUMINATION LAMPS
REAR WINDOW DEFOGGER SWITCH SENSE
FLASH PROGRAM ENABLE
GROUND
TRIP RESET
1
C2
10
C1
9
DATA LINK CONNECTOR
(8W-18-2)
C80
20
DB/WT
D23
20
WT/BR
2
REAR WINDOW DEFOGGER SWITCH SENSE
REAR WINDOW DEFOGGER SWITCH (HARD TOP)
(8W-48-3)


MULTI-
FUNCTION
SWITCH
HEADLAMP
(HIGH BEAM)
LEFT
TURN
SIGNAL
RIGHT
TURN
SIGNAL
17 C1
2 C1
6 C1
L3
14
RD/OR
L61
18
GY
L60
18
TN
A3 C107
EXCEPT
DRL
DRL
S105
(8W-50-3)
S353
(8W-52-4)
(8W-52-5)
1
HEADLAMP
(HIGH BEAM)
HIGH
BEAM
INDICATOR
DRIVER
DAYTIME
RUNNING
LAMP
MODULE
(EXCEPT
EXPORT)
(8W-50-11)
12 C170
A6
B5 C202
4
G34
14
RD/GY
EXCEPT
FOG
LAMPS
FOG
LAMPS
S155
(8W-50-9)
B9 C107
3 C110
TO
S141
(8W-50-4)
(8W-50-5)
(8W-52-4)
(8W-52-5)
12 C170
L3
16
RD/OR
G34
16
RD/GY
3 C1
1 C1
2 C1
INSTRUMENT
CLUSTER
BRAKE
WARNING
INDICATOR
DRIVER
HIGH
BEAM
INDICATOR
LEFT
TURN
SIGNAL
INDICATOR
RIGHT
TURN
SIGNAL
INDICATOR

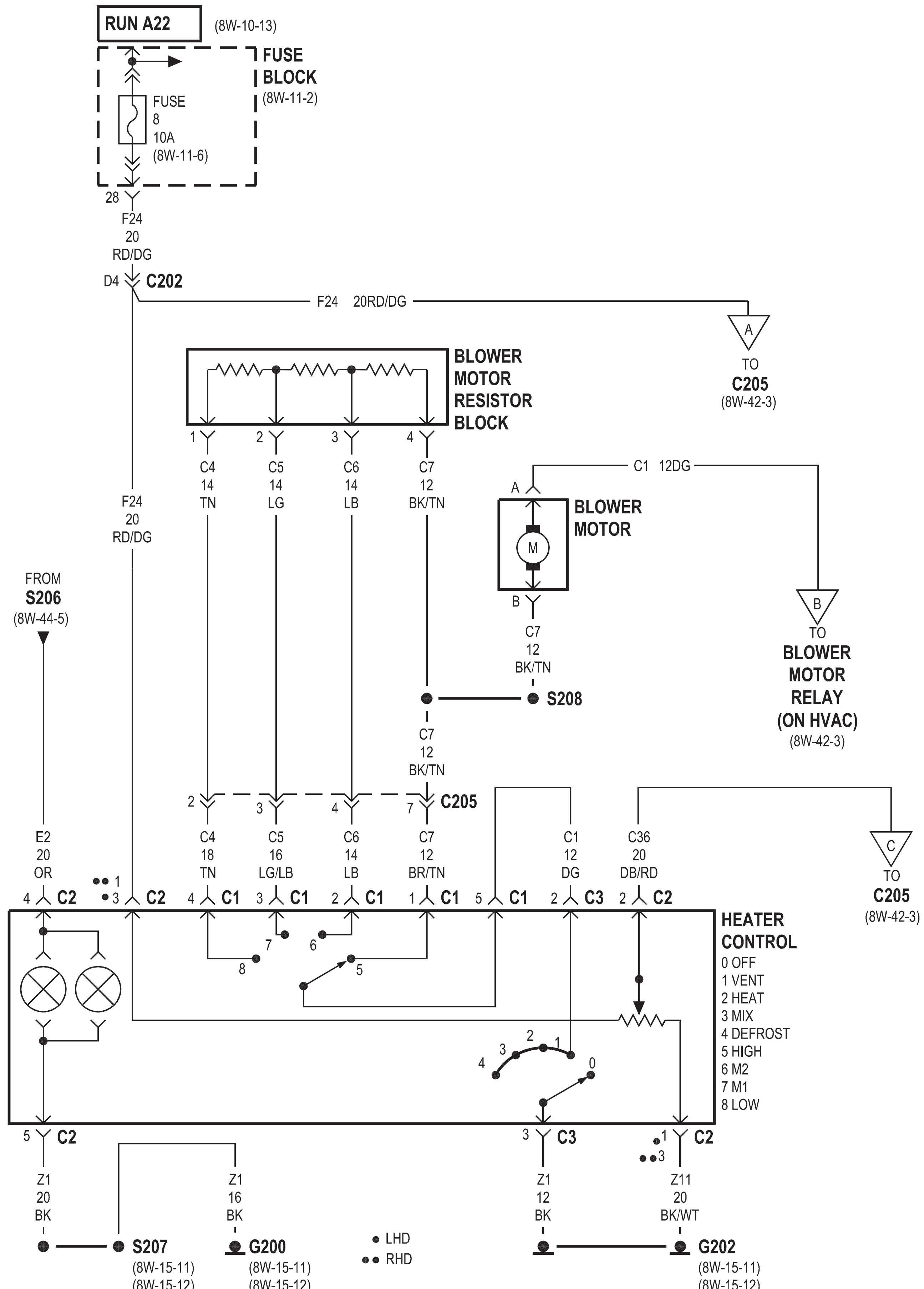
8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

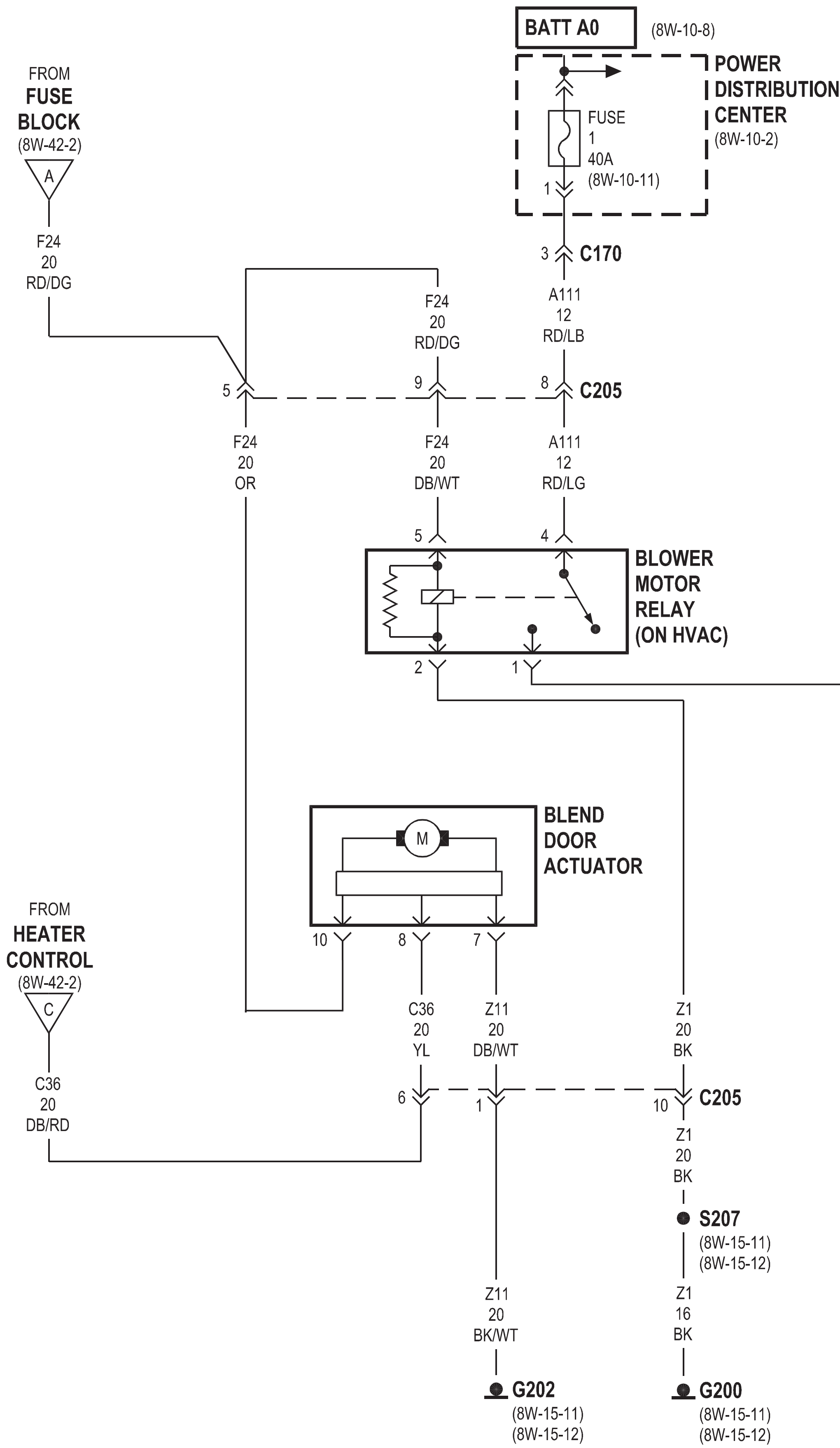

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
18
FUSE 17 20A
(8W-10-21)
19
FUSE 13 40A
(8W-10-15)
13
F70 16 PK/BK
F30 12 RD/PK
A6 C107
F30 12 RD/PK
4
IGNITION SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
(8W-10-15)
3
F22 12 WT/PK
11 C170
17
FUSE BLOCK
(8W-11-2)
FUSE 18 20A
(8W-11-10)
38
F70 16 PK/BK
F38 16 LB/WT
A8 C202
F38 16 LB/WT
1
POWER OUTLET
1
CIGAR LIGHTER/ POWER OUTLET
3
Z1 16 BKWT
3
Z1 16 BK/WT
S207
(8W-15-11)
(8W-15-12)
Z1 16 BK
G200
(8W-15-11)
(8W-15-12)

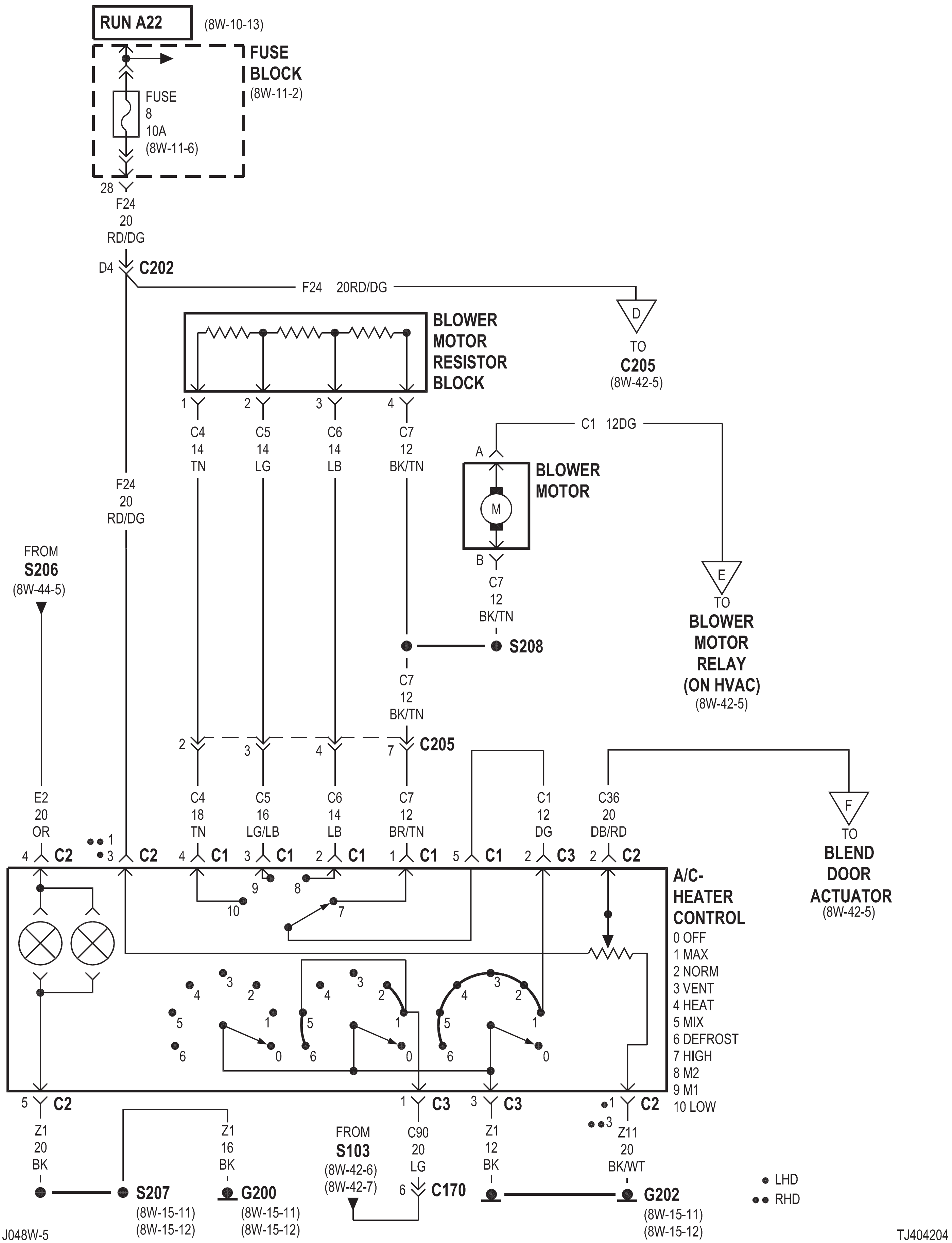

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
20
FUSE
18
20A
(8W-10-19)
21
F31
18
VT
F31
18
VT
C11
C15
HORN RELAY (IN PDC)
C13
C14
X3
20
RD/YL
X2
18
WT/RD
B12
C107
6
C110
X3
20
RD/YL
X2
18
WT/RD
1
C1
CLOCKSPRING
2
HORN
1
Z1
18
BK
S117
(8W-15-3)
(8W-15-4)
Z1
16
BK
G102
(8W-15-3)
(8W-15-4)
HORN SWITCH

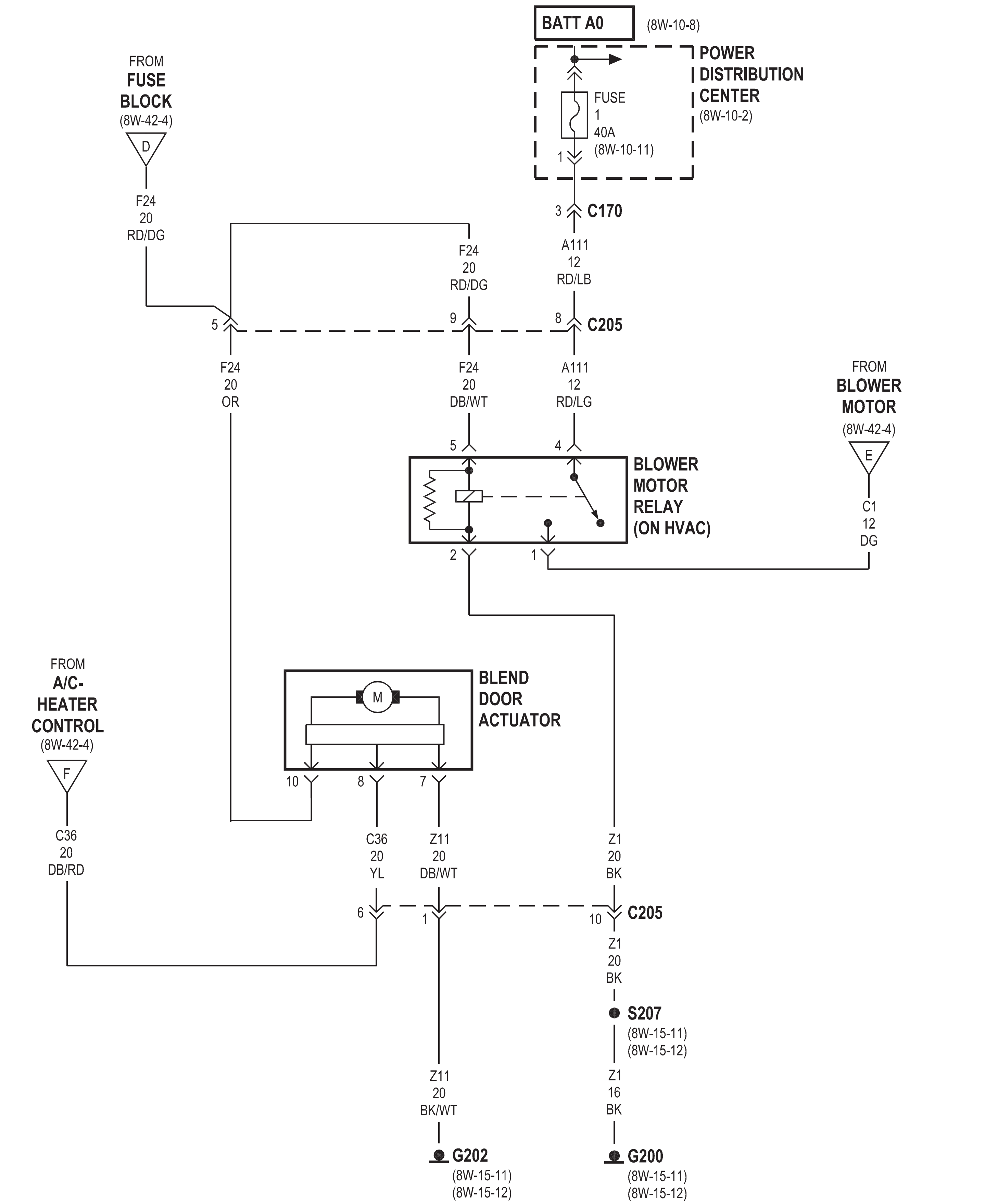
8W-42 AIR CONDITIONING-HEATER

HEATER ONLY

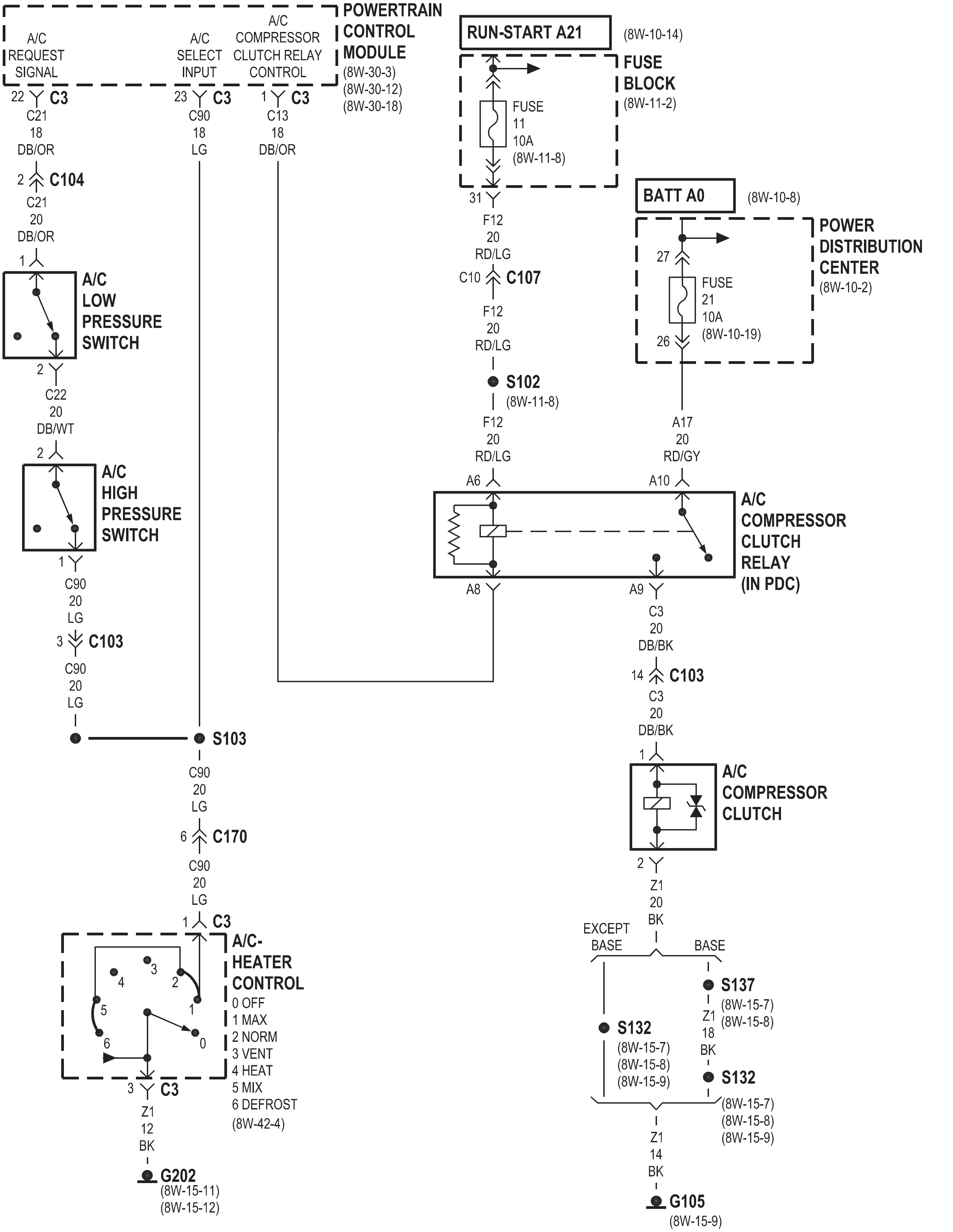

RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE
8
10A
(8W-11-6)
28
F24
20
RD/DG
D4
C202
F24 20RD/DG
A
TO
C205
(8W-42-3)
BLOWER MOTOR RESISTOR BLOCK
1
2
3
4
C4
14
TN
C5
14
LG
C6
14
LB
C7
12
BK/TN
C1 12DG
A
BLOWER MOTOR
M
B
C7
12
BK/TN
S208
B
TO
BLOWER MOTOR RELAY (ON HVAC)
(8W-42-3)
FROM
S206
(8W-44-5)
F24
20
RD/DG
C7
12
BK/TN
C205
7
E2
20
OR
C4
18
TN
C5
16
LG/LB
C6
14
LB
C7
12
BR/TN
C1
12
DG
C36
20
DB/RD
C
TO
C205
(8W-42-3)
4 C2
1
3 C2
4 C1
3 C1
2 C1
1 C1
5 C1
2 C3
2 C2
HEATER CONTROL
0 OFF
1 VENT
2 HEAT
3 MIX
4 DEFROST
5 HIGH
6 M2
7 M1
8 LOW
5 C2
3 C3
1 C2
3
Z1
20
BK
Z1
16
BK
Z1
12
BK
Z11
20
BK/WT
S207
(8W-15-11)
(8W-15-12)
G200
(8W-15-11)
(8W-15-12)
LHD
RHD
G202
(8W-15-11)
(8W-15-12)

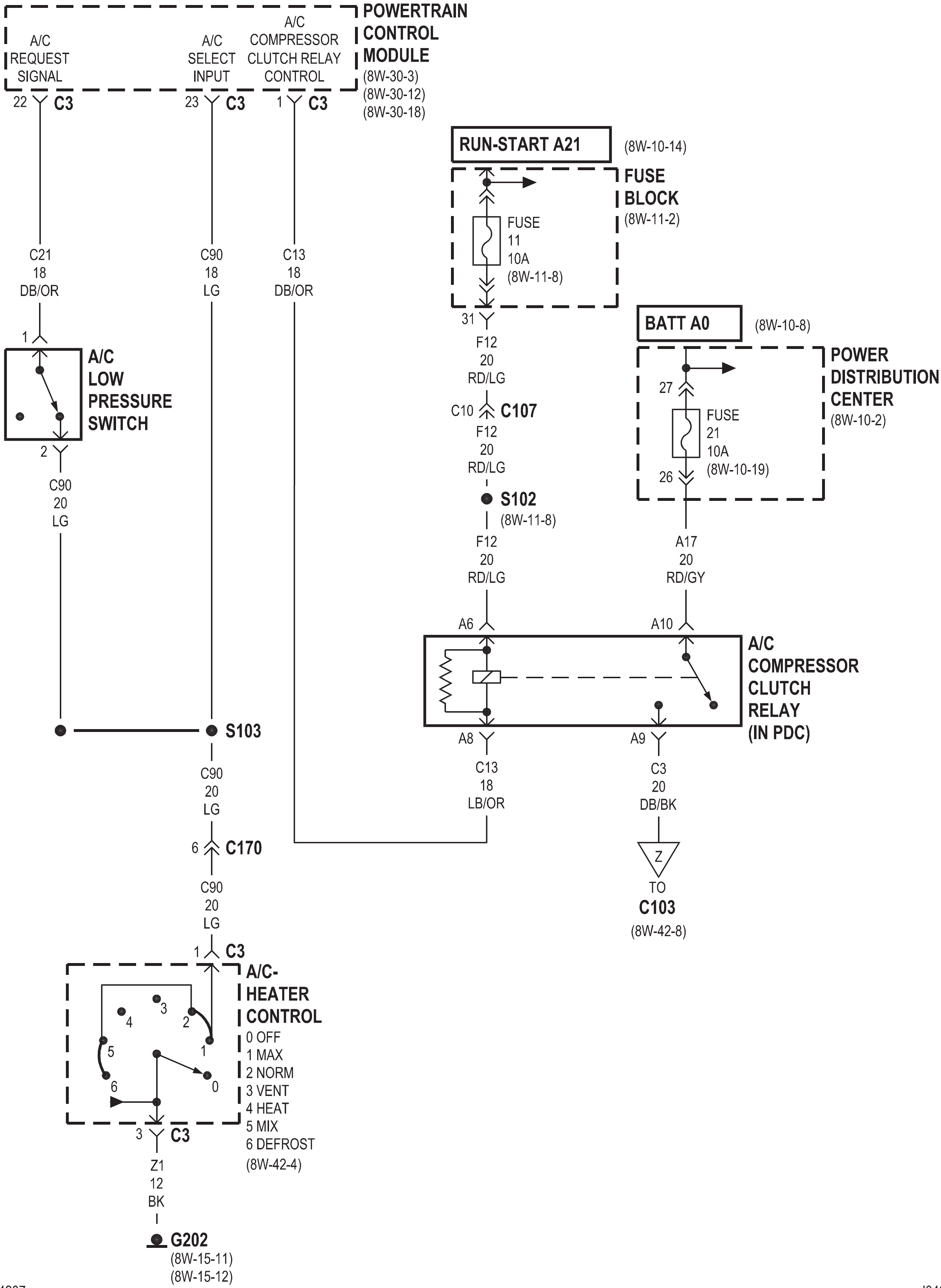

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
40A
(8W-10-11)
1
3
C170
A111
12
RD/LB
FROM
FUSE
BLOCK
(8W-42-2)
A
F24
20
RD/DG
F24
20
RD/DG
5
9
8
C205
F24
20
OR
F24
20
DB/WT
A111
12
RD/LG
FROM
BLOWER
MOTOR
(8W-42-2)
B
C1
12
DG
5
4
BLOWER
MOTOR
RELAY
(ON HVAC)
2
1
BLEND
DOOR
ACTUATOR
M
10
8
7
FROM
HEATER
CONTROL
(8W-42-2)
C
C36
20
YL
Z11
20
DB/WT
Z1
20
BK
C36
20
DB/RD
6
1
10
C205
Z1
20
BK
S207
(8W-15-11)
(8W-15-12)
Z11
20
BK/WT
Z1
16
BK
G202
(8W-15-11)
(8W-15-12)
G200
(8W-15-11)
(8W-15-12)

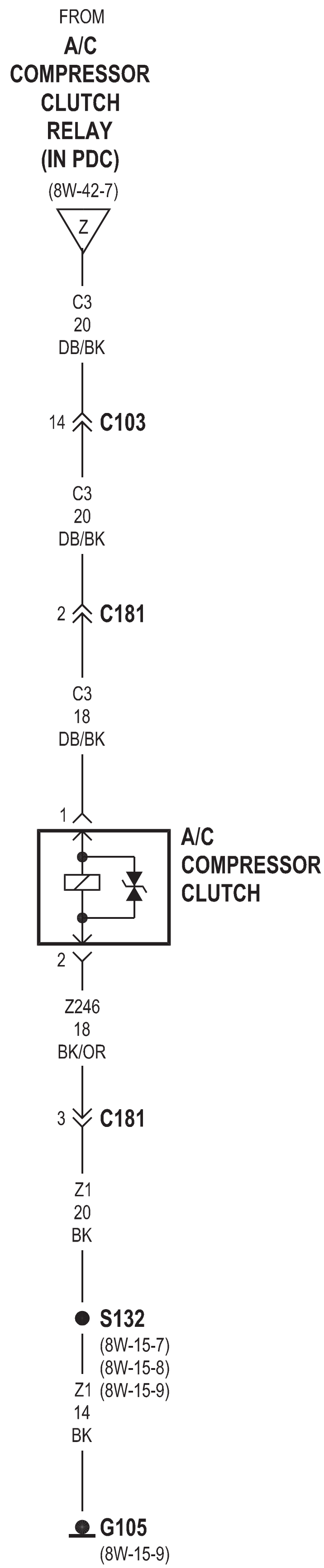

RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 8 10A (8W-11-6)
28
F24 20 RD/DG
D4 C202
F24 20RD/DG
D
TO C205 (8W-42-5)
BLOWER MOTOR RESISTOR BLOCK
1 2 3 4
C4 14 TN
C5 14 LG
C6 14 LB
C7 12 BK/TN
C1 12DG
A
BLOWER MOTOR
M
B
C7 12 BK/TN
S208
E
TO BLOWER MOTOR RELAY (ON HVAC) (8W-42-5)
F24 20 RD/DG
FROM S206 (8W-44-5)
C7 12 BK/TN
2 3 4 7 C205
E2 20 OR
C4 18 TN
C5 16 LG/LB
C6 14 LB
C7 12 BR/TN
C1 12 DG
C36 20 DB/RD
F
TO BLEND DOOR ACTUATOR (8W-42-5)
4 C2
1
3 C2
4 C1
3 C1
2 C1
1 C1
5 C1
2 C3
2 C2
A/C-HEATER CONTROL
0 OFF
1 MAX
2 NORM
3 VENT
4 HEAT
5 MIX
6 DEFROST
7 HIGH
8 M2
9 M1
10 LOW
9 8 10 7
3 4 2 5 1 6 0
3 4 2 5 1 6 0
3 4 2 5 1 6 0
5 C2
1 C3
3 C3
1
3 C2
Z1 20 BK
Z1 16 BK
S207 (8W-15-11) (8W-15-12)
G200 (8W-15-11) (8W-15-12)
FROM S103 (8W-42-6) (8W-42-7)
C90 20 LG
6 C170
Z1 12 BK
Z11 20 BK/WT
G202 (8W-15-11) (8W-15-12)
LHD
RHD

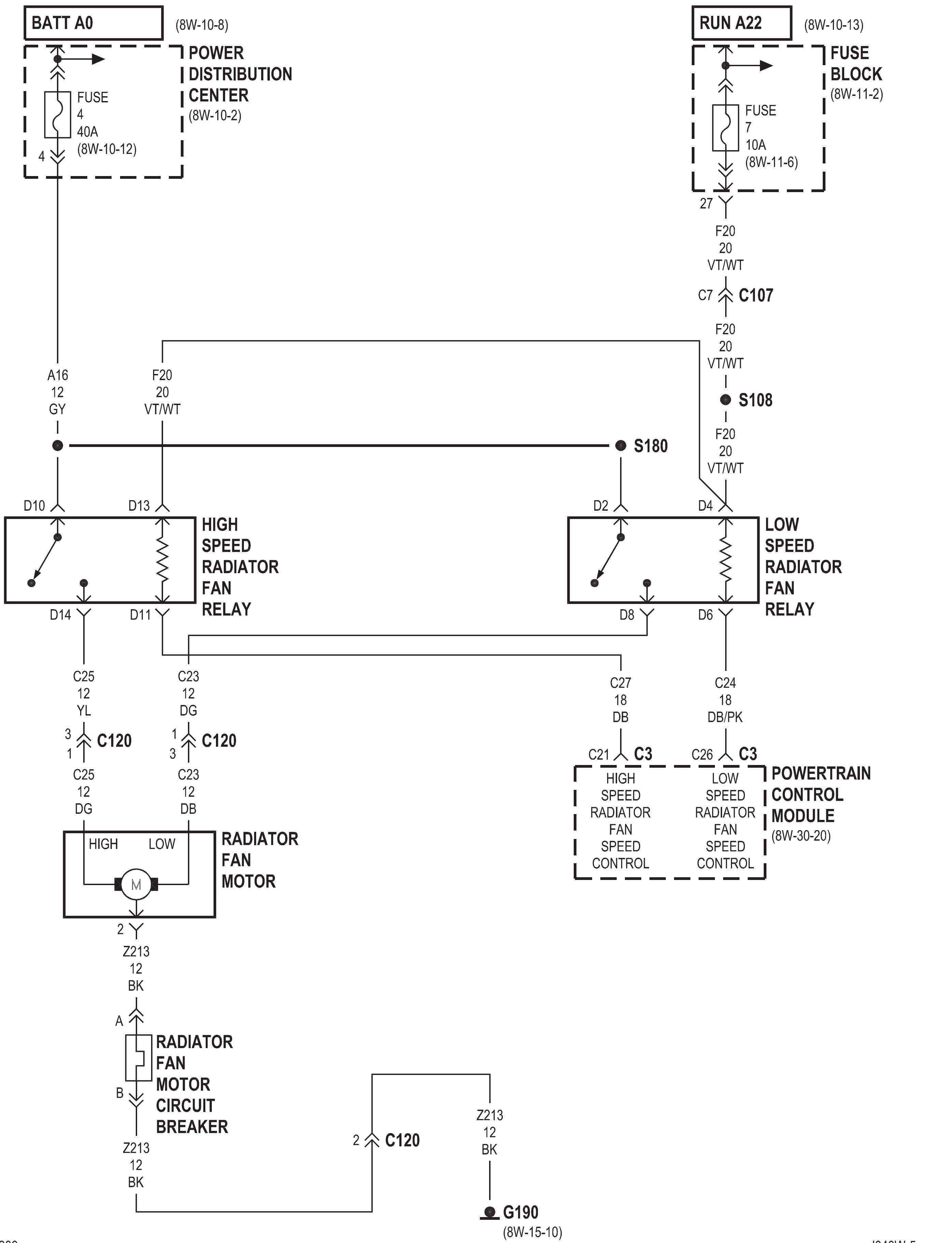

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
40A
(8W-10-11)
1
3
C170
FROM
FUSE
BLOCK
(8W-42-4)
D
F24
20
RD/DG
F24
20
RD/DG
A111
12
RD/LB
5
9
8
C205
F24
20
OR
F24
20
DB/WT
A111
12
RD/LG
FROM
BLOWER
MOTOR
(8W-42-4)
E
5
4
BLOWER
MOTOR
RELAY
(ON HVAC)
C1
12
DG
2
1
FROM
A/C-
HEATER
CONTROL
(8W-42-4)
F
BLEND
DOOR
ACTUATOR
M
10
8
7
C36
20
DB/RD
C36
20
YL
Z11
20
DB/WT
Z1
20
BK
6
1
10
C205
Z1
20
BK
S207
(8W-15-11)
(8W-15-12)
Z11
20
BK/WT
Z1
16
BK
G202
(8W-15-11)
(8W-15-12)
G200
(8W-15-11)
(8W-15-12)

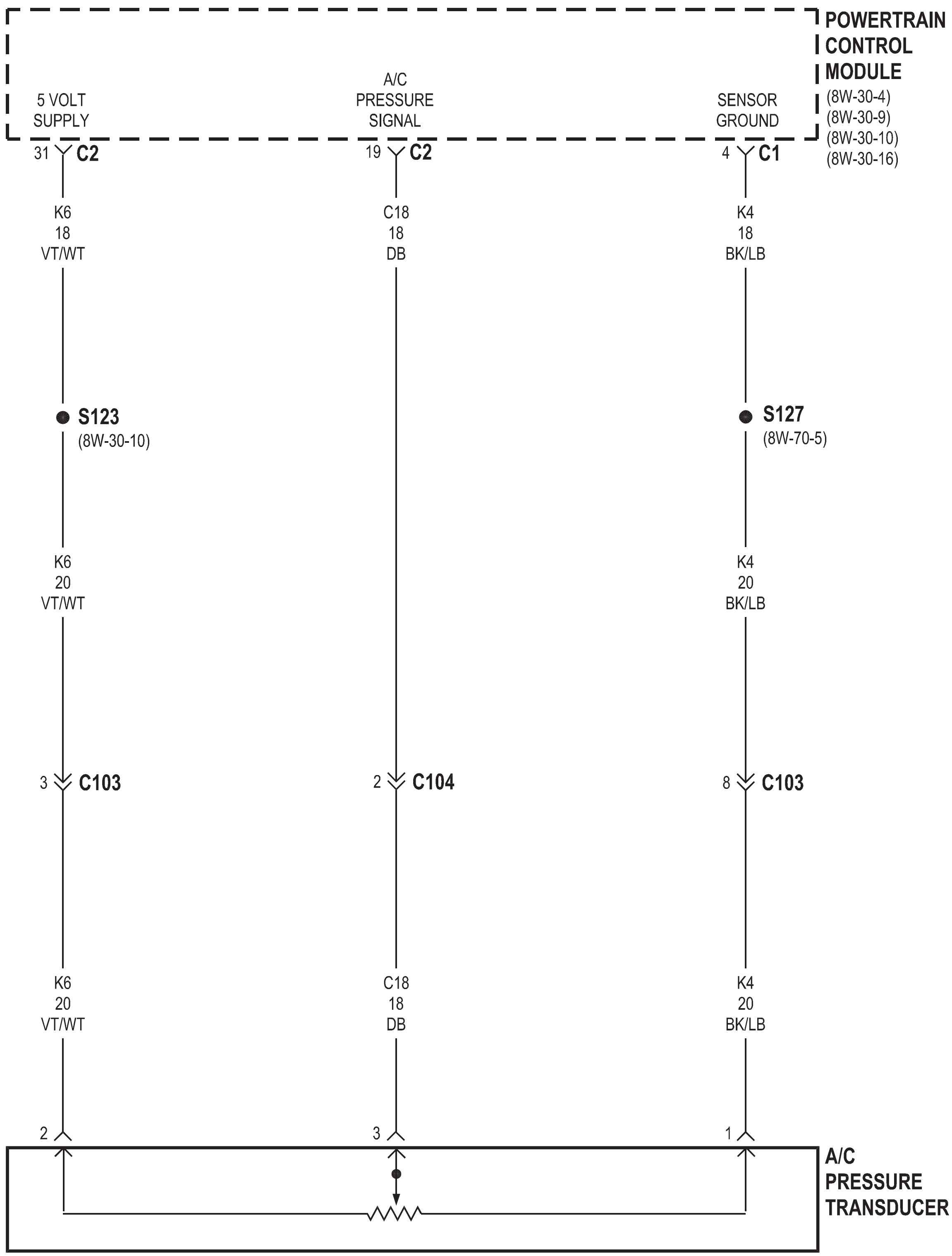
4.0L


POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-12)
(8W-30-18)
A/C REQUEST SIGNAL
A/C SELECT INPUT
A/C COMPRESSOR CLUTCH RELAY CONTROL
22 C3
23 C3
1 C3
C21 18 DB/OR
C90 18 LG
C13 18 DB/OR
2 C104
C21 20 DB/OR
A/C LOW PRESSURE SWITCH
C22 20 DB/WT
A/C HIGH PRESSURE SWITCH
C90 20 LG
3 C103
S103
6 C170
A/C-HEATER CONTROL
0 OFF
1 MAX
2 NORM
3 VENT
4 HEAT
5 MIX
6 DEFROST
(8W-42-4)
Z1 12 BK
G202
(8W-15-11)
(8W-15-12)
RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 11 10A
(8W-11-8)
31
F12 20 RD/LG
C10 C107
S102
(8W-11-8)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
27
FUSE 21 10A
(8W-10-19)
26
A17 20 RD/GY
A6
A10
A8
A9
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
C3 20 DB/BK
14 C103
A/C COMPRESSOR CLUTCH
Z1 20 BK
EXCEPT BASE
BASE
S137
(8W-15-7)
(8W-15-8)
Z1 18 BK
S132
(8W-15-9)
Z1 14 BK
G105
(8W-15-9)

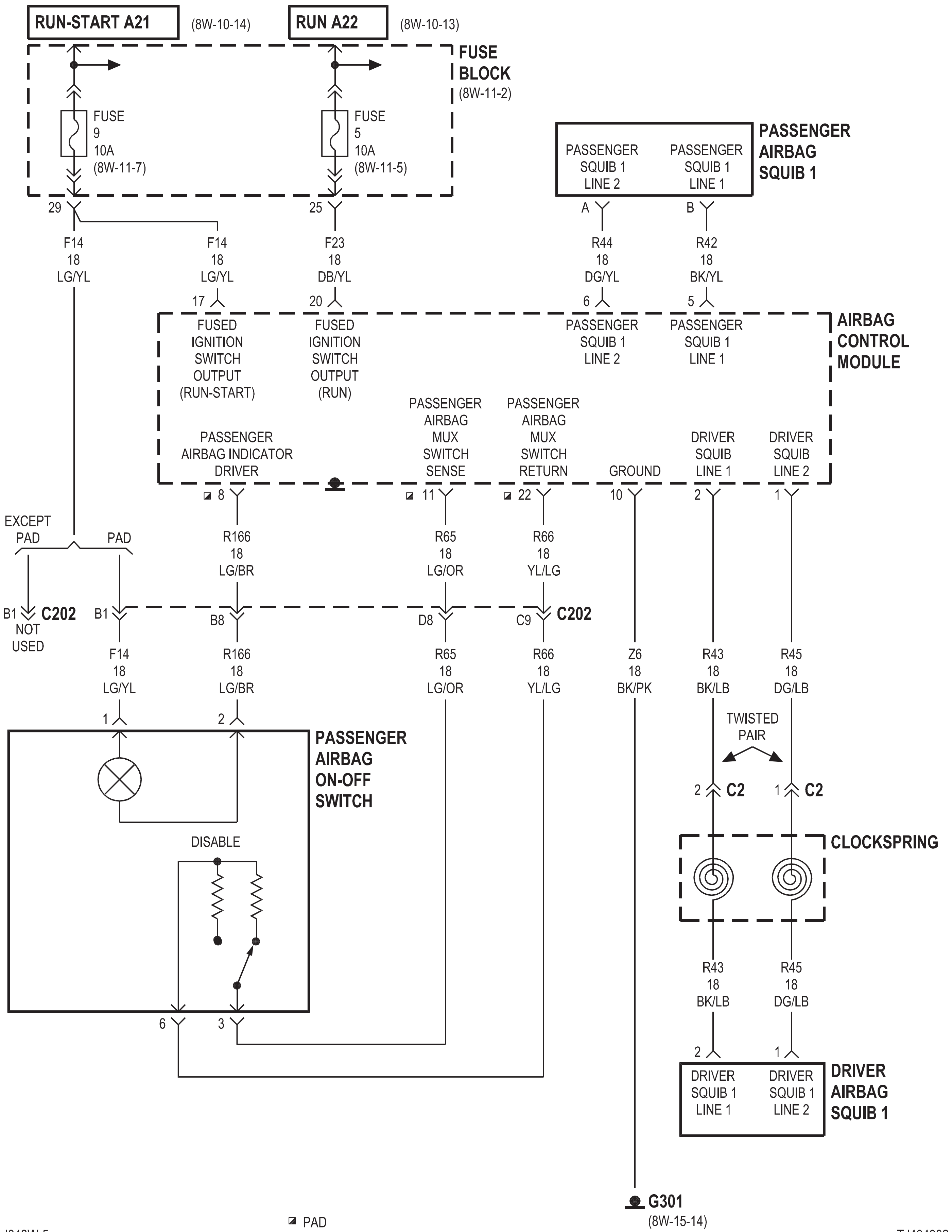

POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-12)
(8W-30-18)
A/C REQUEST SIGNAL
A/C SELECT INPUT
A/C COMPRESSOR CLUTCH RELAY CONTROL
22 C3
23 C3
1 C3
C21 18 DB/OR
C90 18 LG
C13 18 DB/OR
RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE 11 10A (8W-11-8)
31
F12 20 RD/LG
C10 C107
S102
(8W-11-8)
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
27
FUSE 21 10A (8W-10-19)
26
A17 20 RD/GY
A/C LOW PRESSURE SWITCH
1
2
C90 20 LG
A6
A10
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
A8
A9
C13 18 LB/OR
C3 20 DB/BK
Z
TO C103
(8W-42-8)
S103
C90 20 LG
6 C170
1 C3
A/C-HEATER CONTROL
0 OFF
1 MAX
2 NORM
3 VENT
4 HEAT
5 MIX
6 DEFROST
(8W-42-4)
3 C3
Z1 12 BK
G202
(8W-15-11)
(8W-15-12)


FROM
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-42-7)
Z
C3
20
DB/BK
14
C103
C3
20
DB/BK
2
C181
C3
18
DB/BK
1
A/C
COMPRESSOR
CLUTCH
2
Z246
18
BK/OR
3
C181
Z1
20
BK
S132
(8W-15-7)
(8W-15-8)
(8W-15-9)
Z1
14
BK
G105
(8W-15-9)

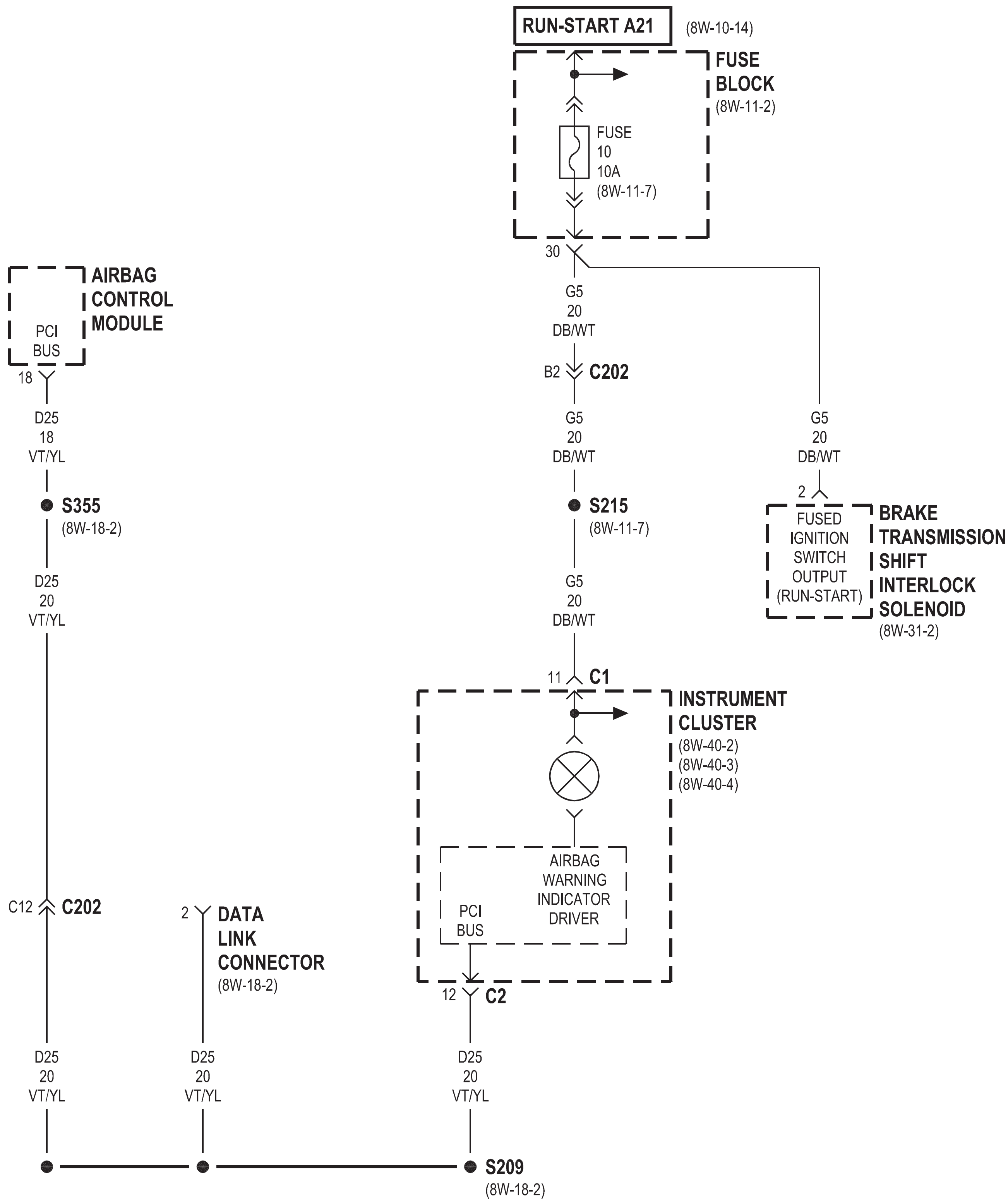

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 4 40A
(8W-10-12)
4
RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 7 10A
(8W-11-6)
27
F20 20 VT/WT
C7 C107
S108
A16 12 GY
S180
D10
D13
HIGH SPEED RADIATOR FAN RELAY
D14
D11
D2
D4
LOW SPEED RADIATOR FAN RELAY
D8
D6
C25 12 YL
C23 12 DG
3 1 C120
1 3 C120
C25 12 DG
C23 12 DB
C27 18 DB
C24 18 DB/PK
C21 C3
C26 C3
HIGH SPEED RADIATOR FAN SPEED CONTROL
LOW SPEED RADIATOR FAN SPEED CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-20)
HIGH
LOW
M
RADIATOR FAN MOTOR
2
Z213 12 BK
A
B
RADIATOR FAN MOTOR CIRCUIT BREAKER
2 C120
G190
(8W-15-10)


POWERTRAIN
CONTROL
MODULE
(8W-30-4)
(8W-30-9)
(8W-30-10)
(8W-30-16)
5 VOLT
SUPPLY
A/C
PRESSURE
SIGNAL
SENSOR
GROUND
31 C2
19 C2
4 C1
K6
18
VT/WT
C18
18
DB
K4
18
BK/LB
S123
(8W-30-10)
S127
(8W-70-5)
K6
20
VT/WT
K4
20
BK/LB
3 C103
2 C104
8 C103
K6
20
VT/WT
C18
18
DB
K4
20
BK/LB
2
3
1
A/C
PRESSURE
TRANSDUCER

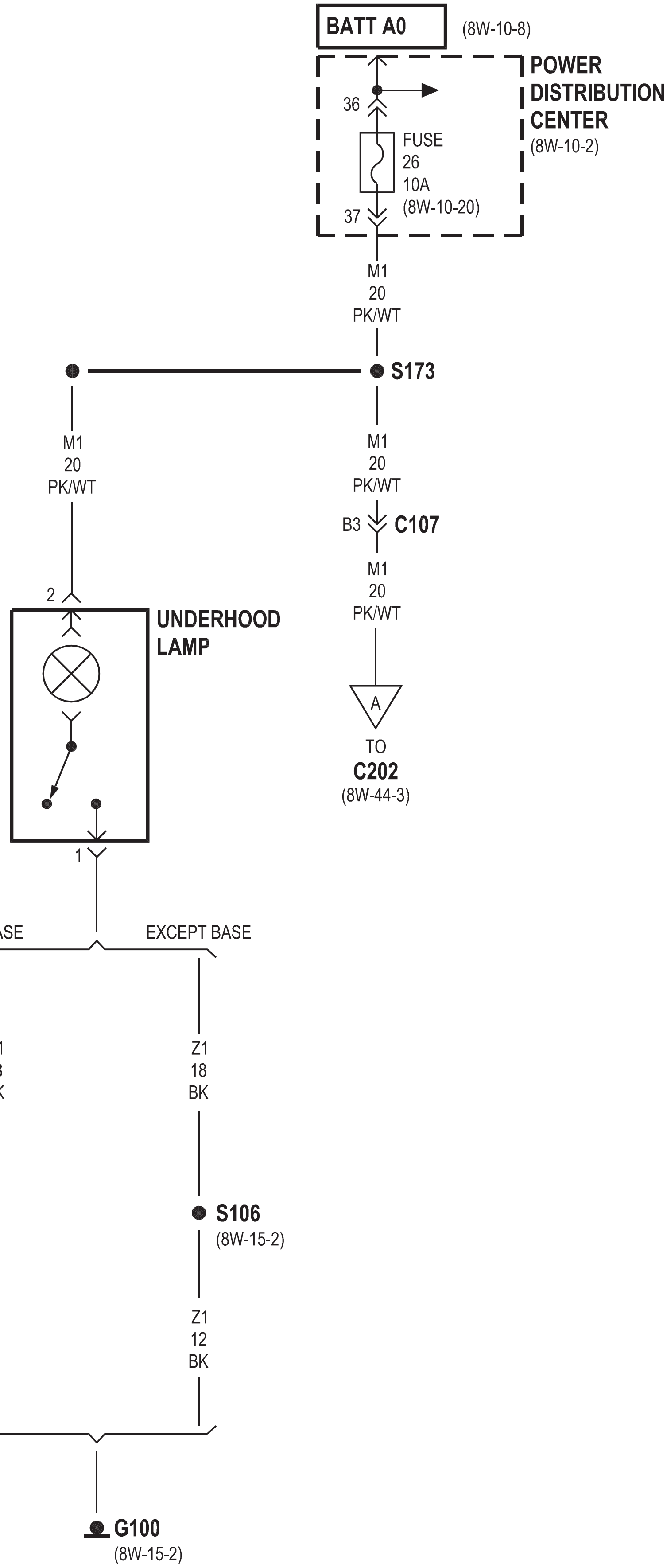
8W-43 AIRBAG SYSTEM

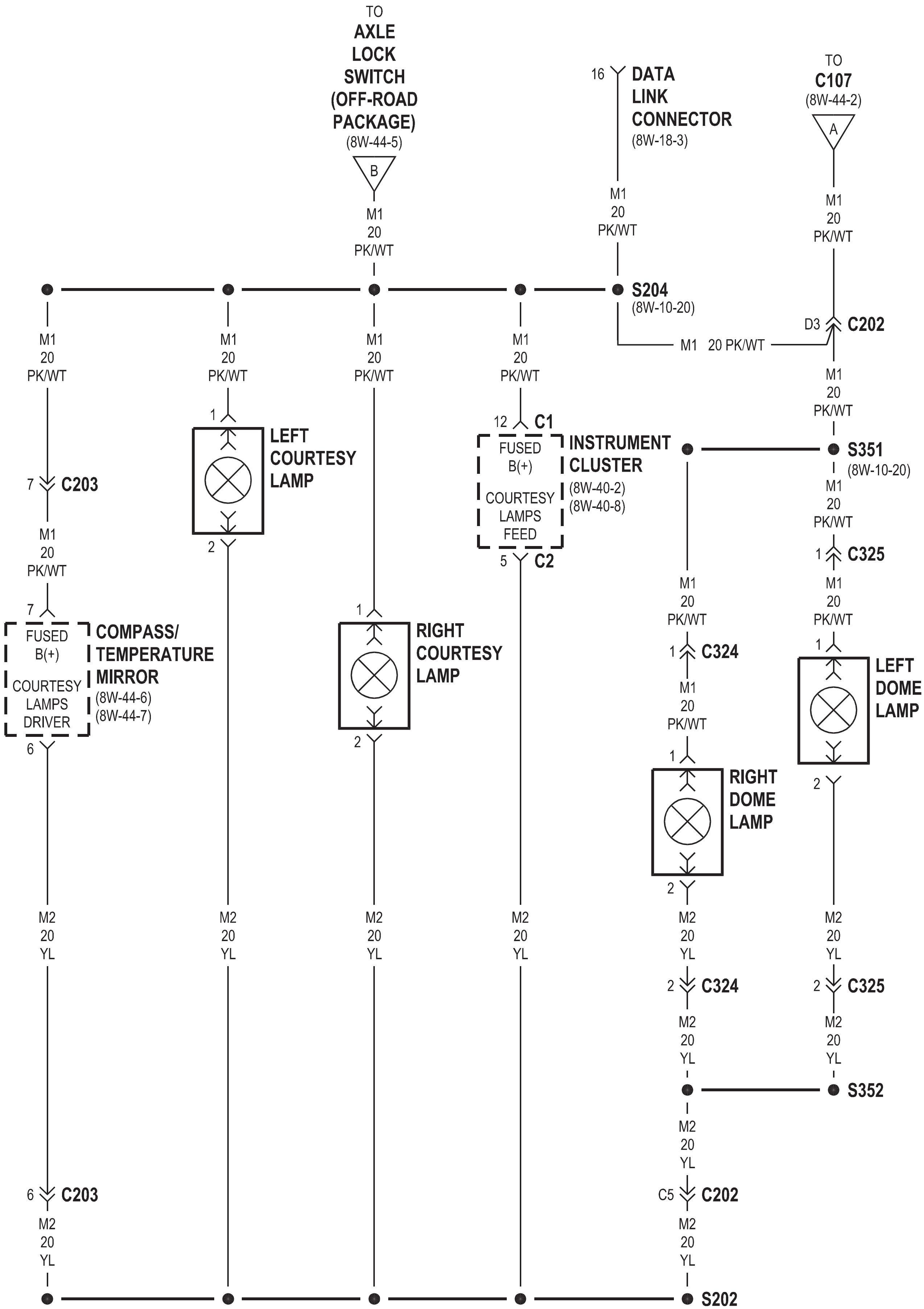


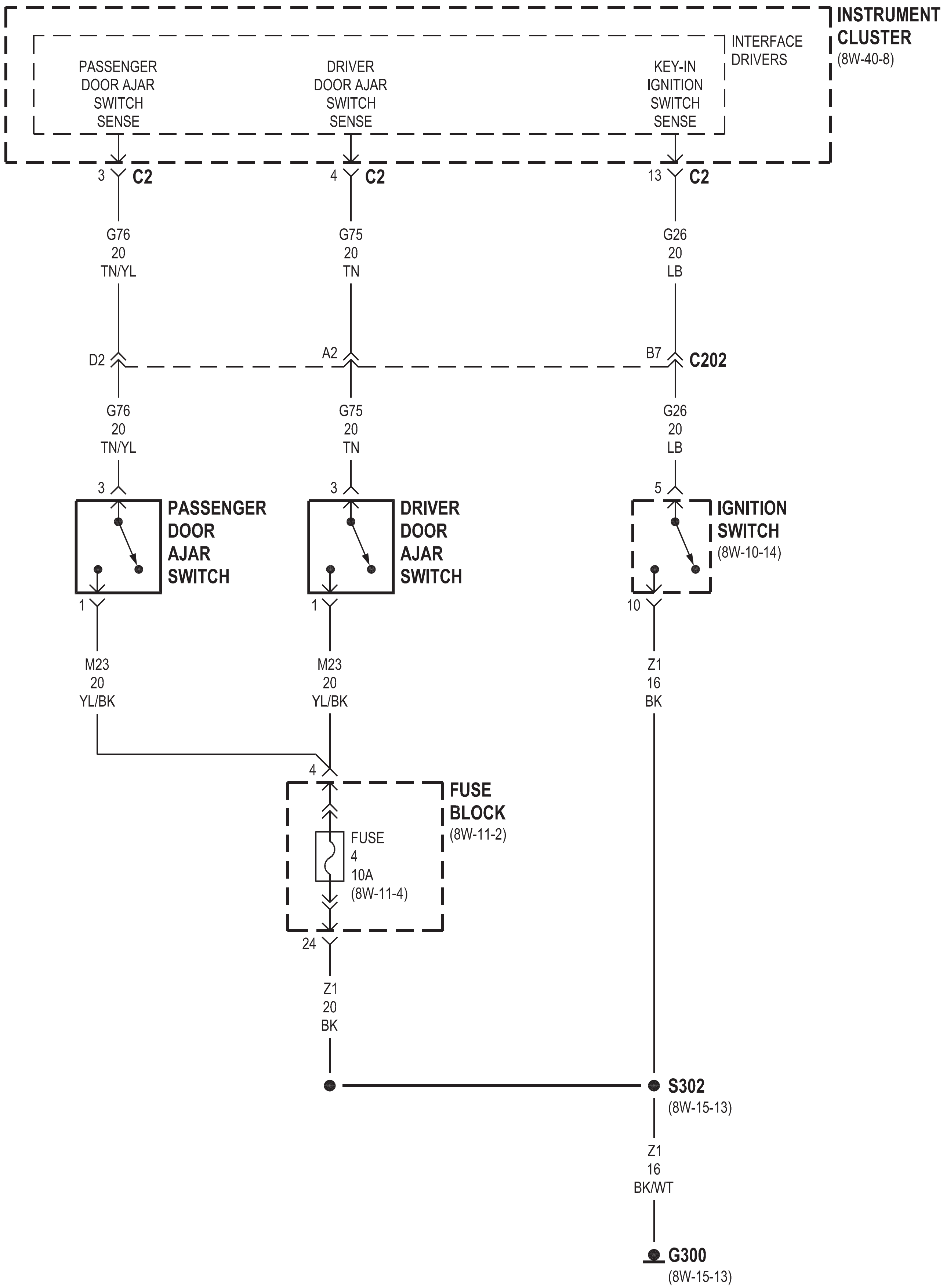
RUN-START A21
(8W-10-14)
RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 9 10A (8W-11-7)
FUSE 5 10A (8W-11-5)
29
25
F14 18 LG/YL
F14 18 LG/YL
F23 18 DB/YL
PASSENGER AIRBAG SQUIB 1
PASSENGER SQUIB 1 LINE 2
PASSENGER SQUIB 1 LINE 1
A
B
R44 18 DG/YL
R42 18 BK/YL
17
20
6
5
AIRBAG CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN)
PASSENGER SQUIB 1 LINE 2
PASSENGER SQUIB 1 LINE 1
PASSENGER AIRBAG INDICATOR DRIVER
PASSENGER AIRBAG MUX SWITCH SENSE
PASSENGER AIRBAG MUX SWITCH RETURN
GROUND
DRIVER SQUIB LINE 1
DRIVER SQUIB LINE 2
8
11
22
10
2
1
EXCEPT PAD
PAD
R166 18 LG/BR
R65 18 LG/OR
R66 18 YL/LG
B1
C202
B1
B8
D8
C9
C202
NOT USED
F14 18 LG/YL
R166 18 LG/BR
R65 18 LG/OR
R66 18 YL/LG
Z6 18 BK/PK
R43 18 BK/LB
R45 18 DG/LB
1
2
PASSENGER AIRBAG ON-OFF SWITCH
DISABLE
6
3
TWISTED PAIR
2
C2
1
C2
CLOCKSPRING
R43 18 BK/LB
R45 18 DG/LB
2
1
DRIVER AIRBAG SQUIB 1
DRIVER SQUIB 1 LINE 1
DRIVER SQUIB 1 LINE 2
G301
(8W-15-14)
PAD

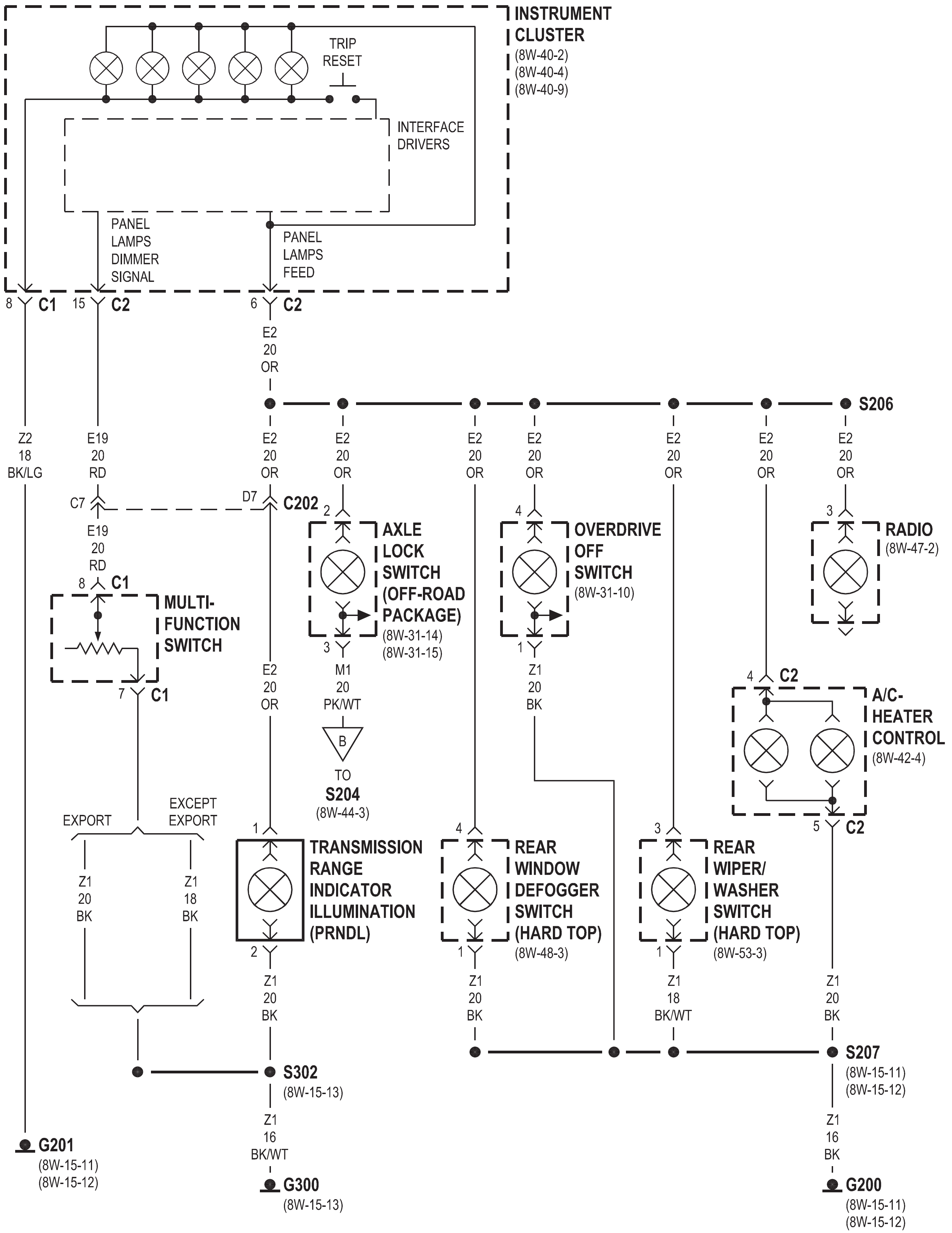

RUN-START A21
(8W-10-14)
FUSE
BLOCK
(8W-11-2)
FUSE
10
10A
(8W-11-7)
30
G5
20
DB/WT
B2
C202
G5
20
DB/WT
S215
(8W-11-7)
G5
20
DB/WT
G5
20
DB/WT
2
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
BRAKE
TRANSMISSION
SHIFT
INTERLOCK
SOLENOID
(8W-31-2)
11
C1
INSTRUMENT
CLUSTER
(8W-40-2)
(8W-40-3)
(8W-40-4)
AIRBAG
WARNING
INDICATOR
DRIVER
PCI
BUS
12
C2
AIRBAG
CONTROL
MODULE
PCI
BUS
18
D25
18
VT/YL
S355
(8W-18-2)
D25
20
VT/YL
C12
C202
2
DATA
LINK
CONNECTOR
(8W-18-2)
D25
20
VT/YL
D25
20
VT/YL
D25
20
VT/YL
S209
(8W-18-2)

8W-44 INTERIOR LIGHTING

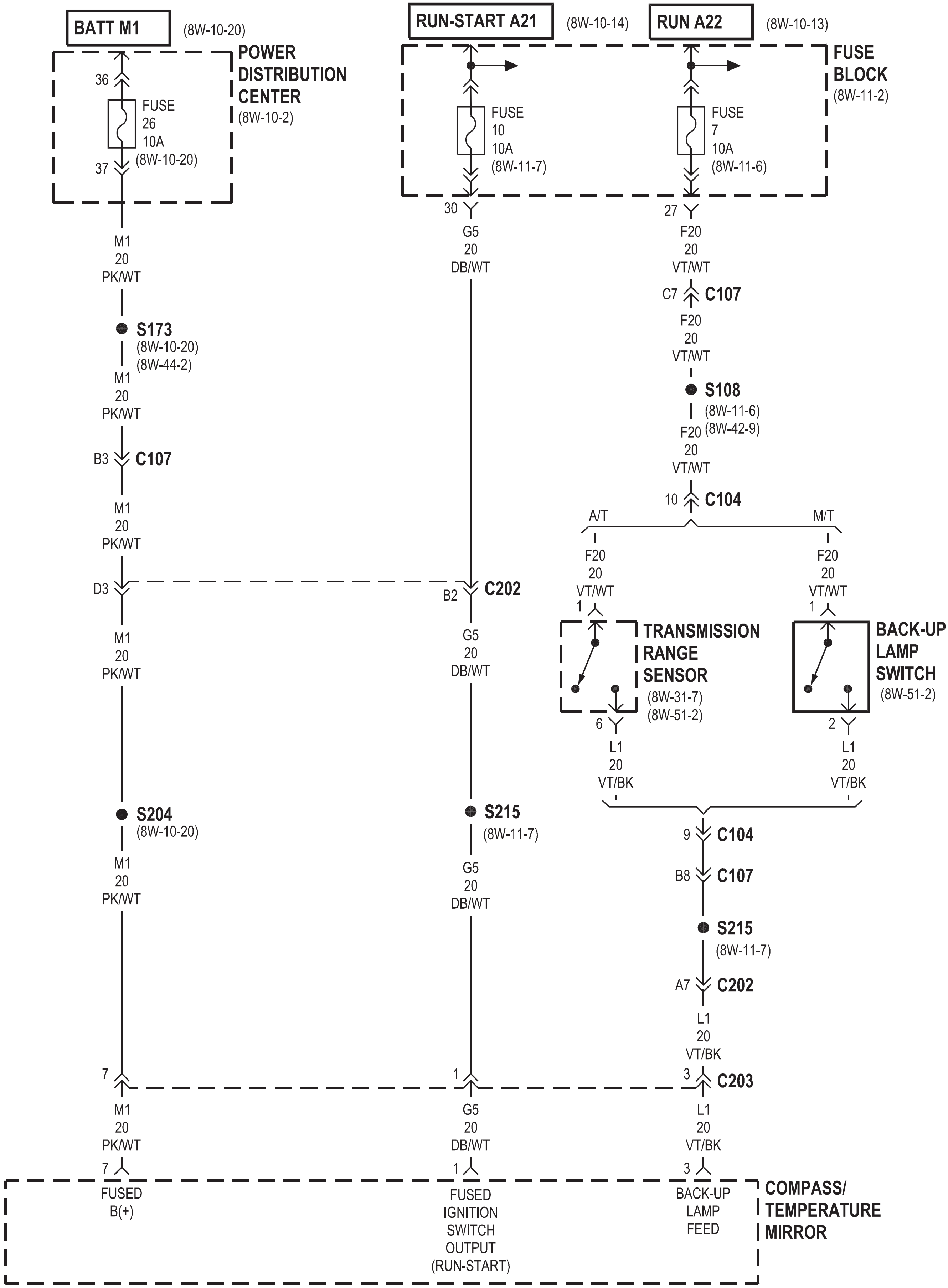

BATT A0
(8W-10-8)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
36
FUSE
26
10A
(8W-10-20)
37
M1
20
PK/WT
S173
M1
20
PK/WT
M1
20
PK/WT
B3
C107
M1
20
PK/WT
2
UNDERHOOD
LAMP
A
TO
C202
(8W-44-3)
1
BASE
EXCEPT BASE
Z1
18
BK
Z1
18
BK
S106
(8W-15-2)
Z1
12
BK
G100
(8W-15-2)


TO
AXLE
LOCK
SWITCH
(OFF-ROAD
PACKAGE)
(8W-44-5)
B
16
DATA
LINK
CONNECTOR
(8W-18-3)
TO
C107
(8W-44-2)
A
M1
20
PK/WT
S204
(8W-10-20)
D3
C202
M1 20 PK/WT
7
C203
1
LEFT
COURTESY
LAMP
2
12
C1
FUSED
B(+)
COURTESY
LAMPS
FEED
INSTRUMENT
CLUSTER
(8W-40-2)
(8W-40-8)
5
C2
S351
(8W-10-20)
1
C325
C324
FUSED
B(+)
COURTESY
LAMPS
DRIVER
COMPASS/
TEMPERATURE
MIRROR
(8W-44-6)
(8W-44-7)
6
RIGHT
COURTESY
LAMP
LEFT
DOME
LAMP
RIGHT
DOME
LAMP
M2
20
YL
S352
C5
S202


INSTRUMENT CLUSTER
(8W-40-8)
INTERFACE DRIVERS
PASSENGER DOOR AJAR SWITCH SENSE
DRIVER DOOR AJAR SWITCH SENSE
KEY-IN IGNITION SWITCH SENSE
3 C2
4 C2
13 C2
G76 20 TN/YL
G75 20 TN
G26 20 LB
D2
A2
B7
C202
G76 20 TN/YL
G75 20 TN
G26 20 LB
3
3
5
PASSENGER DOOR AJAR SWITCH
DRIVER DOOR AJAR SWITCH
IGNITION SWITCH
(8W-10-14)
1
1
10
M23 20 YL/BK
M23 20 YL/BK
Z1 16 BK
4
FUSE BLOCK
(8W-11-2)
FUSE 4 10A (8W-11-4)
24
Z1 20 BK
S302
(8W-15-13)
Z1 16 BK/WT
G300
(8W-15-13)

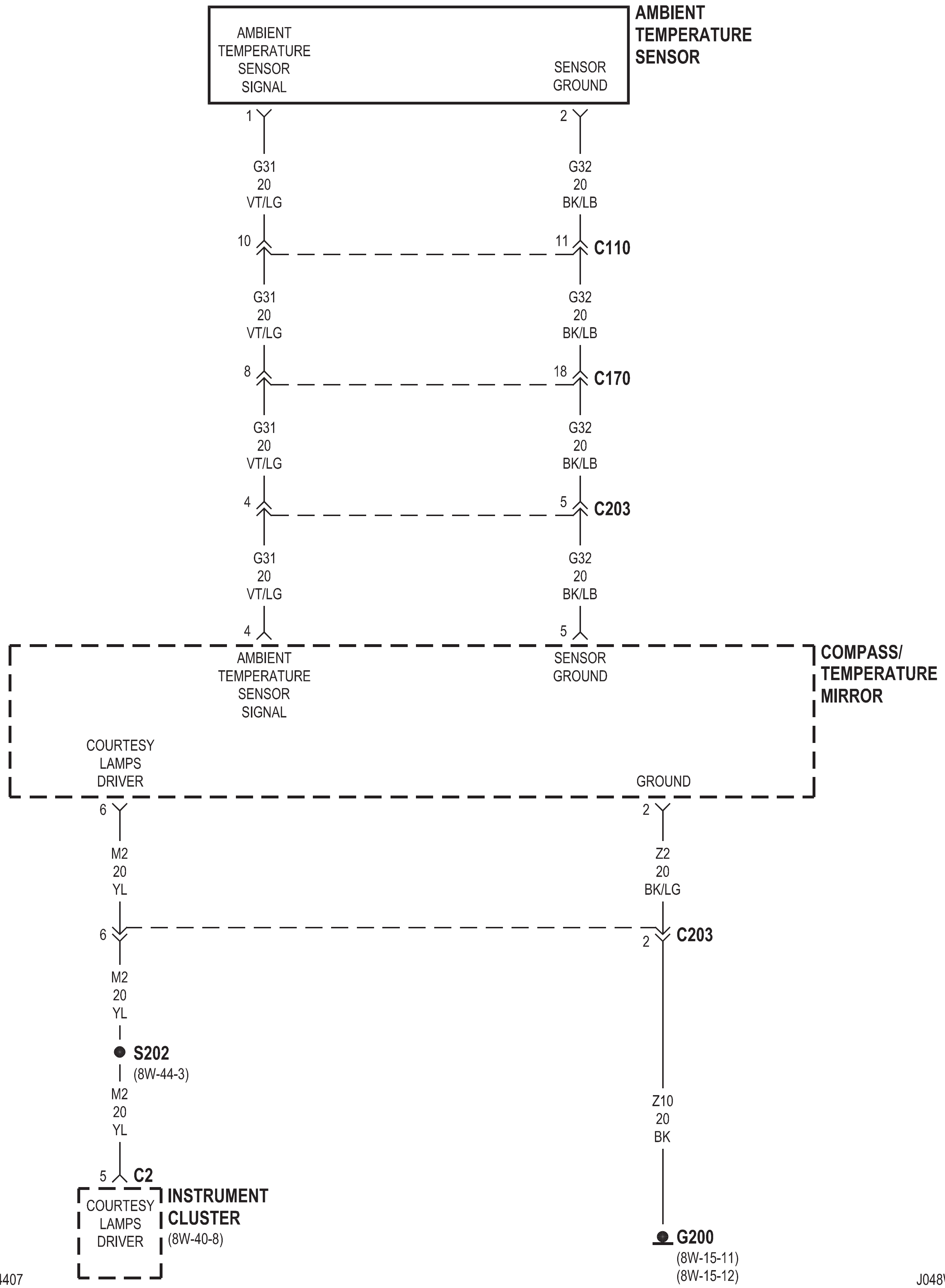


TJ404405 J048W-5

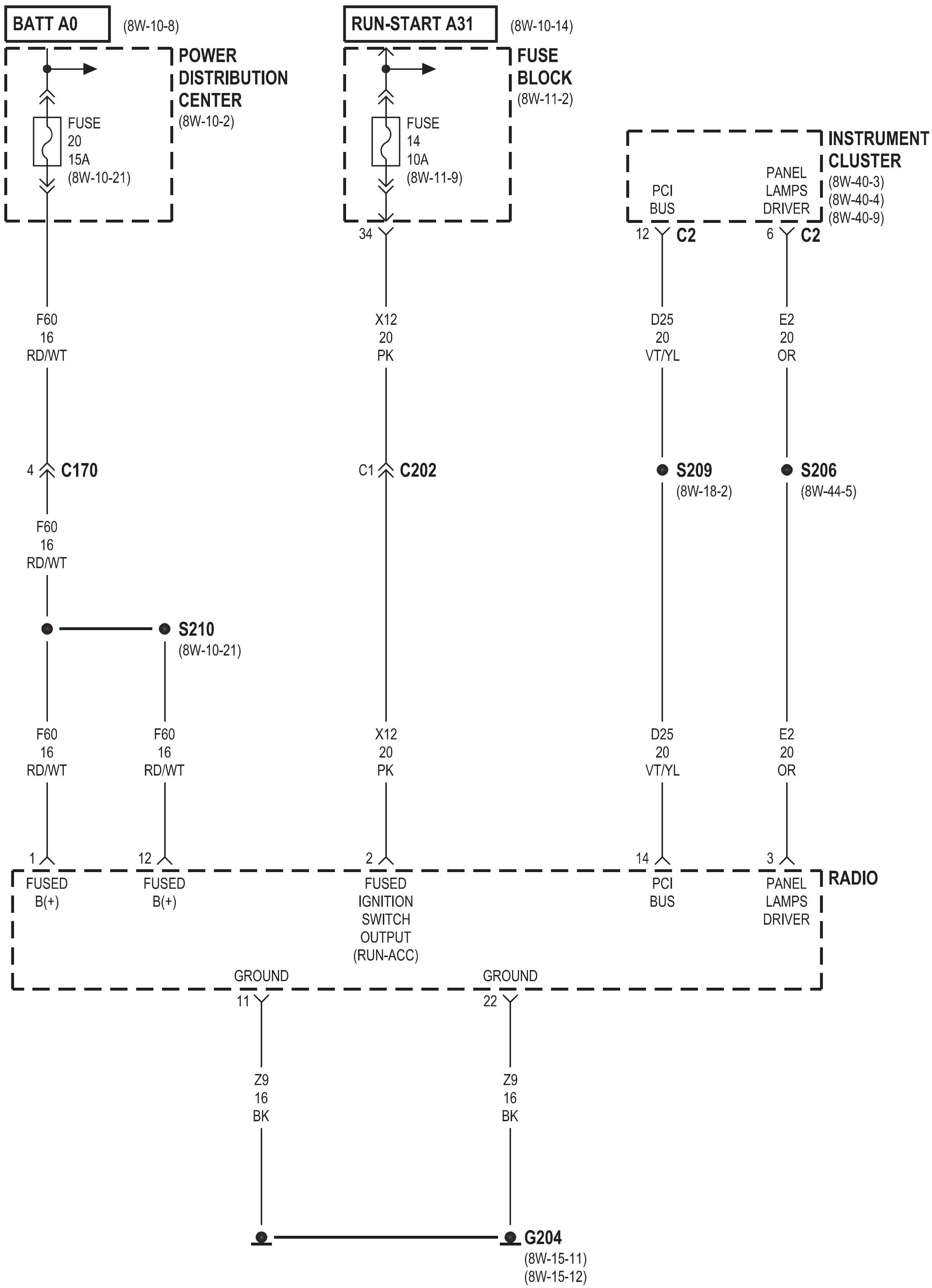


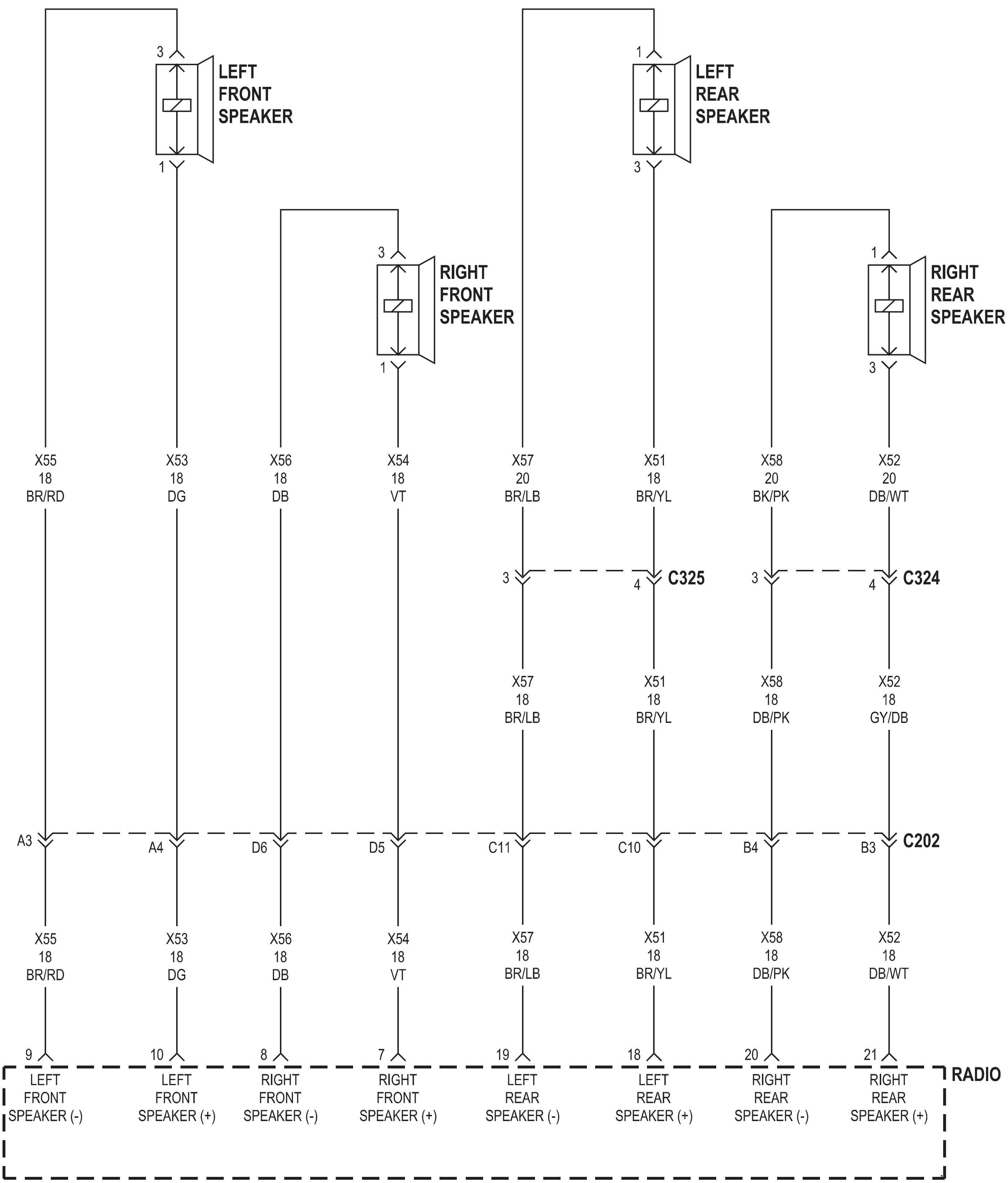
J048W-5

TJ404406

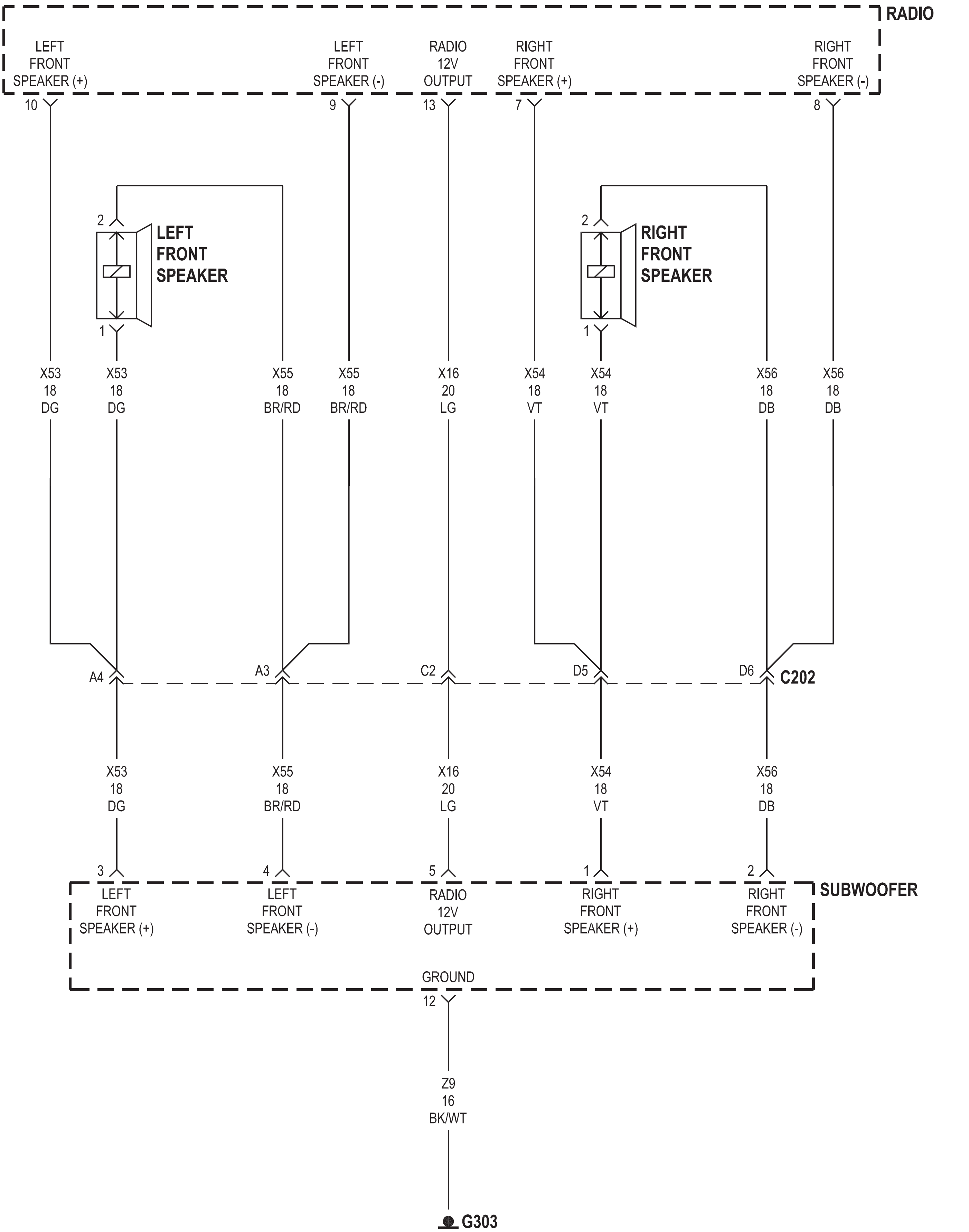

AMBIENT TEMPERATURE SENSOR
AMBIENT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
1
2
G31 20 VT/LG
G32 20 BK/LB
10
11
C110
G31 20 VT/LG
G32 20 BK/LB
8
18
C170
G31 20 VT/LG
G32 20 BK/LB
4
5
C203
G31 20 VT/LG
G32 20 BK/LB
4
5
COMPASS/ TEMPERATURE MIRROR
AMBIENT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
COURTESY LAMPS DRIVER
GROUND
6
2
M2 20 YL
Z2 20 BK/LG
6
2
C203
M2 20 YL
S202
(8W-44-3)
M2 20 YL
Z10 20 BK
5
C2
INSTRUMENT CLUSTER
(8W-40-8)
COURTESY LAMPS DRIVER
G200
(8W-15-11)
(8W-15-12)

8W-47 AUDIO SYSTEM


BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
20
15A
(8W-10-21)
RUN-START A31
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
14
10A
(8W-11-9)
INSTRUMENT CLUSTER
(8W-40-3)
(8W-40-4)
(8W-40-9)
PCI BUS
PANEL LAMPS DRIVER
34
12 C2
6 C2
F60
16
RD/WT
X12
20
PK
D25
20
VT/YL
E2
20
OR
4 C170
C1 C202
S209
(8W-18-2)
S206
(8W-44-5)
F60
16
RD/WT
S210
(8W-10-21)
F60
16
RD/WT
F60
16
RD/WT
X12
20
PK
D25
20
VT/YL
E2
20
OR
1
12
2
14
3
RADIO
FUSED B(+)
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
PCI BUS
PANEL LAMPS DRIVER
GROUND
GROUND
11
22
Z9
16
BK
Z9
16
BK
G204
(8W-15-11)
(8W-15-12)

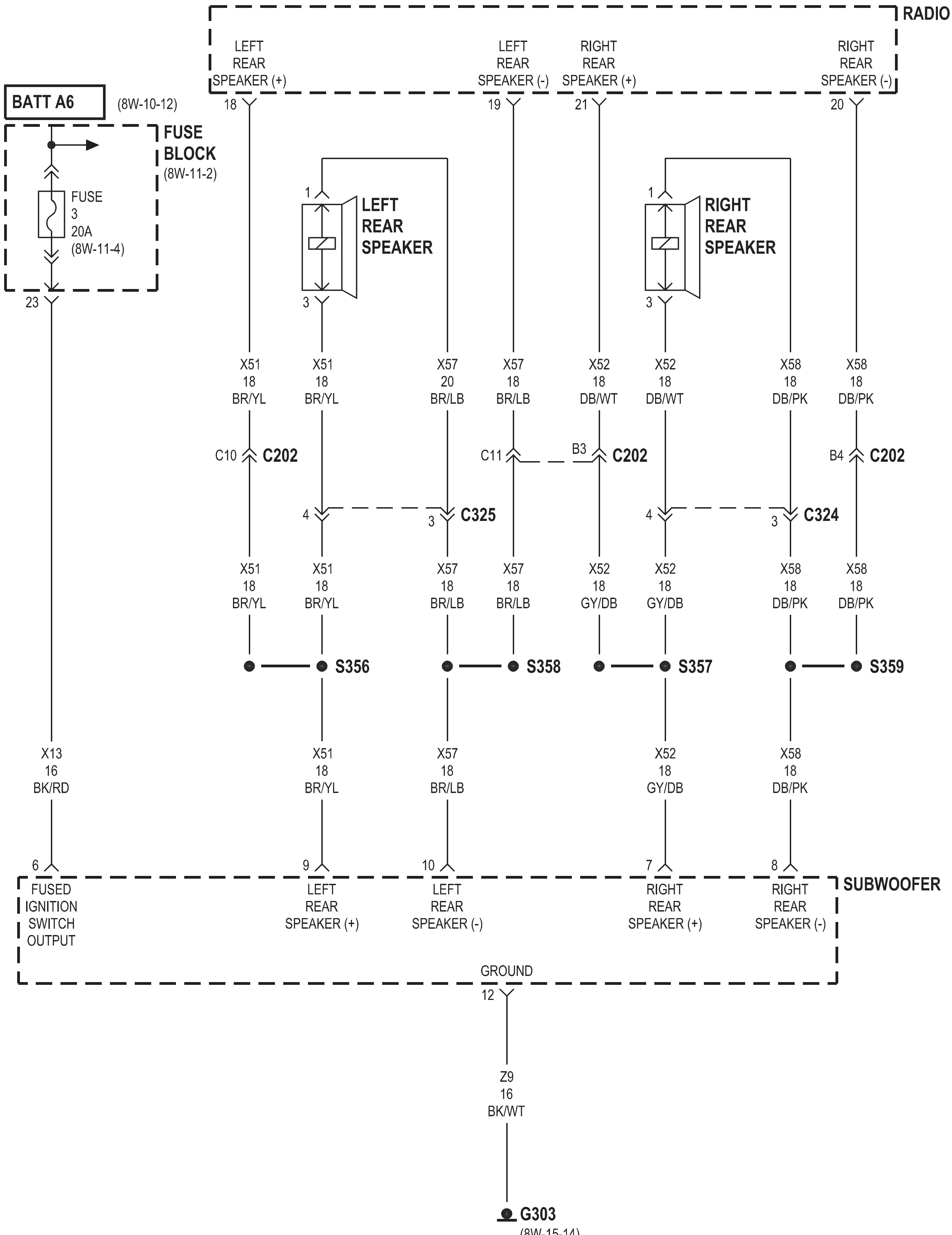

LEFT FRONT SPEAKER
RIGHT FRONT SPEAKER
LEFT REAR SPEAKER
RIGHT REAR SPEAKER
X55 18 BR/RD
X53 18 DG
X56 18 DB
X54 18 VT
X57 20 BR/LB
X51 18 BR/YL
X58 20 BK/PK
X52 20 DB/WT
C325
C324
X57 18 BR/LB
X51 18 BR/YL
X58 18 DB/PK
X52 18 GY/DB
A3 A4 D6 D5 C11 C10 B4 B3
C202
X55 18 BR/RD
X53 18 DG
X56 18 DB
X54 18 VT
X57 18 BR/LB
X51 18 BR/YL
X58 18 DB/PK
X52 18 DB/WT
RADIO
9 LEFT FRONT SPEAKER (-)
10 LEFT FRONT SPEAKER (+)
8 RIGHT FRONT SPEAKER (-)
7 RIGHT FRONT SPEAKER (+)
19 LEFT REAR SPEAKER (-)
18 LEFT REAR SPEAKER (+)
20 RIGHT REAR SPEAKER (-)
21 RIGHT REAR SPEAKER (+)

SUBWOOFER

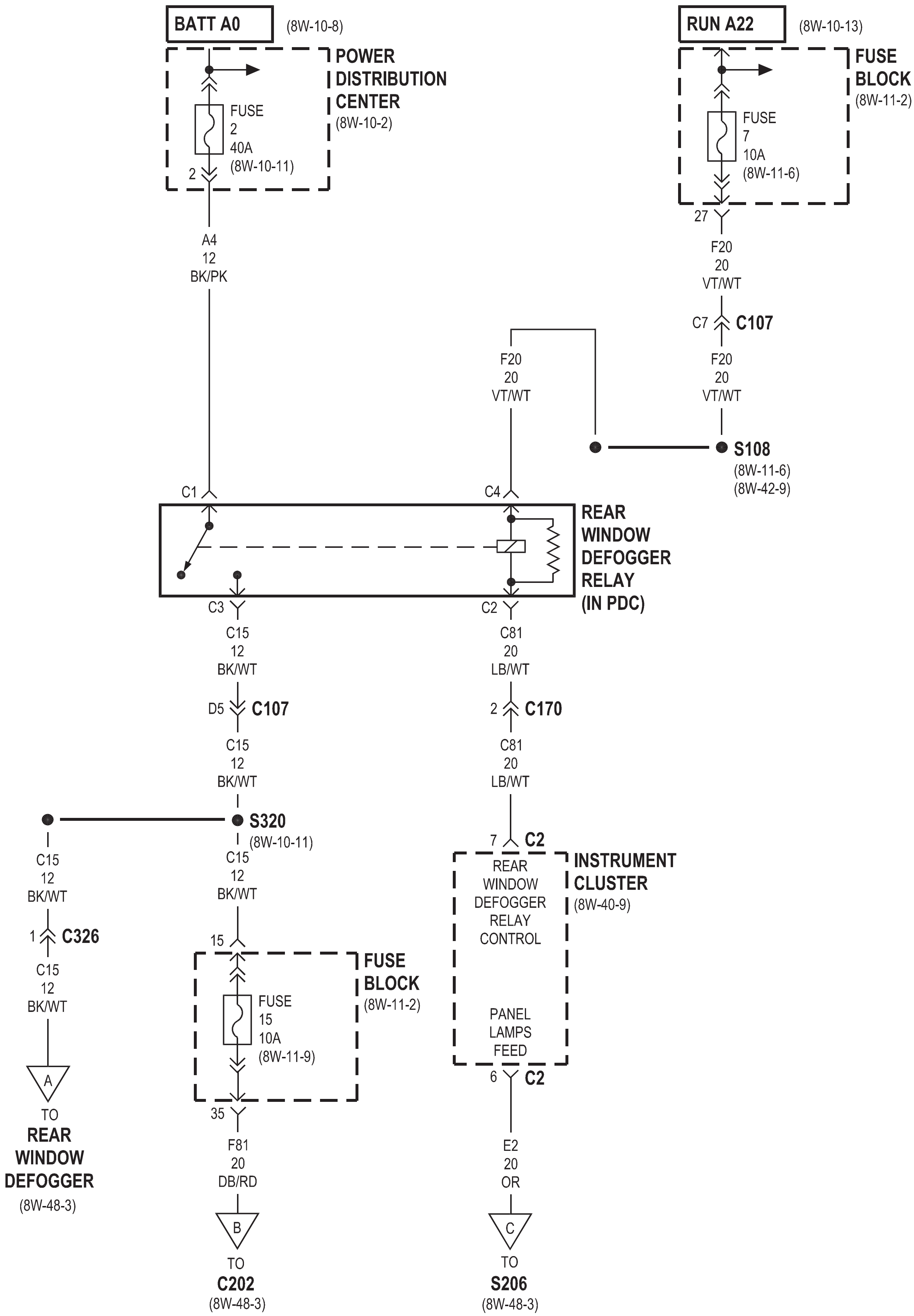


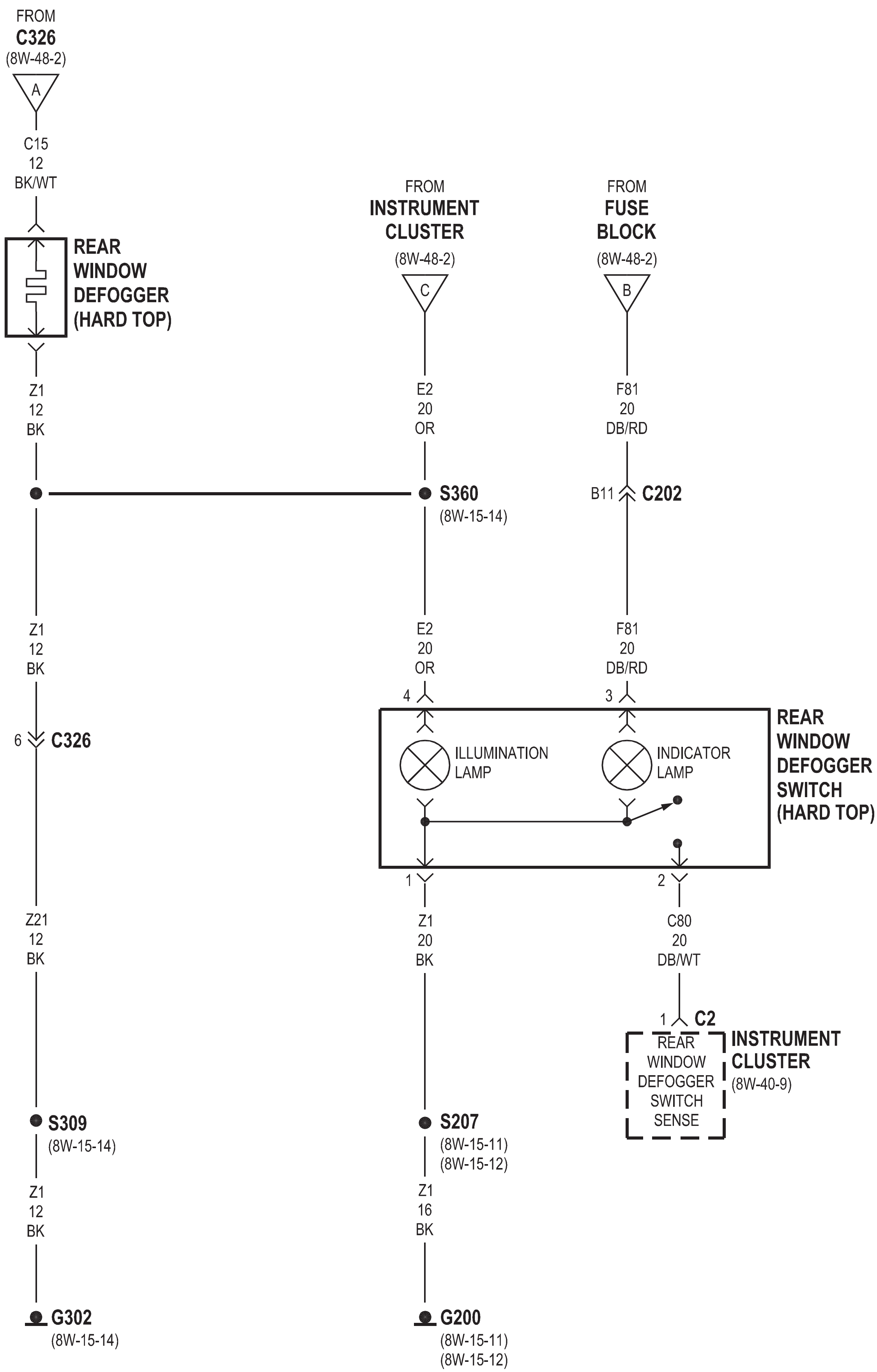
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RADIO 12V OUTPUT
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
10
9
13
7
8
2
1
LEFT FRONT SPEAKER
2
1
RIGHT FRONT SPEAKER
X53 18 DG
X53 18 DG
X55 18 BR/RD
X55 18 BR/RD
X16 20 LG
X54 18 VT
X54 18 VT
X56 18 DB
X56 18 DB
A4
A3
C2
D5
D6
C202
X53 18 DG
X55 18 BR/RD
X16 20 LG
X54 18 VT
X56 18 DB
3
4
5
1
2
SUBWOOFER
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RADIO 12V OUTPUT
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
GROUND
12
Z9 16 BK/WT
G303
(8W-15-14)

SUBWOOFER


RADIO
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
18
19
21
20
BATT A6
(8W-10-12)
FUSE BLOCK
(8W-11-2)
FUSE 3 20A (8W-11-4)
23
LEFT REAR SPEAKER
RIGHT REAR SPEAKER
1
3
X51 18 BR/YL
X57 20 BR/LB
X57 18 BR/LB
X52 18 DB/WT
X58 18 DB/PK
C10
C202
C11
B3
B4
4
3
C325
C324
X52 18 GY/DB
S356
S358
S357
S359
X13 16 BK/RD
6
9
10
7
8
SUBWOOFER
FUSED IGNITION SWITCH OUTPUT
GROUND
12
Z9 16 BK/WT
G303
(8W-15-14)

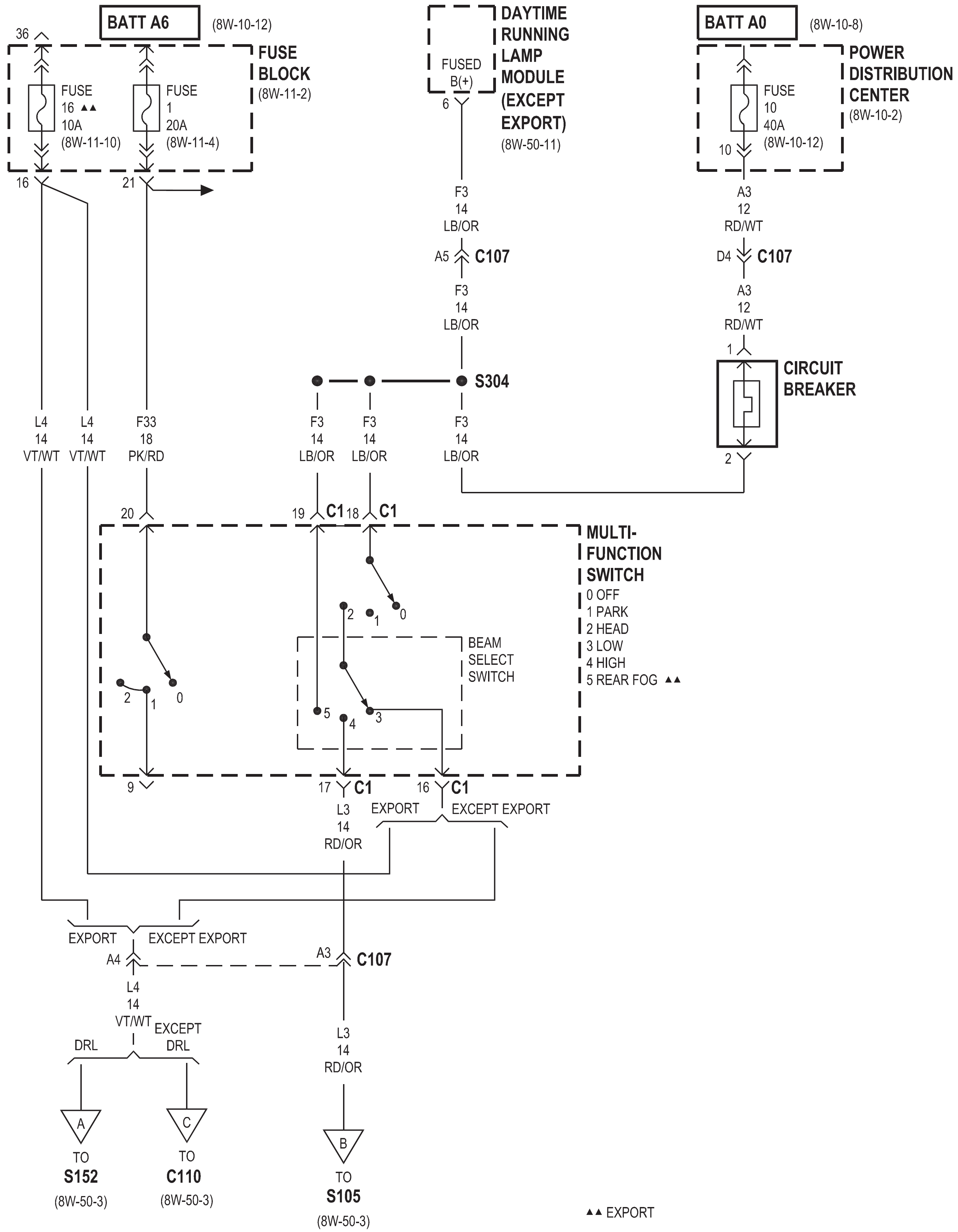
8W-48 REAR WINDOW DEFOGGER

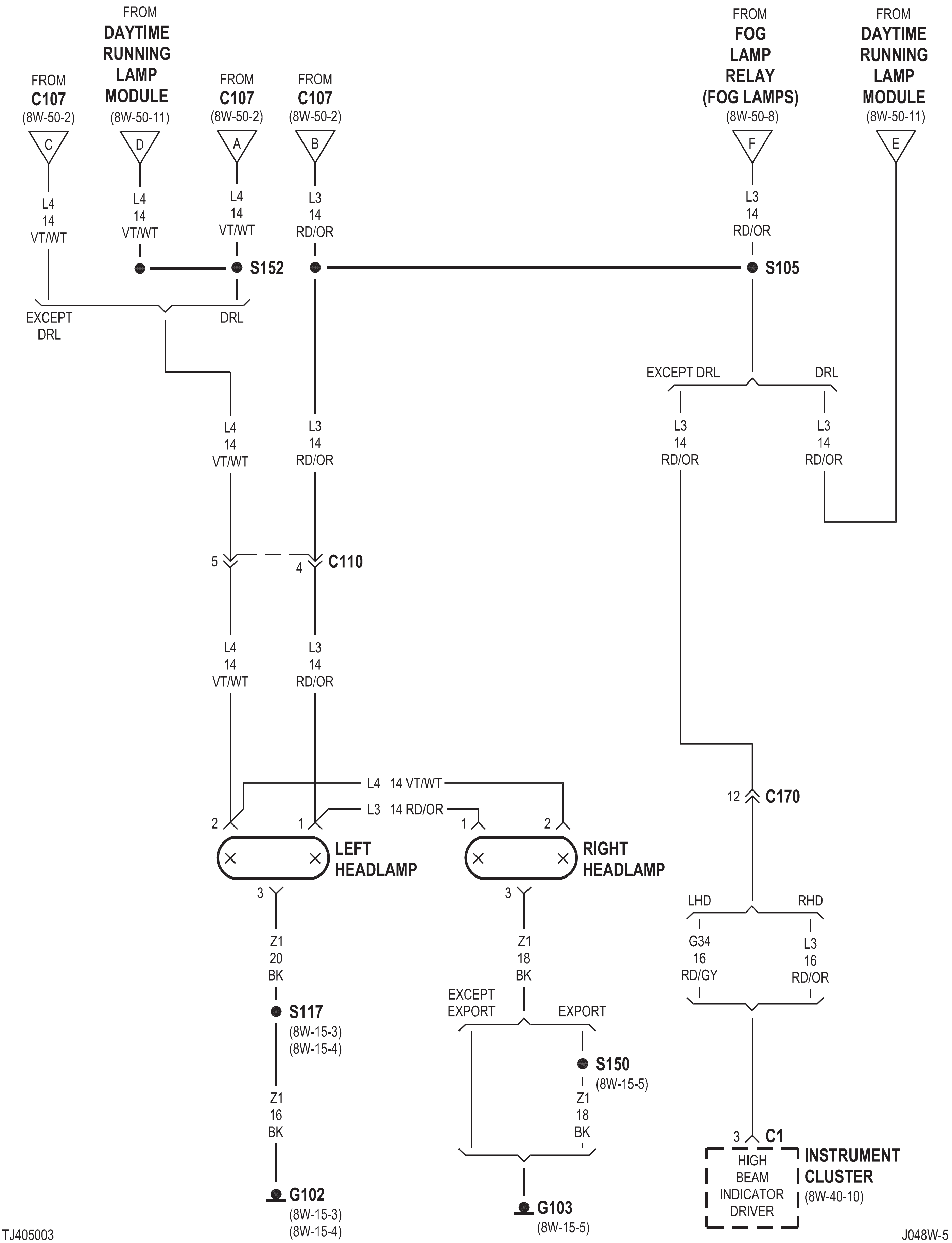

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 2 40A (8W-10-11)
2
A4 12 BK/PK
RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 7 10A (8W-11-6)
27
F20 20 VT/WT
C7 C107
F20 20 VT/WT
F20 20 VT/WT
S108
(8W-11-6)
(8W-42-9)
C1
C4
REAR WINDOW DEFOGGER RELAY (IN PDC)
C3
C2
C15 12 BK/WT
D5 C107
C15 12 BK/WT
C81 20 LB/WT
2 C170
C81 20 LB/WT
S320
(8W-10-11)
C15 12 BK/WT
C15 12 BK/WT
1 C326
C15 12 BK/WT
A
TO REAR WINDOW DEFOGGER
(8W-48-3)
15
FUSE BLOCK
(8W-11-2)
FUSE 15 10A (8W-11-9)
35
F81 20 DB/RD
B
TO C202
(8W-48-3)
7 C2
INSTRUMENT CLUSTER
(8W-40-9)
REAR WINDOW DEFOGGER RELAY CONTROL
PANEL LAMPS FEED
6 C2
E2 20 OR
C
TO S206
(8W-48-3)



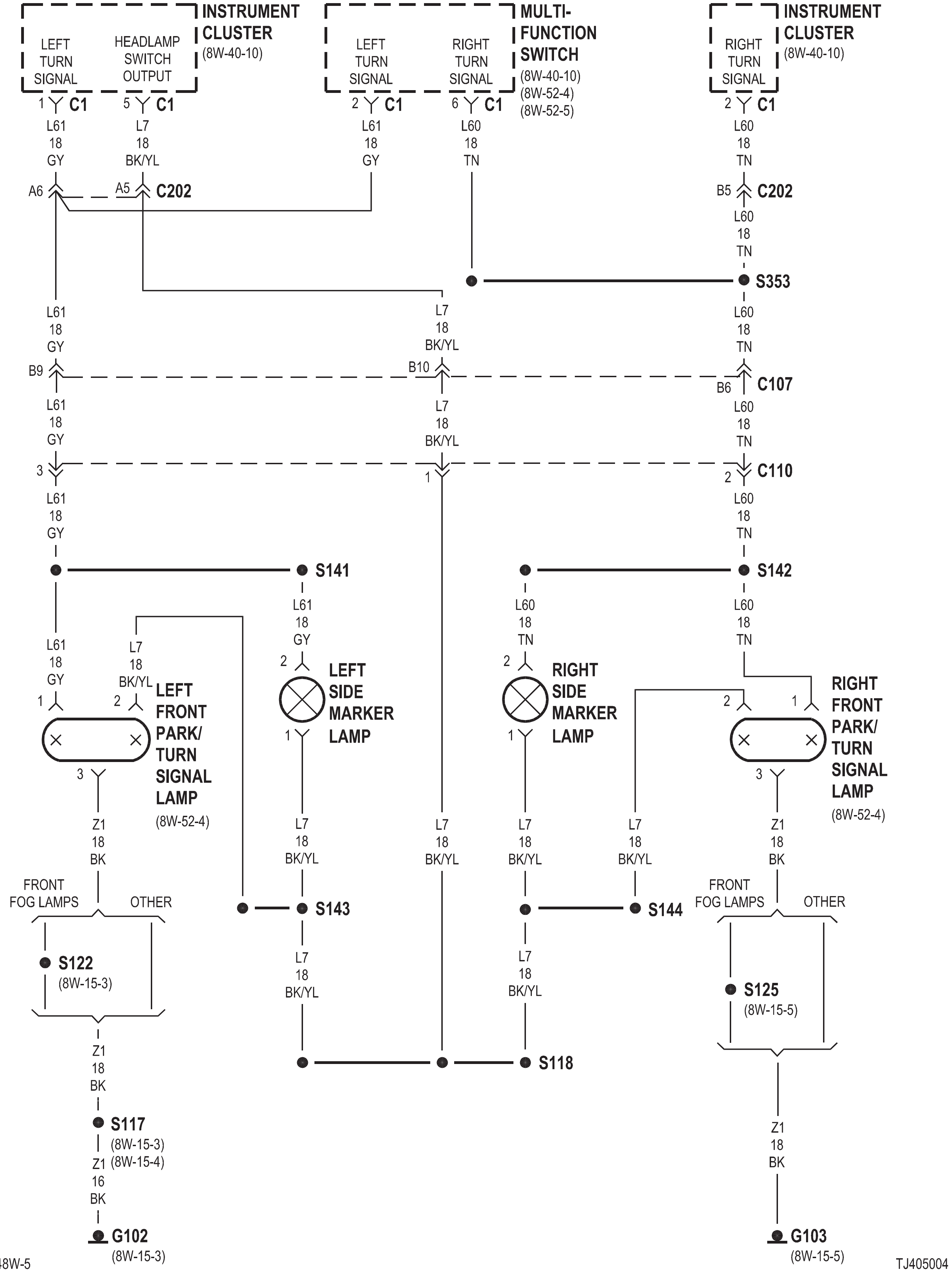
FROM
C326
(8W-48-2)
A
C15
12
BK/WT
REAR
WINDOW
DEFOGGER
(HARD TOP)
Z1
12
BK
FROM
INSTRUMENT
CLUSTER
(8W-48-2)
C
E2
20
OR
S360
(8W-15-14)
FROM
FUSE
BLOCK
(8W-48-2)
B
F81
20
DB/RD
B11
C202
Z1
12
BK
6
C326
E2
20
OR
4
F81
20
DB/RD
3
ILLUMINATION
LAMP
INDICATOR
LAMP
REAR
WINDOW
DEFOGGER
SWITCH
(HARD TOP)
1
2
Z21
12
BK
Z1
20
BK
C80
20
DB/WT
1
C2
REAR
WINDOW
DEFOGGER
SWITCH
SENSE
INSTRUMENT
CLUSTER
(8W-40-9)
S309
(8W-15-14)
S207
(8W-15-11)
(8W-15-12)
Z1
12
BK
Z1
16
BK
G302
(8W-15-14)
G200
(8W-15-11)
(8W-15-12)

8W-50 FRONT LIGHTING


BATT A6
(8W-10-12)
36
FUSE BLOCK
(8W-11-2)
FUSE
16 ▲▲
10A
(8W-11-10)
FUSE
1
20A
(8W-11-4)
16
21
DAYTIME RUNNING LAMP MODULE (EXCEPT EXPORT)
(8W-50-11)
FUSED B(+)
6
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
10
40A
(8W-10-12)
10
F3 14 LB/OR
A5 C107
A3 12 RD/WT
D4 C107
1
CIRCUIT BREAKER
2
S304
L4 14 VT/WT
L4 14 VT/WT
F33 18 PK/RD
F3 14 LB/OR
F3 14 LB/OR
F3 14 LB/OR
20
19 C1
18 C1
MULTI-FUNCTION SWITCH
0 OFF
1 PARK
2 HEAD
3 LOW
4 HIGH
5 REAR FOG ▲▲
BEAM SELECT SWITCH
2 1 0
2 1 0
5 4 3
9
17 C1
16 C1
L3 14 RD/OR
EXPORT
EXCEPT EXPORT
EXPORT
EXCEPT EXPORT
A4
A3 C107
L4 14 VT/WT
DRL
EXCEPT DRL
L3 14 RD/OR
A
TO S152
(8W-50-3)
C
TO C110
(8W-50-3)
B
TO S105
(8W-50-3)
▲▲ EXPORT


FROM
C107
(8W-50-2)
C
L4
14
VT/WT
FROM
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-11)
D
L4
14
VT/WT
FROM
C107
(8W-50-2)
A
L4
14
VT/WT
FROM
C107
(8W-50-2)
B
L3
14
RD/OR
S152
EXCEPT
DRL
DRL
FROM
FOG
LAMP
RELAY
(FOG LAMPS)
(8W-50-8)
F
L3
14
RD/OR
S105
FROM
DAYTIME
RUNNING
LAMP
MODULE
(8W-50-11)
E
EXCEPT DRL
DRL
L3
14
RD/OR
L3
14
RD/OR
L4
14
VT/WT
L3
14
RD/OR
5
4
C110
L4
14
VT/WT
L3
14
RD/OR
L4 14 VT/WT
L3 14 RD/OR
2
1
1
2
LEFT
HEADLAMP
RIGHT
HEADLAMP
12
C170
3
Z1
20
BK
S117
(8W-15-3)
(8W-15-4)
Z1
16
BK
G102
(8W-15-3)
(8W-15-4)
3
Z1
18
BK
EXCEPT
EXPORT
EXPORT
S150
(8W-15-5)
Z1
18
BK
G103
(8W-15-5)
LHD
RHD
G34
16
RD/GY
L3
16
RD/OR
3
C1
HIGH
BEAM
INDICATOR
DRIVER
INSTRUMENT
CLUSTER
(8W-40-10)

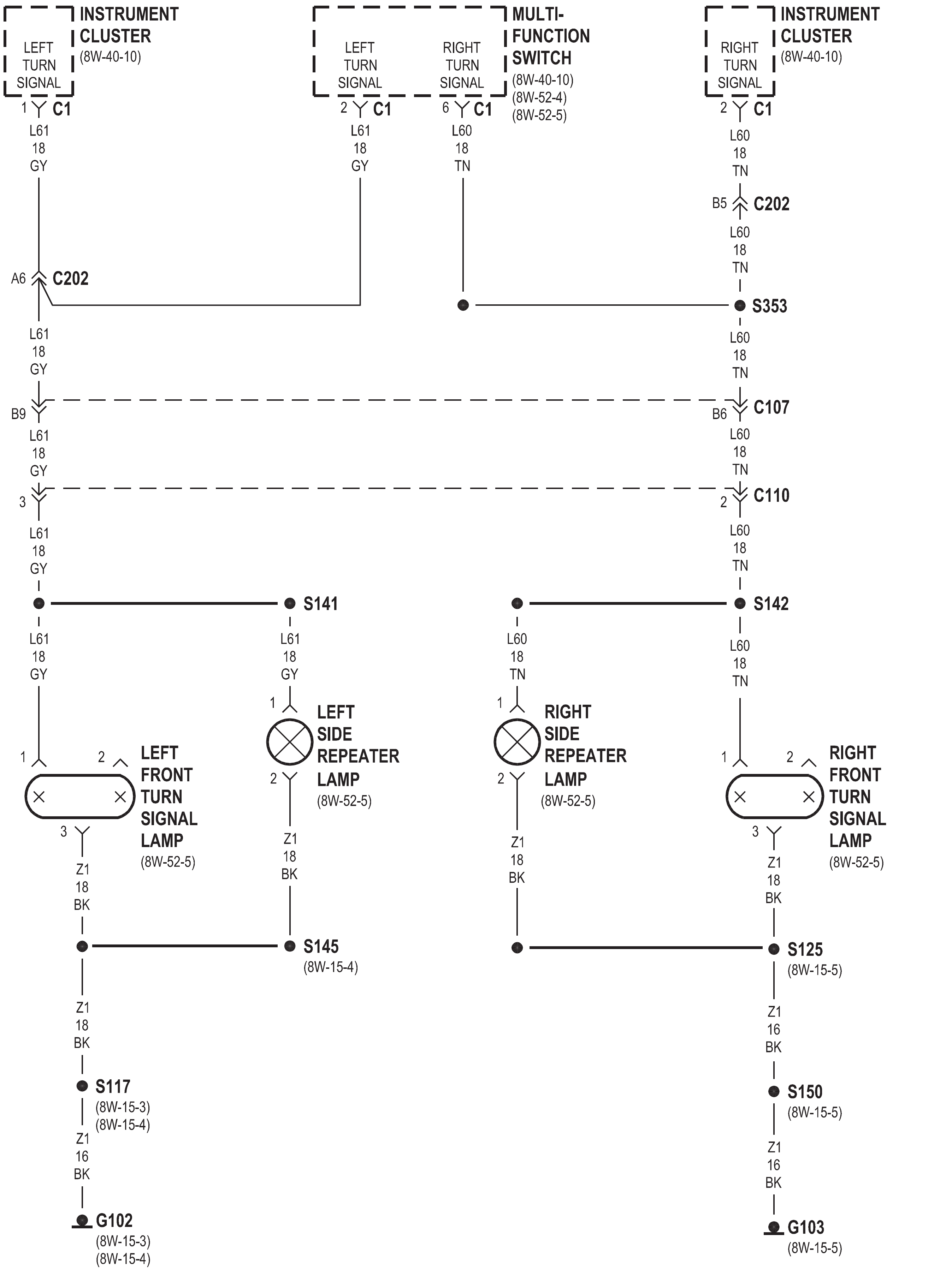
EXCEPT EXPORT



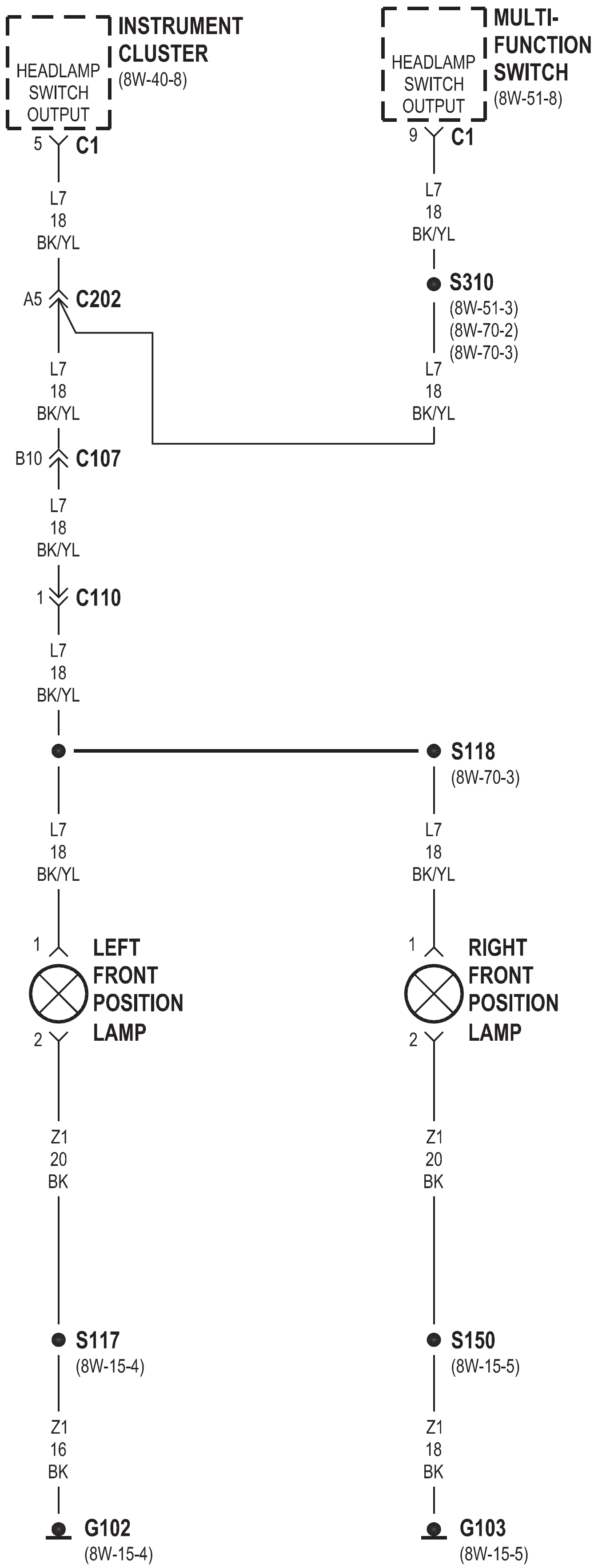
J048W-5

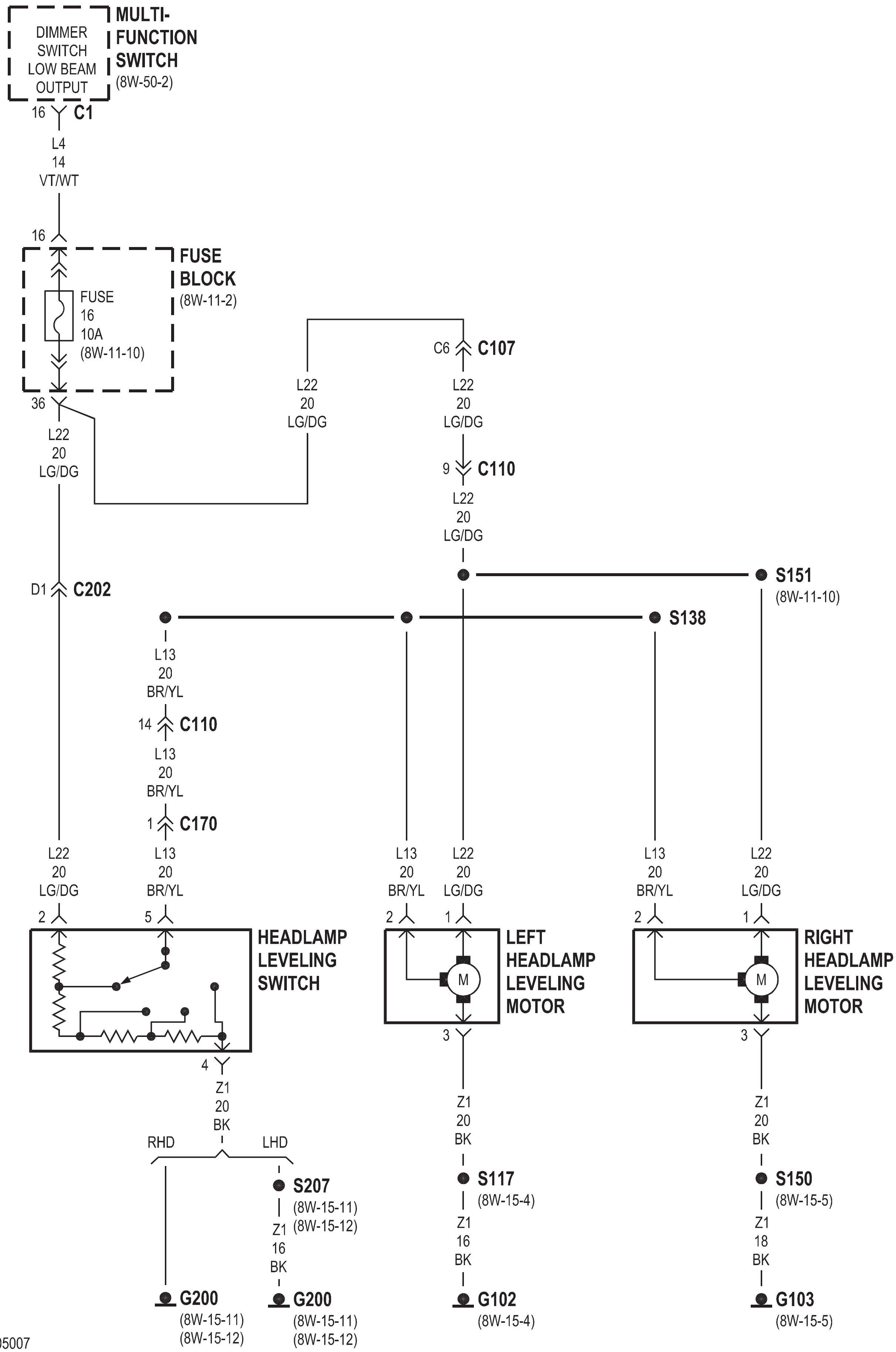
TJ405004

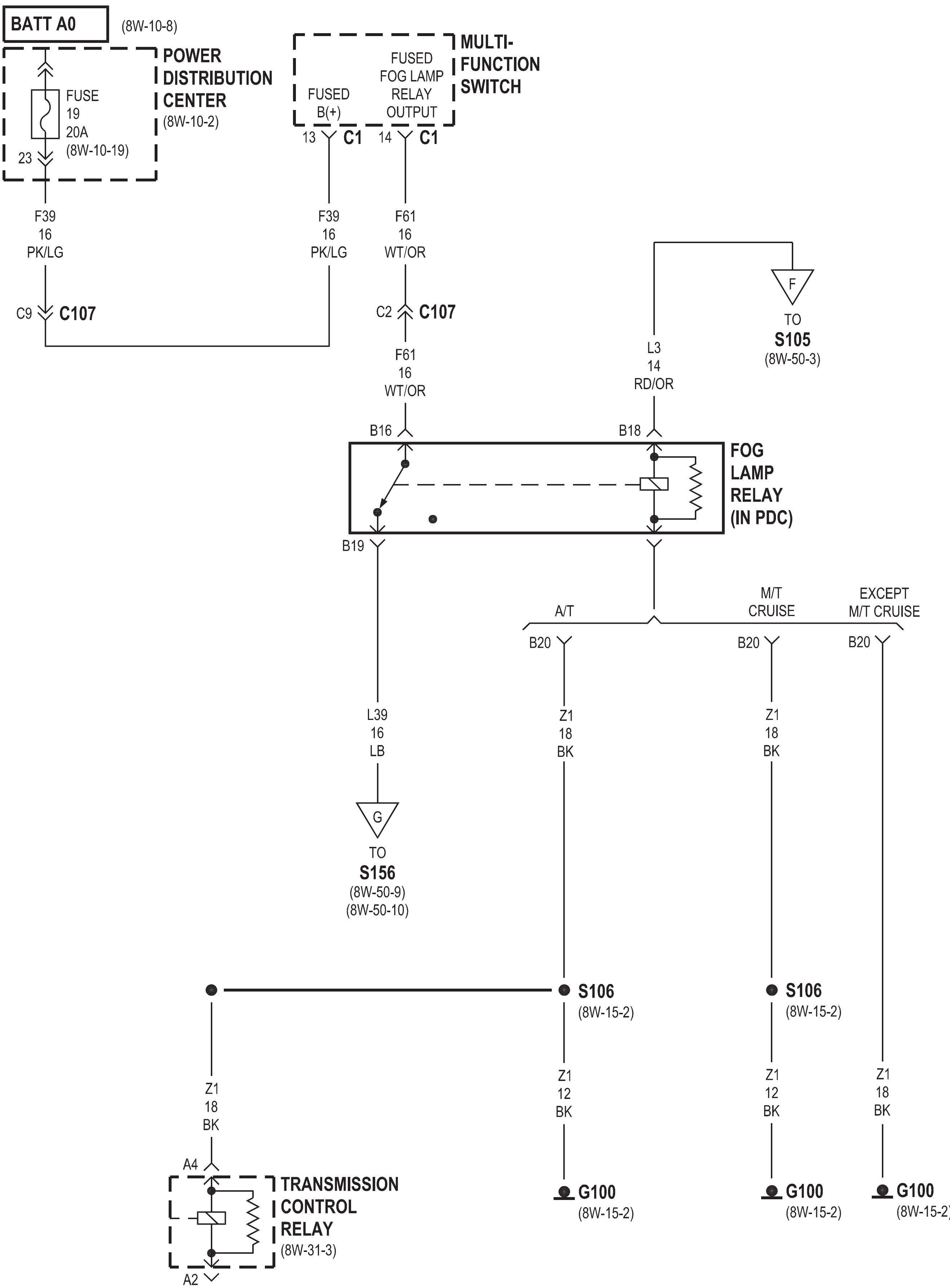
EXPORT


INSTRUMENT CLUSTER (8W-40-10)
LEFT TURN SIGNAL
MULTI-FUNCTION SWITCH (8W-40-10) (8W-52-4) (8W-52-5)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
INSTRUMENT CLUSTER (8W-40-10)
RIGHT TURN SIGNAL
1 C1
2 C1
6 C1
2 C1
L61 18 GY
L60 18 TN
A6 C202
B5 C202
S353
B9
B6 C107
3
2 C110
S141
S142
LEFT SIDE REPEATER LAMP (8W-52-5)
RIGHT SIDE REPEATER LAMP (8W-52-5)
LEFT FRONT TURN SIGNAL LAMP (8W-52-5)
RIGHT FRONT TURN SIGNAL LAMP (8W-52-5)
Z1 18 BK
Z1 16 BK
S145 (8W-15-4)
S125 (8W-15-5)
S117 (8W-15-3) (8W-15-4)
S150 (8W-15-5)
G102 (8W-15-3) (8W-15-4)
G103 (8W-15-5)

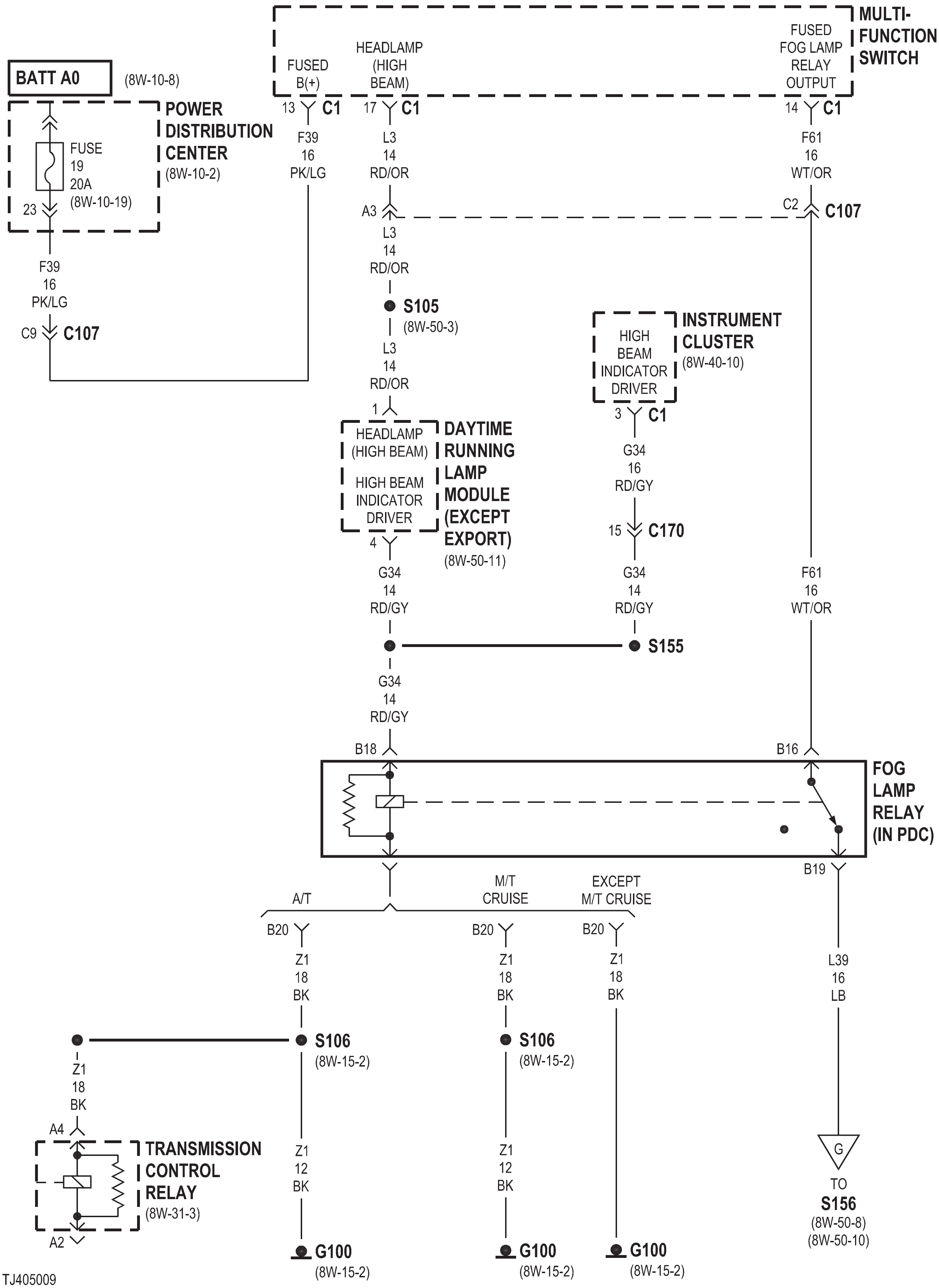
EXPORT

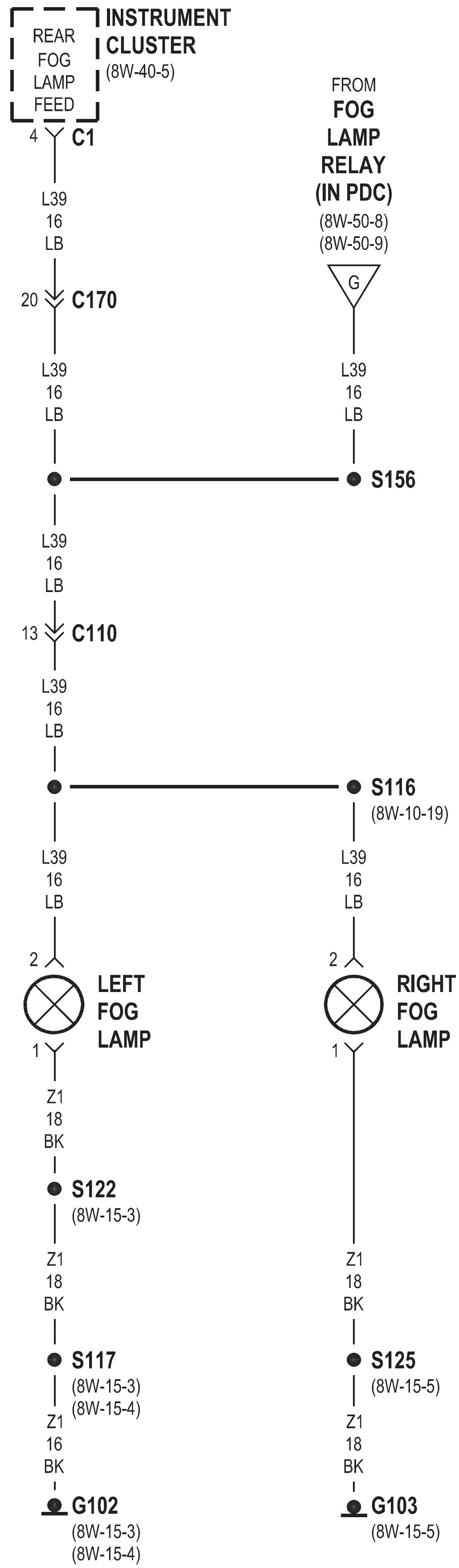

INSTRUMENT CLUSTER
(8W-40-8)
HEADLAMP SWITCH OUTPUT
5 C1
L7
18
BK/YL
A5 C202
L7
18
BK/YL
B10 C107
L7
18
BK/YL
1 C110
L7
18
BK/YL
MULTI-FUNCTION SWITCH
(8W-51-8)
HEADLAMP SWITCH OUTPUT
9 C1
L7
18
BK/YL
S310
(8W-51-3)
(8W-70-2)
(8W-70-3)
L7
18
BK/YL
S118
(8W-70-3)
L7
18
BK/YL
L7
18
BK/YL
1
LEFT FRONT POSITION LAMP
2
1
RIGHT FRONT POSITION LAMP
2
Z1
20
BK
Z1
20
BK
S117
(8W-15-4)
S150
(8W-15-5)
Z1
16
BK
Z1
18
BK
G102
(8W-15-4)
G103
(8W-15-5)


MULTI-FUNCTION SWITCH
(8W-50-2)
DIMMER SWITCH LOW BEAM OUTPUT
16 C1
L4 14 VT/WT
16
FUSE BLOCK
(8W-11-2)
FUSE 16 10A
(8W-11-10)
36
L22 20 LG/DG
C6 C107
9 C110
D1 C202
S151
(8W-11-10)
S138
L13 20 BR/YL
14 C110
1 C170
HEADLAMP LEVELING SWITCH
LEFT HEADLAMP LEVELING MOTOR
RIGHT HEADLAMP LEVELING MOTOR
M
Z1 20 BK
RHD
LHD
S207
(8W-15-11)
(8W-15-12)
Z1 16 BK
G200
S117
(8W-15-4)
G102
S150
(8W-15-5)
Z1 18 BK
G103

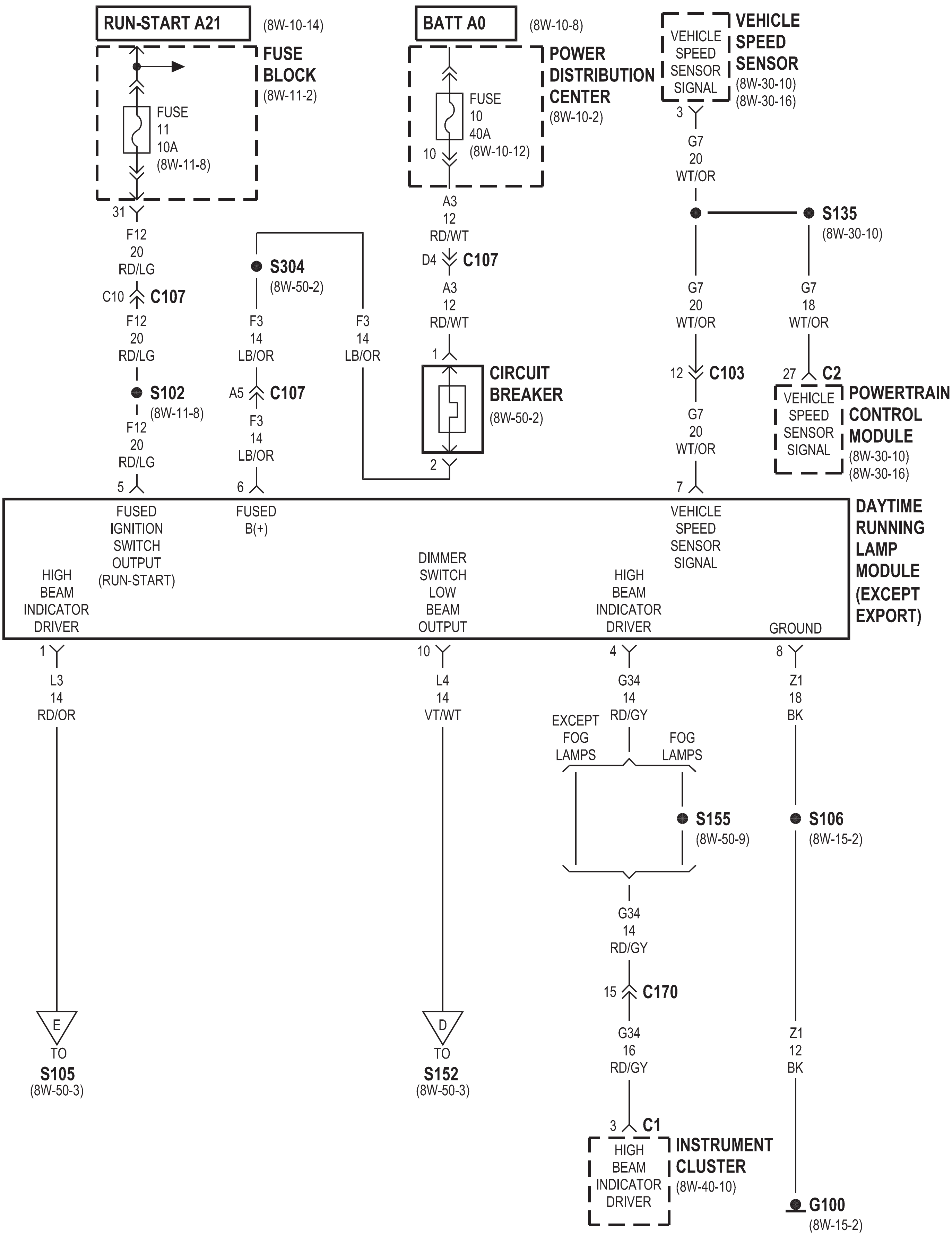

BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 19 20A
(8W-10-19)
23
MULTI-FUNCTION SWITCH
FUSED B(+)
FUSED FOG LAMP RELAY OUTPUT
13 C1
14 C1
F39 16 PK/LG
F39 16 PK/LG
F61 16 WT/OR
C9 C107
C2 C107
F61 16 WT/OR
F
TO S105
(8W-50-3)
L3 14 RD/OR
B16
B18
FOG LAMP RELAY (IN PDC)
B19
A/T
M/T CRUISE
EXCEPT M/T CRUISE
B20
B20
B20
L39 16 LB
Z1 18 BK
Z1 18 BK
G
TO S156
(8W-50-9)
(8W-50-10)
S106
(8W-15-2)
S106
(8W-15-2)
Z1 18 BK
Z1 12 BK
Z1 12 BK
Z1 18 BK
A4
TRANSMISSION CONTROL RELAY
(8W-31-3)
A2
G100
(8W-15-2)
G100
(8W-15-2)
G100
(8W-15-2)

FOG LAMPS WITH DRL



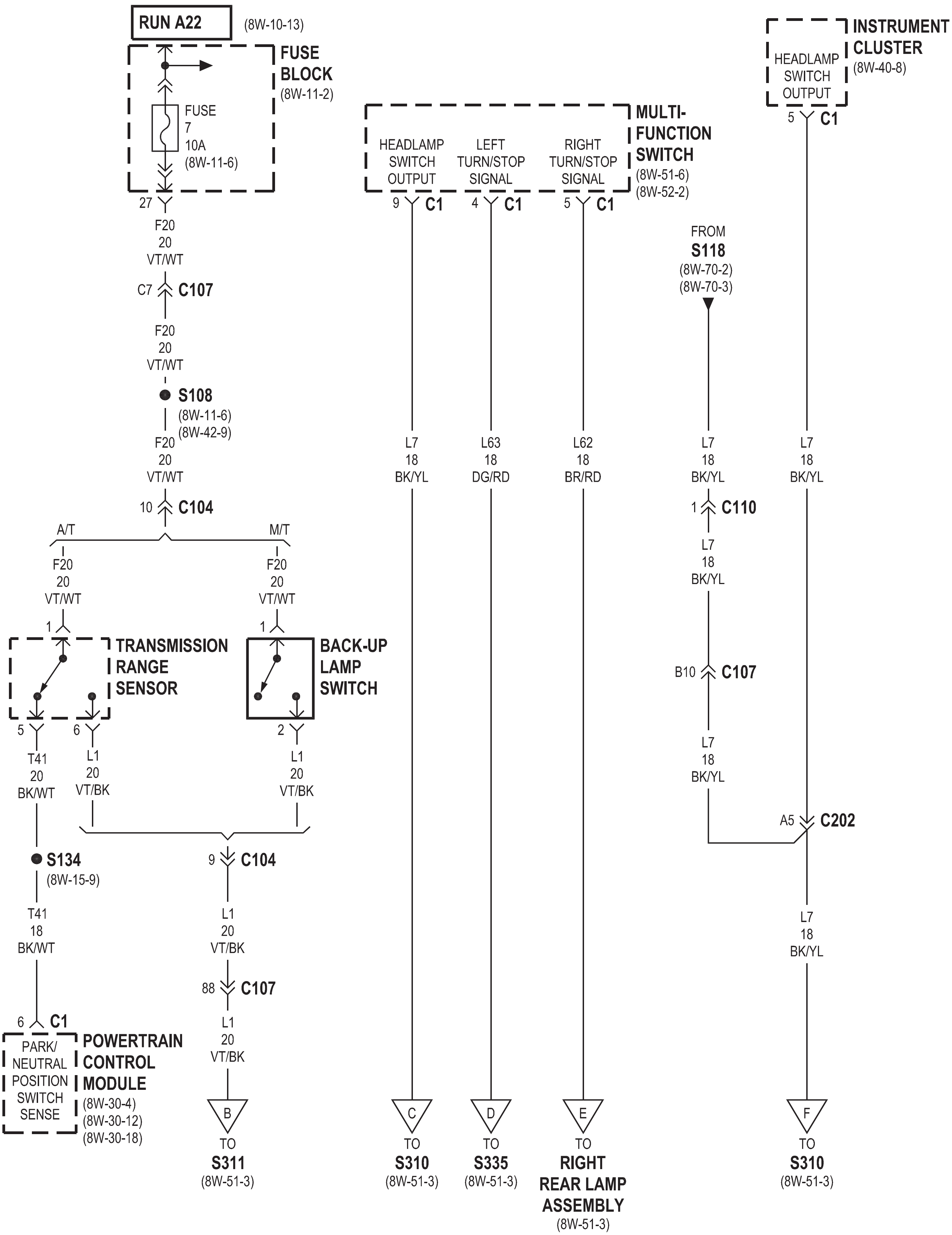

INSTRUMENT CLUSTER
(8W-40-5)
REAR FOG LAMP FEED
4 C1
L39 16 LB
20 C170
L39 16 LB
FROM
FOG LAMP RELAY (IN PDC)
(8W-50-8)
(8W-50-9)
G
L39 16 LB
S156
L39 16 LB
13 C110
L39 16 LB
S116
(8W-10-19)
L39 16 LB
L39 16 LB
2
2
LEFT FOG LAMP
RIGHT FOG LAMP
1
1
Z1 18 BK
S122
(8W-15-3)
Z1 18 BK
Z1 18 BK
S117
(8W-15-3)
(8W-15-4)
S125
(8W-15-5)
Z1 16 BK
Z1 18 BK
G102
(8W-15-3)
(8W-15-4)
G103
(8W-15-5)

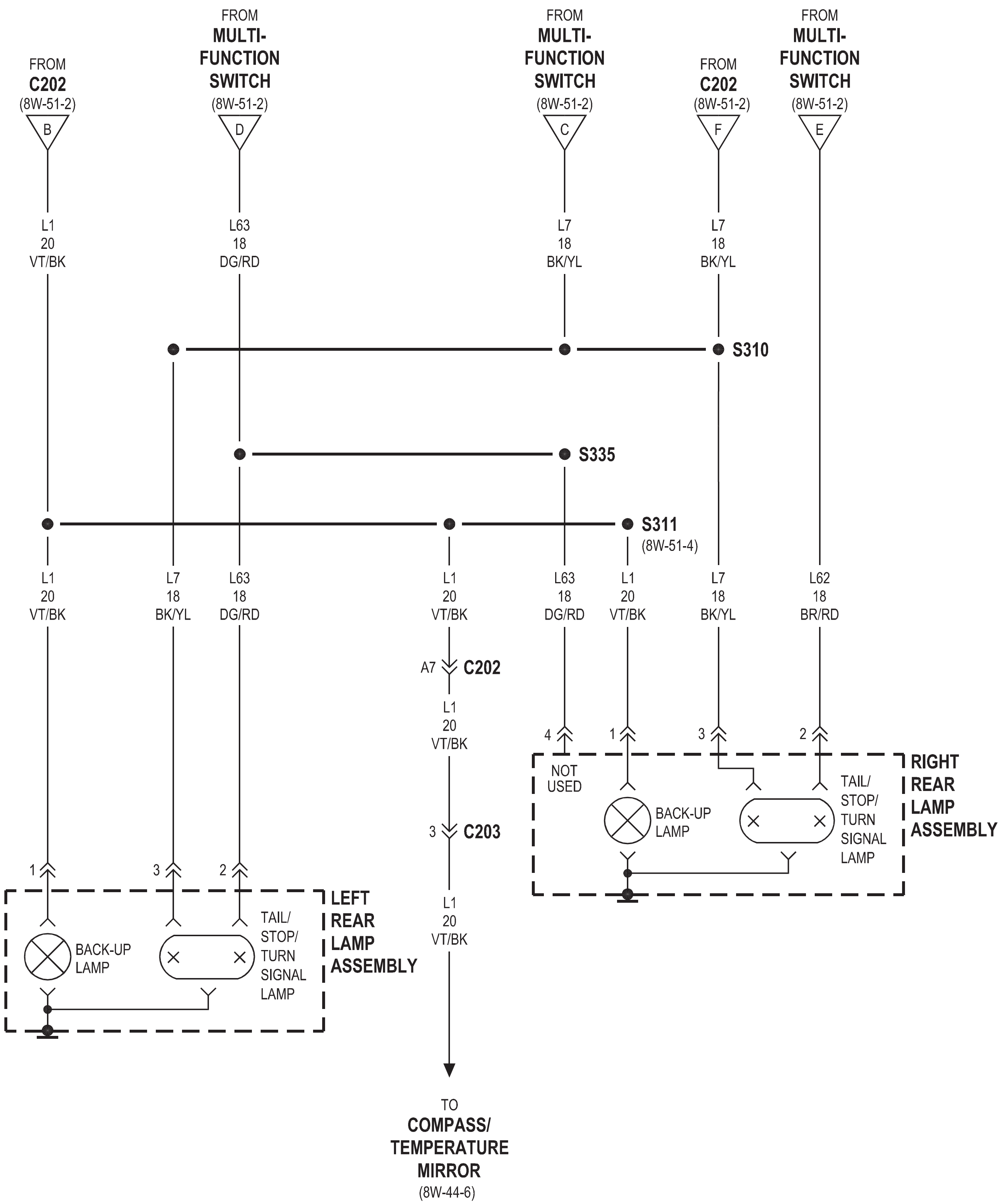
DRL

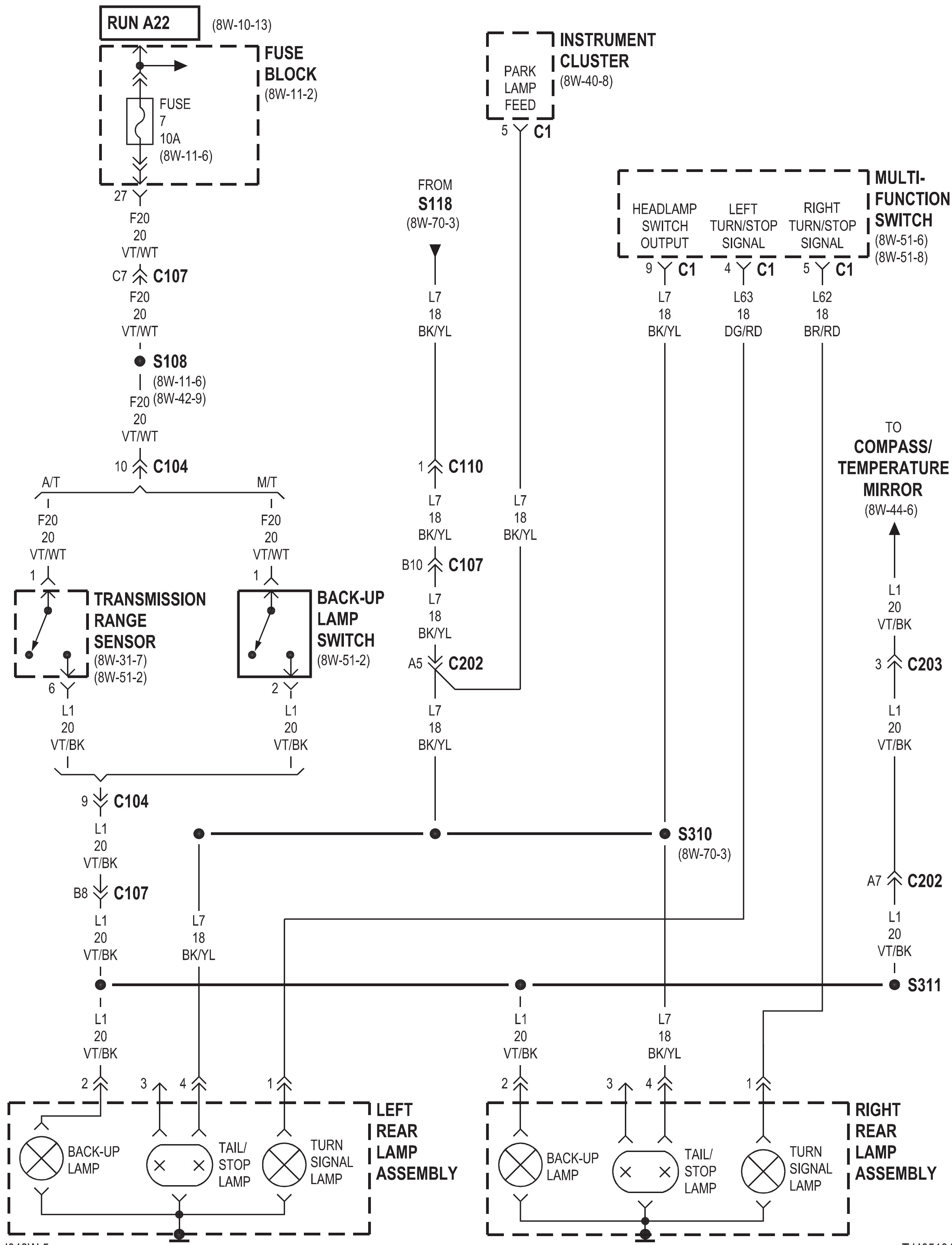


RUN-START A21
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
11
10A
(8W-11-8)
31
F12
20
RD/LG
C10
C107
S102
(8W-11-8)
5
S304
(8W-50-2)
F3
14
LB/OR
A5
C107
6
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
10
40A
(8W-10-12)
A3
12
RD/WT
D4
C107
1
CIRCUIT BREAKER
(8W-50-2)
2
VEHICLE SPEED SENSOR SIGNAL
VEHICLE SPEED SENSOR
(8W-30-10)
(8W-30-16)
3
G7
20
WT/OR
S135
(8W-30-10)
G7
18
WT/OR
27
C2
POWERTRAIN CONTROL MODULE
12
C103
7
DAYTIME RUNNING LAMP MODULE (EXCEPT EXPORT)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED B(+)
VEHICLE SPEED SENSOR SIGNAL
HIGH BEAM INDICATOR DRIVER
DIMMER SWITCH LOW BEAM OUTPUT
HIGH BEAM INDICATOR DRIVER
GROUND
1
L3
14
RD/OR
E
TO
S105
(8W-50-3)
10
L4
14
VT/WT
D
TO
S152
(8W-50-3)
4
G34
14
RD/GY
EXCEPT FOG LAMPS
FOG LAMPS
S155
(8W-50-9)
15
C170
G34
16
RD/GY
3
C1
HIGH BEAM INDICATOR DRIVER
INSTRUMENT CLUSTER
(8W-40-10)
8
Z1
18
BK
S106
(8W-15-2)
Z1
12
BK
G100
(8W-15-2)

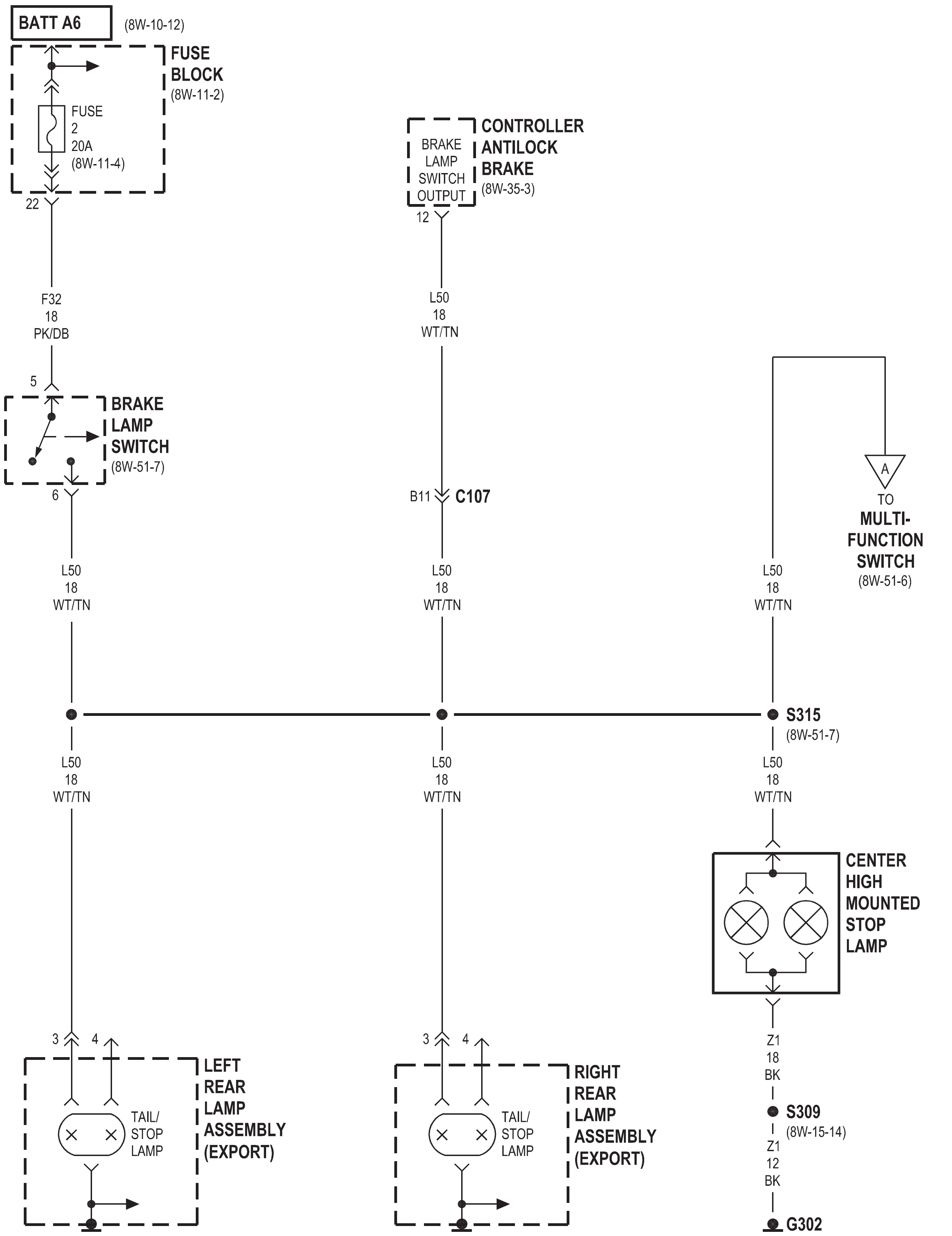
8W-51 REAR LIGHTING

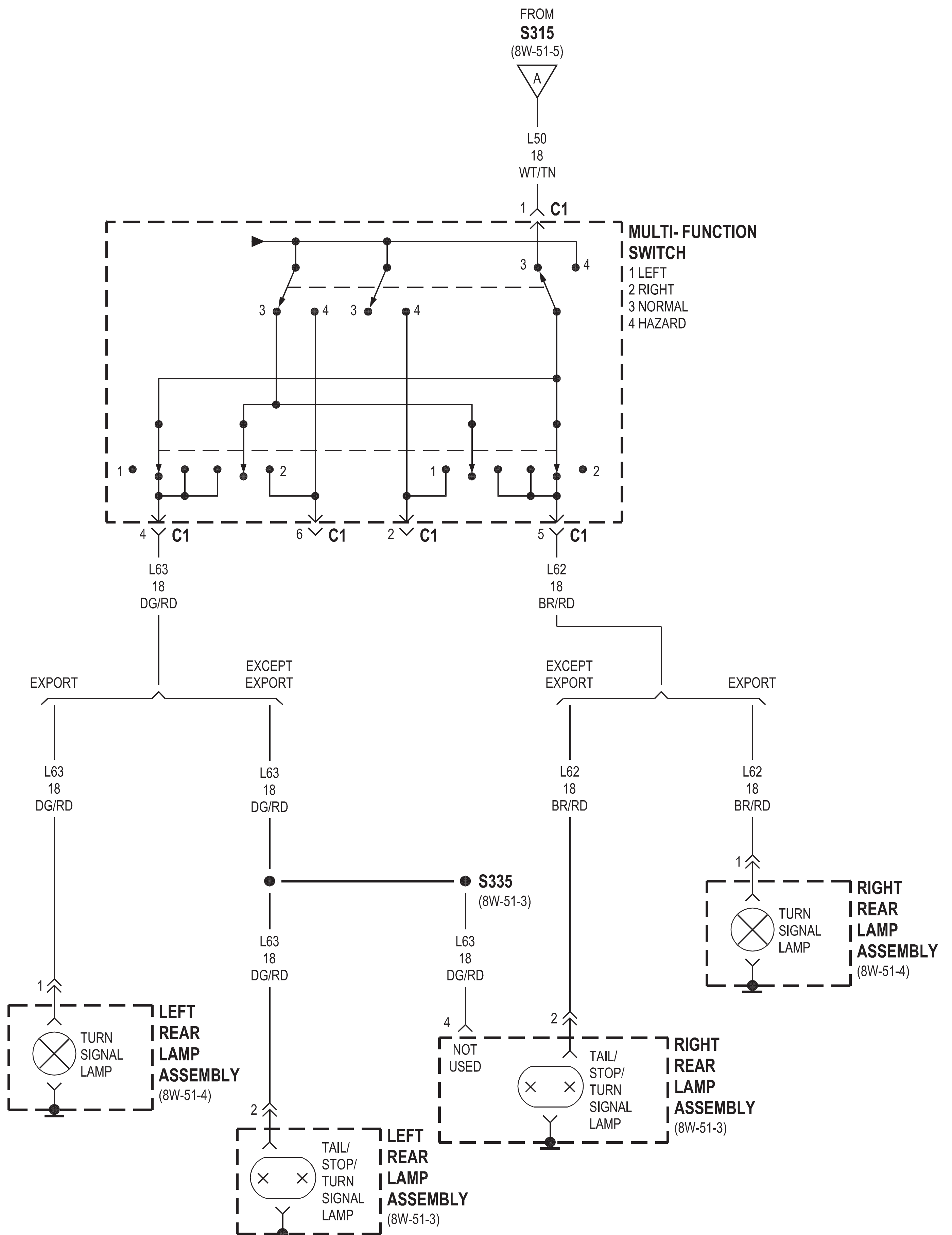

RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE
7
10A
(8W-11-6)
27
F20
20
VT/WT
C7 C107
F20
20
VT/WT
S108
(8W-11-6)
(8W-42-9)
F20
20
VT/WT
10 C104
A/T
M/T
F20
20
VT/WT
1
TRANSMISSION RANGE SENSOR
BACK-UP LAMP SWITCH
5
6
2
T41
20
BK/WT
L1
20
VT/BK
S134
(8W-15-9)
9 C104
T41
18
BK/WT
L1
20
VT/BK
88 C107
6 C1
PARK/ NEUTRAL POSITION SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-12)
(8W-30-18)
B
TO
S311
(8W-51-3)
MULTI-FUNCTION SWITCH
(8W-51-6)
(8W-52-2)
HEADLAMP SWITCH OUTPUT
LEFT TURN/STOP SIGNAL
RIGHT TURN/STOP SIGNAL
9 C1
4 C1
5 C1
L7
18
BK/YL
L63
18
DG/RD
L62
18
BR/RD
C
TO
S310
(8W-51-3)
D
TO
S335
(8W-51-3)
E
TO
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
INSTRUMENT CLUSTER
(8W-40-8)
HEADLAMP SWITCH OUTPUT
5 C1
FROM
S118
(8W-70-2)
(8W-70-3)
L7
18
BK/YL
1 C110
B10 C107
A5 C202
F
TO
S310
(8W-51-3)

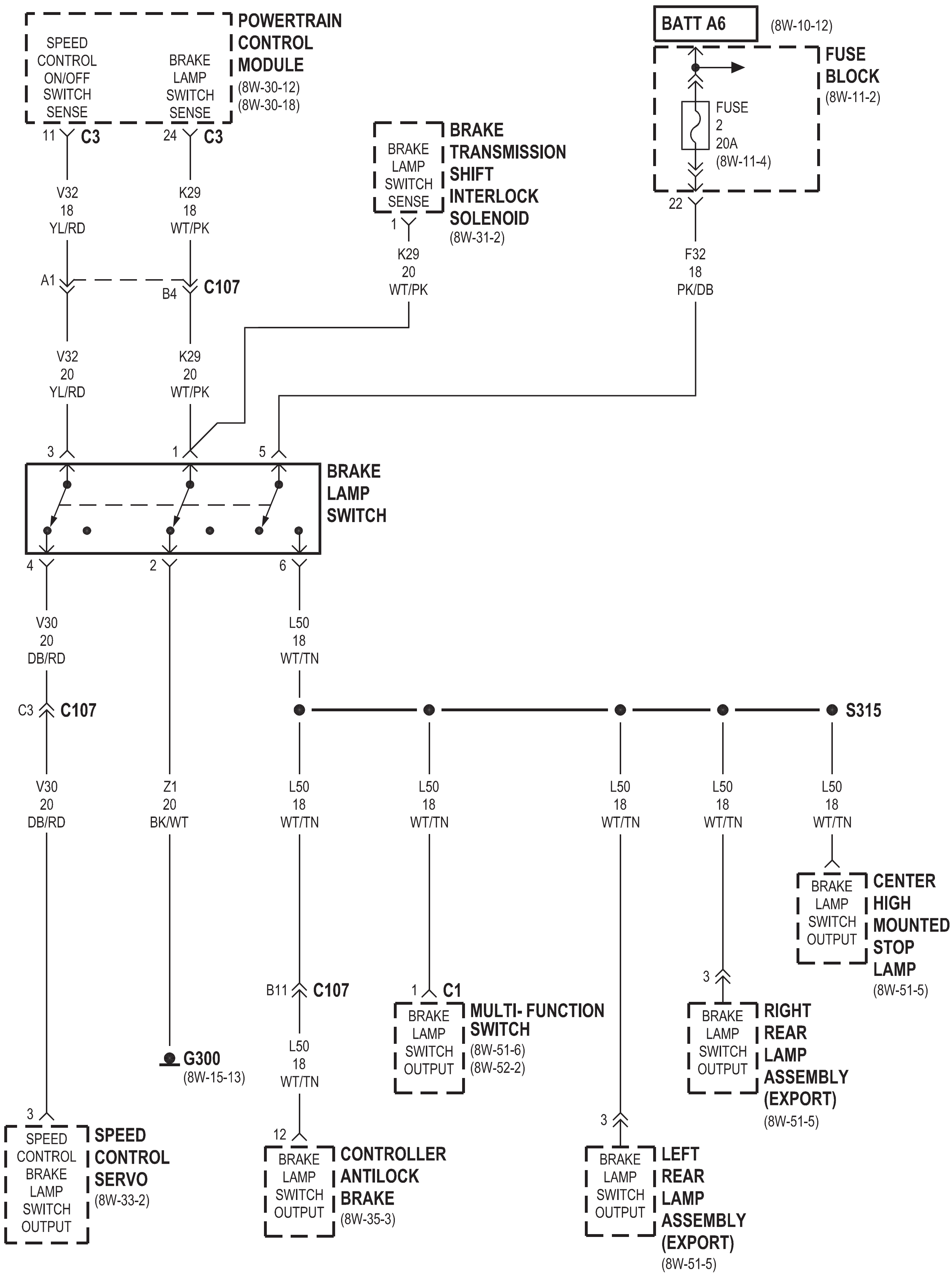

FROM
C202
(8W-51-2)
B
FROM
MULTI-FUNCTION SWITCH
(8W-51-2)
D
FROM
MULTI-FUNCTION SWITCH
(8W-51-2)
C
FROM
C202
(8W-51-2)
F
FROM
MULTI-FUNCTION SWITCH
(8W-51-2)
E
L1 20 VT/BK
L63 18 DG/RD
L7 18 BK/YL
L7 18 BK/YL
S310
S335
S311
(8W-51-4)
L1 20 VT/BK
L7 18 BK/YL
L63 18 DG/RD
L1 20 VT/BK
L63 18 DG/RD
L1 20 VT/BK
L7 18 BK/YL
L62 18 BR/RD
A7
C202
L1 20 VT/BK
3
C203
L1 20 VT/BK
4
1
3
2
NOT USED
BACK-UP LAMP
TAIL/ STOP/ TURN SIGNAL LAMP
RIGHT REAR LAMP ASSEMBLY
1
3
2
BACK-UP LAMP
TAIL/ STOP/ TURN SIGNAL LAMP
LEFT REAR LAMP ASSEMBLY
TO
COMPASS/ TEMPERATURE MIRROR
(8W-44-6)

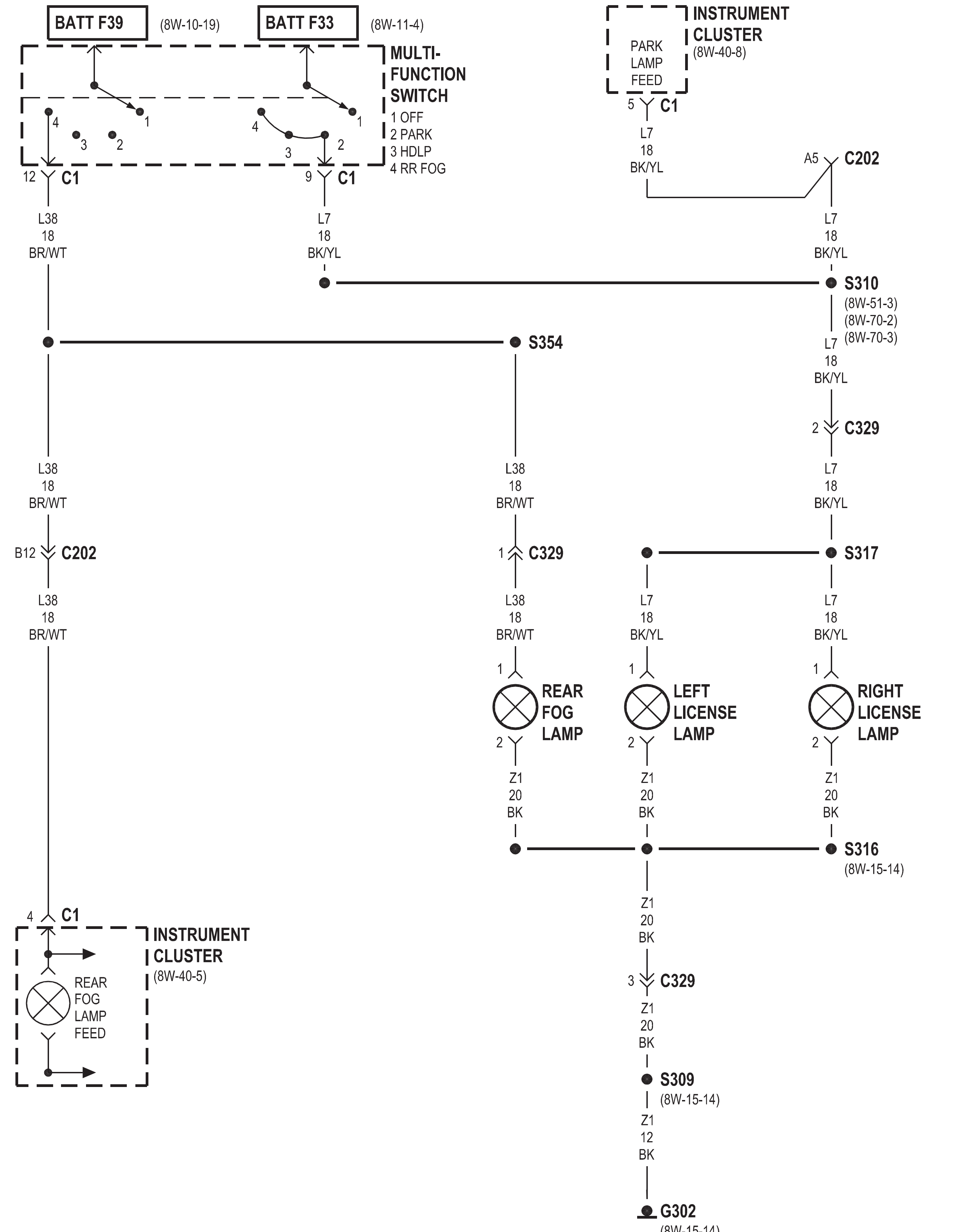


RUN A22
(8W-10-13)
FUSE BLOCK
(8W-11-2)
FUSE 7 10A (8W-11-6)
27
F20 20 VT/WT
C7 C107
F20 20 VT/WT
S108
(8W-11-6)
(8W-42-9)
F20 20 VT/WT
10 C104
A/T
M/T
F20 20 VT/WT
F20 20 VT/WT
1
1
TRANSMISSION RANGE SENSOR
(8W-31-7)
(8W-51-2)
BACK-UP LAMP SWITCH
(8W-51-2)
6
2
L1 20 VT/BK
L1 20 VT/BK
9 C104
L1 20 VT/BK
B8 C107
L1 20 VT/BK
INSTRUMENT CLUSTER
(8W-40-8)
PARK LAMP FEED
5 C1
FROM S118
(8W-70-3)
L7 18 BK/YL
1 C110
L7 18 BK/YL
L7 18 BK/YL
B10 C107
L7 18 BK/YL
A5 C202
L7 18 BK/YL
MULTI-FUNCTION SWITCH
(8W-51-6)
(8W-51-8)
HEADLAMP SWITCH OUTPUT
LEFT TURN/STOP SIGNAL
RIGHT TURN/STOP SIGNAL
9 C1
4 C1
5 C1
L7 18 BK/YL
L63 18 DG/RD
L62 18 BR/RD
S310
(8W-70-3)
TO COMPASS/ TEMPERATURE MIRROR
(8W-44-6)
L1 20 VT/BK
3 C203
L1 20 VT/BK
A7 C202
L1 20 VT/BK
S311
L7 18 BK/YL
L1 20 VT/BK
L1 20 VT/BK
L7 18 BK/YL
2
3
4
1
2
3
4
1
BACK-UP LAMP
TAIL/ STOP LAMP
TURN SIGNAL LAMP
LEFT REAR LAMP ASSEMBLY
BACK-UP LAMP
TAIL/ STOP LAMP
TURN SIGNAL LAMP
RIGHT REAR LAMP ASSEMBLY

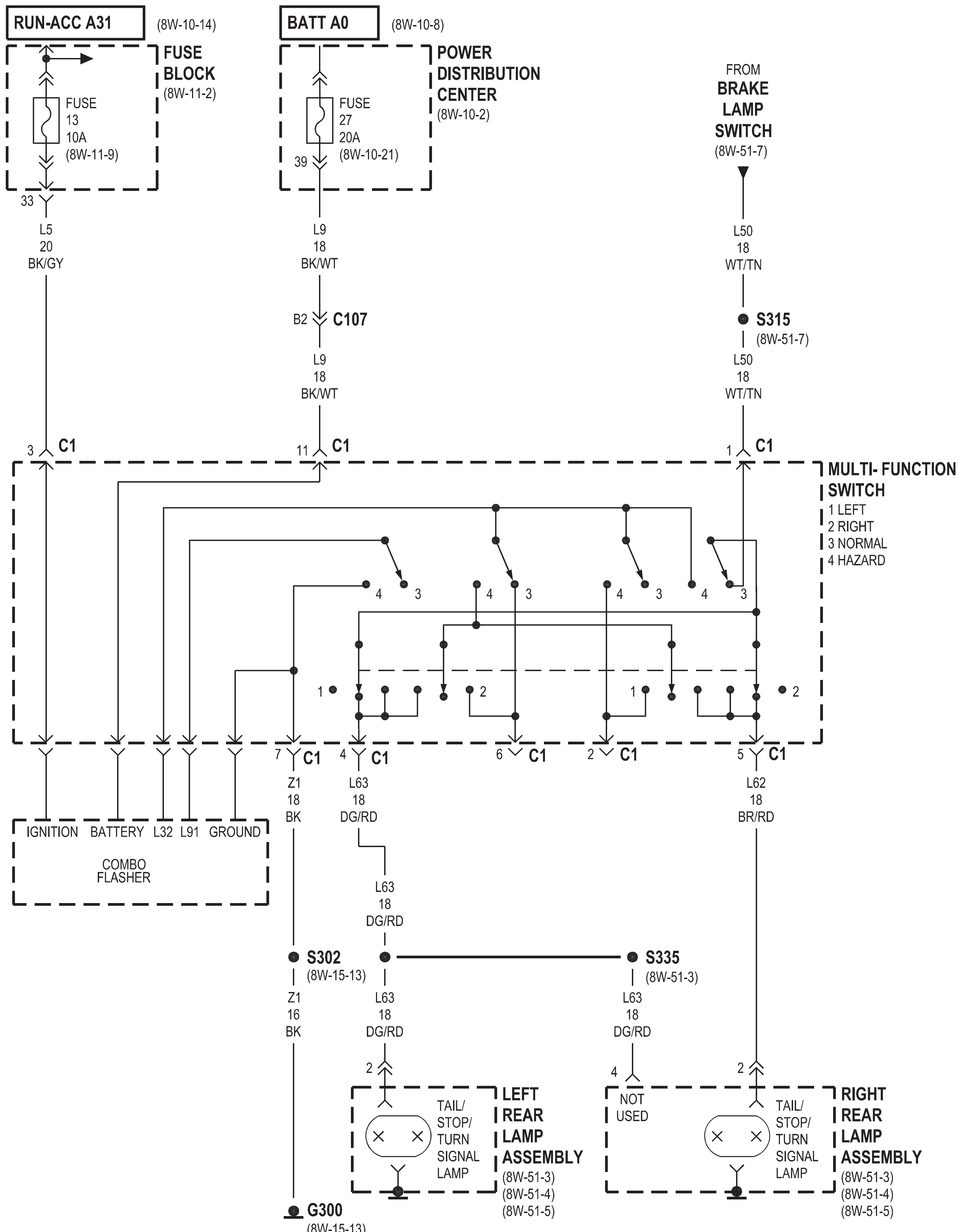

BATT A6
(8W-10-12)
FUSE BLOCK
(8W-11-2)
FUSE 2 20A (8W-11-4)
22
F32 18 PK/DB
5
BRAKE LAMP SWITCH
(8W-51-7)
6
CONTROLLER ANTILOCK BRAKE
(8W-35-3)
BRAKE LAMP SWITCH OUTPUT
12
L50 18 WT/TN
B11
C107
A
TO MULTI-FUNCTION SWITCH
(8W-51-6)
L50 18 WT/TN
S315
(8W-51-7)
CENTER HIGH MOUNTED STOP LAMP
Z1 18 BK
S309
(8W-15-14)
Z1 12 BK
G302
(8W-15-14)
3 4
LEFT REAR LAMP ASSEMBLY (EXPORT)
TAIL/ STOP LAMP
RIGHT REAR LAMP ASSEMBLY (EXPORT)


FROM
S315
(8W-51-5)
A
L50
18
WT/TN
1
C1
MULTI- FUNCTION
SWITCH
1 LEFT
2 RIGHT
3 NORMAL
4 HAZARD
3
4
3
4
3
4
1
2
1
2
4
C1
6
C1
2
C1
5
C1
L63
18
DG/RD
L62
18
BR/RD
EXPORT
EXCEPT
EXPORT
EXCEPT
EXPORT
EXPORT
L63
18
DG/RD
L63
18
DG/RD
L62
18
BR/RD
L62
18
BR/RD
S335
(8W-51-3)
L63
18
DG/RD
L63
18
DG/RD
1
RIGHT
REAR
LAMP
ASSEMBLY
(8W-51-4)
TURN
SIGNAL
LAMP
1
TURN
SIGNAL
LAMP
LEFT
REAR
LAMP
ASSEMBLY
(8W-51-4)
4
NOT
USED
2
TAIL/
STOP/
TURN
SIGNAL
LAMP
RIGHT
REAR
LAMP
ASSEMBLY
(8W-51-3)
2
TAIL/
STOP/
TURN
SIGNAL
LAMP
LEFT
REAR
LAMP
ASSEMBLY
(8W-51-3)

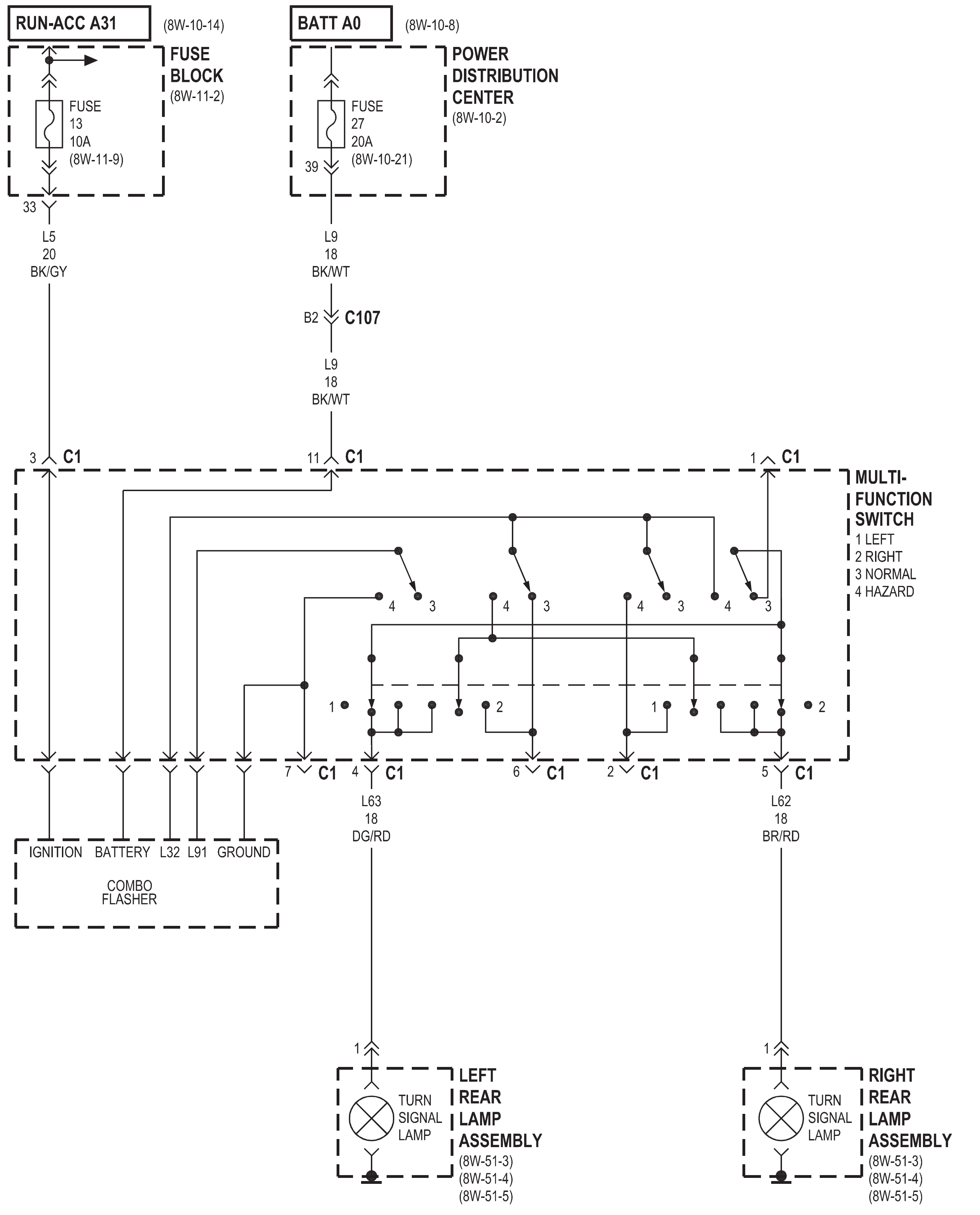

POWERTRAIN CONTROL MODULE
(8W-30-12)
(8W-30-18)
SPEED CONTROL ON/OFF SWITCH SENSE
BRAKE LAMP SWITCH SENSE
11 C3
24 C3
V32 18 YL/RD
K29 18 WT/PK
A1
B4 C107
V32 20 YL/RD
K29 20 WT/PK
BRAKE LAMP SWITCH SENSE
BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID
(8W-31-2)
1
K29 20 WT/PK
BATT A6
(8W-10-12)
FUSE BLOCK
(8W-11-2)
FUSE 2 20A (8W-11-4)
22
F32 18 PK/DB
3
1
5
BRAKE LAMP SWITCH
4
2
6
V30 20 DB/RD
C3 C107
V30 20 DB/RD
Z1 20 BK/WT
G300
(8W-15-13)
L50 18 WT/TN
S315
L50 18 WT/TN
B11 C107
L50 18 WT/TN
12
BRAKE LAMP SWITCH OUTPUT
CONTROLLER ANTILOCK BRAKE
(8W-35-3)
1 C1
BRAKE LAMP SWITCH OUTPUT
MULTI- FUNCTION SWITCH
(8W-51-6)
(8W-52-2)
3
SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
SPEED CONTROL SERVO
(8W-33-2)
3
BRAKE LAMP SWITCH OUTPUT
LEFT REAR LAMP ASSEMBLY (EXPORT)
(8W-51-5)
3
BRAKE LAMP SWITCH OUTPUT
RIGHT REAR LAMP ASSEMBLY (EXPORT)
(8W-51-5)
BRAKE LAMP SWITCH OUTPUT
CENTER HIGH MOUNTED STOP LAMP
(8W-51-5)

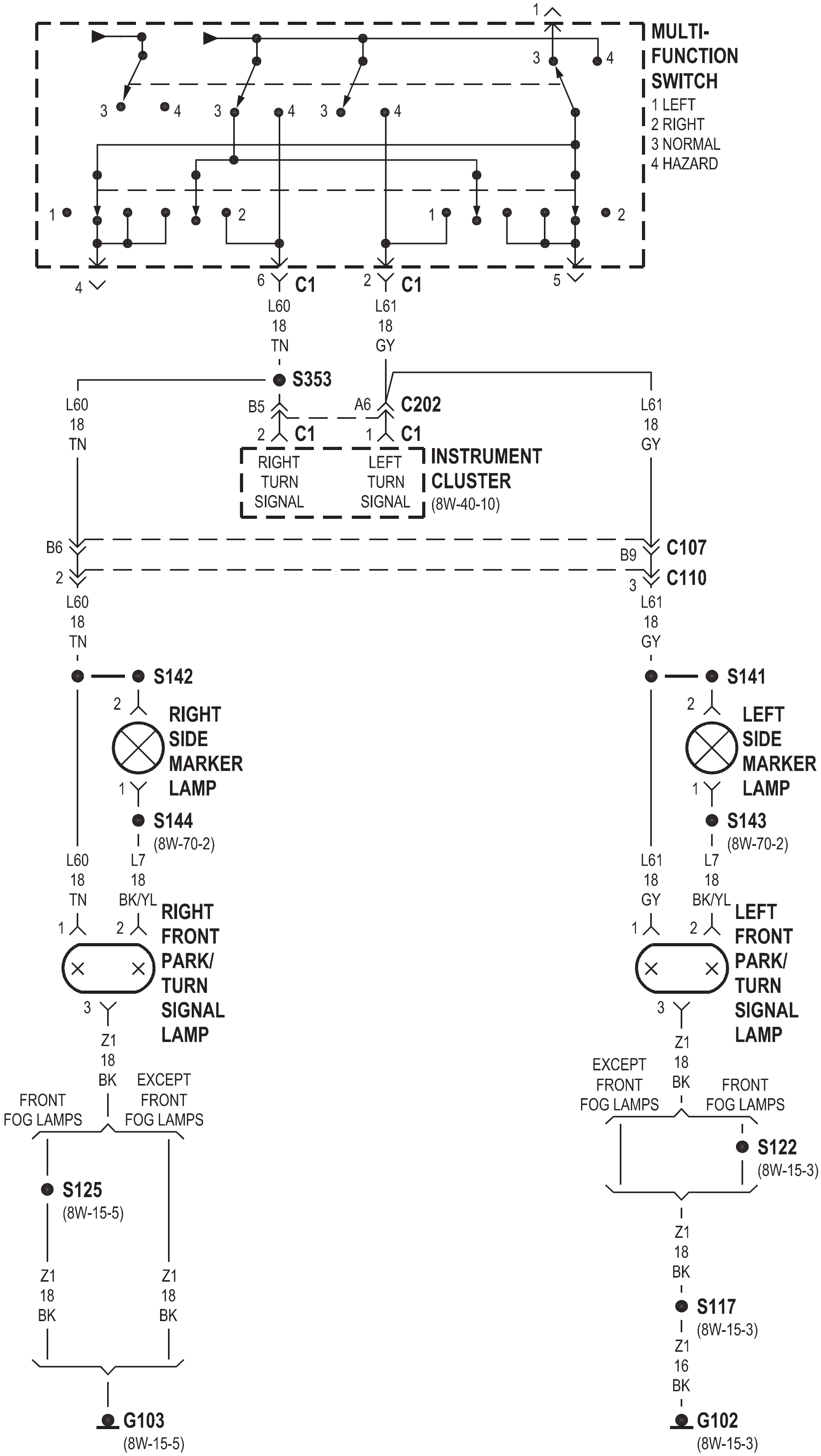

BATT F39
(8W-10-19)
BATT F33
(8W-11-4)
MULTI-FUNCTION SWITCH
1 OFF
2 PARK
3 HDLP
4 RR FOG
12 C1
9 C1
INSTRUMENT CLUSTER
(8W-40-8)
PARK LAMP FEED
5 C1
L7 18 BK/YL
A5 C202
L38 18 BR/WT
L7 18 BK/YL
S310
(8W-51-3)
(8W-70-2)
(8W-70-3)
S354
2 C329
B12 C202
1 C329
S317
REAR FOG LAMP
LEFT LICENSE LAMP
RIGHT LICENSE LAMP
Z1 20 BK
S316
(8W-15-14)
3 C329
S309
(8W-15-14)
Z1 12 BK
G302
(8W-15-14)
4 C1
INSTRUMENT CLUSTER
(8W-40-5)
REAR FOG LAMP FEED

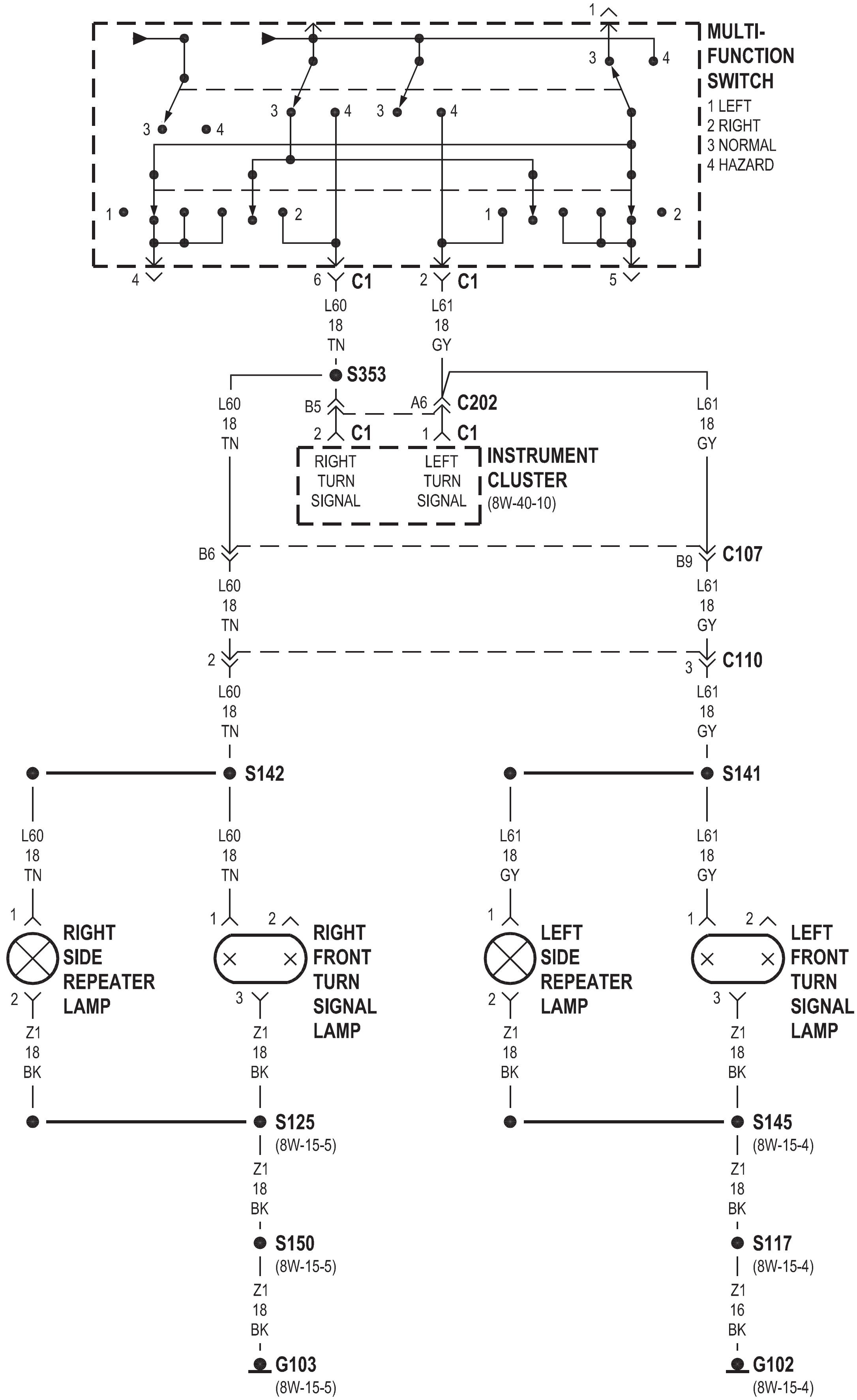
8W-52 TURN SIGNALS



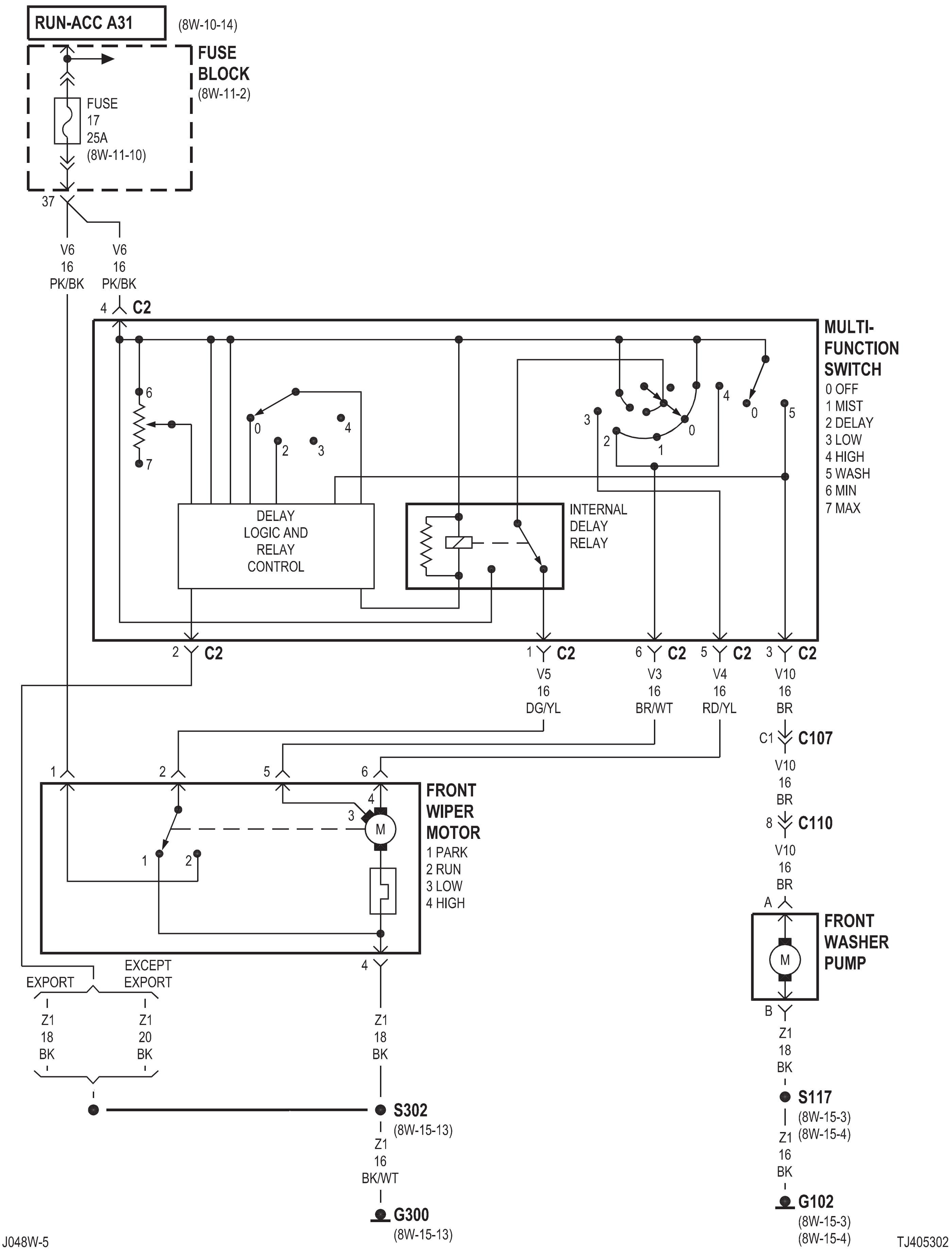
RUN-ACC A31
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
13
10A
(8W-11-9)
33
L5
20
BK/GY
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
27
20A
(8W-10-21)
39
L9
18
BK/WT
B2
C107
L9
18
BK/WT
FROM BRAKE LAMP SWITCH
(8W-51-7)
L50
18
WT/TN
S315
(8W-51-7)
L50
18
WT/TN
3 C1
11 C1
1 C1
MULTI- FUNCTION SWITCH
1 LEFT
2 RIGHT
3 NORMAL
4 HAZARD
4 3 4 3 4 3 4 3
1 2 1 2
7 C1
4 C1
6 C1
2 C1
5 C1
Z1
18
BK
L63
18
DG/RD
L62
18
BR/RD
IGNITION BATTERY L32 L91 GROUND
COMBO FLASHER
L63
18
DG/RD
S302
(8W-15-13)
S335
(8W-51-3)
Z1
16
BK
L63
18
DG/RD
L63
18
DG/RD
2
4
2
TAIL/ STOP/ TURN SIGNAL LAMP
LEFT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-4)
(8W-51-5)
NOT USED
TAIL/ STOP/ TURN SIGNAL LAMP
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-4)
(8W-51-5)
G300
(8W-15-13)


RUN-ACC A31
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
13
10A
(8W-11-9)
33
L5
20
BK/GY
BATT A0
(8W-10-8)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
27
20A
(8W-10-21)
39
L9
18
BK/WT
B2
C107
L9
18
BK/WT
3 C1
11 C1
1 C1
MULTI-FUNCTION SWITCH
1 LEFT
2 RIGHT
3 NORMAL
4 HAZARD
4 3 4 3 4 3 4 3
1 2 1 2
7 C1
4 C1
6 C1
2 C1
5 C1
IGNITION
BATTERY
L32
L91
GROUND
COMBO FLASHER
L63
18
DG/RD
L62
18
BR/RD
1
TURN SIGNAL LAMP
LEFT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-4)
(8W-51-5)
1
TURN SIGNAL LAMP
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-4)
(8W-51-5)


MULTI-
FUNCTION
SWITCH
1 LEFT
2 RIGHT
3 NORMAL
4 HAZARD
C1
L60
18
TN
L61
18
GY
S353
C202
B5
A6
INSTRUMENT
CLUSTER
(8W-40-10)
RIGHT
TURN
SIGNAL
LEFT
TURN
SIGNAL
C107
C110
B6
B9
S142
S141
RIGHT
SIDE
MARKER
LAMP
LEFT
SIDE
MARKER
LAMP
S144
(8W-70-2)
S143
(8W-70-2)
L7
18
BK/YL
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
Z1
18
BK
FRONT
FOG LAMPS
EXCEPT
FRONT
FOG LAMPS
S125
(8W-15-5)
S122
(8W-15-3)
S117
(8W-15-3)
Z1
16
BK
G103
(8W-15-5)
G102
(8W-15-3)

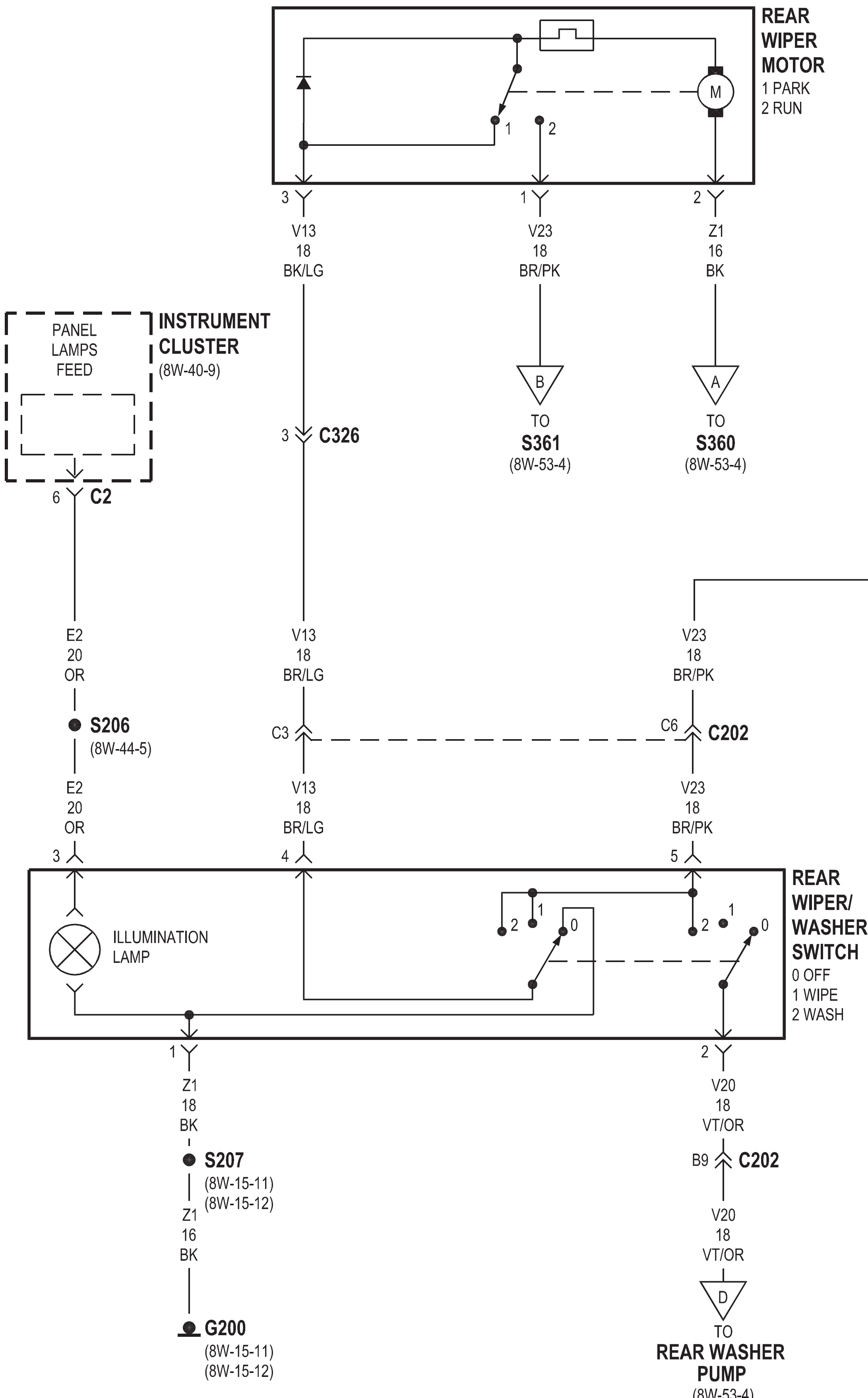

MULTI-
FUNCTION
SWITCH
1 LEFT
2 RIGHT
3 NORMAL
4 HAZARD
C1
L60
18
TN
L61
18
GY
S353
B5
A6
C202
C1
RIGHT
TURN
SIGNAL
LEFT
TURN
SIGNAL
INSTRUMENT
CLUSTER
(8W-40-10)
B6
B9
C107
C110
S142
S141
RIGHT
SIDE
REPEATER
LAMP
RIGHT
FRONT
TURN
SIGNAL
LAMP
LEFT
SIDE
REPEATER
LAMP
LEFT
FRONT
TURN
SIGNAL
LAMP
Z1
18
BK
S125
(8W-15-5)
S145
(8W-15-4)
S150
(8W-15-5)
S117
(8W-15-4)
Z1
16
BK
G103
(8W-15-5)
G102
(8W-15-4)

8W-53 WIPERS

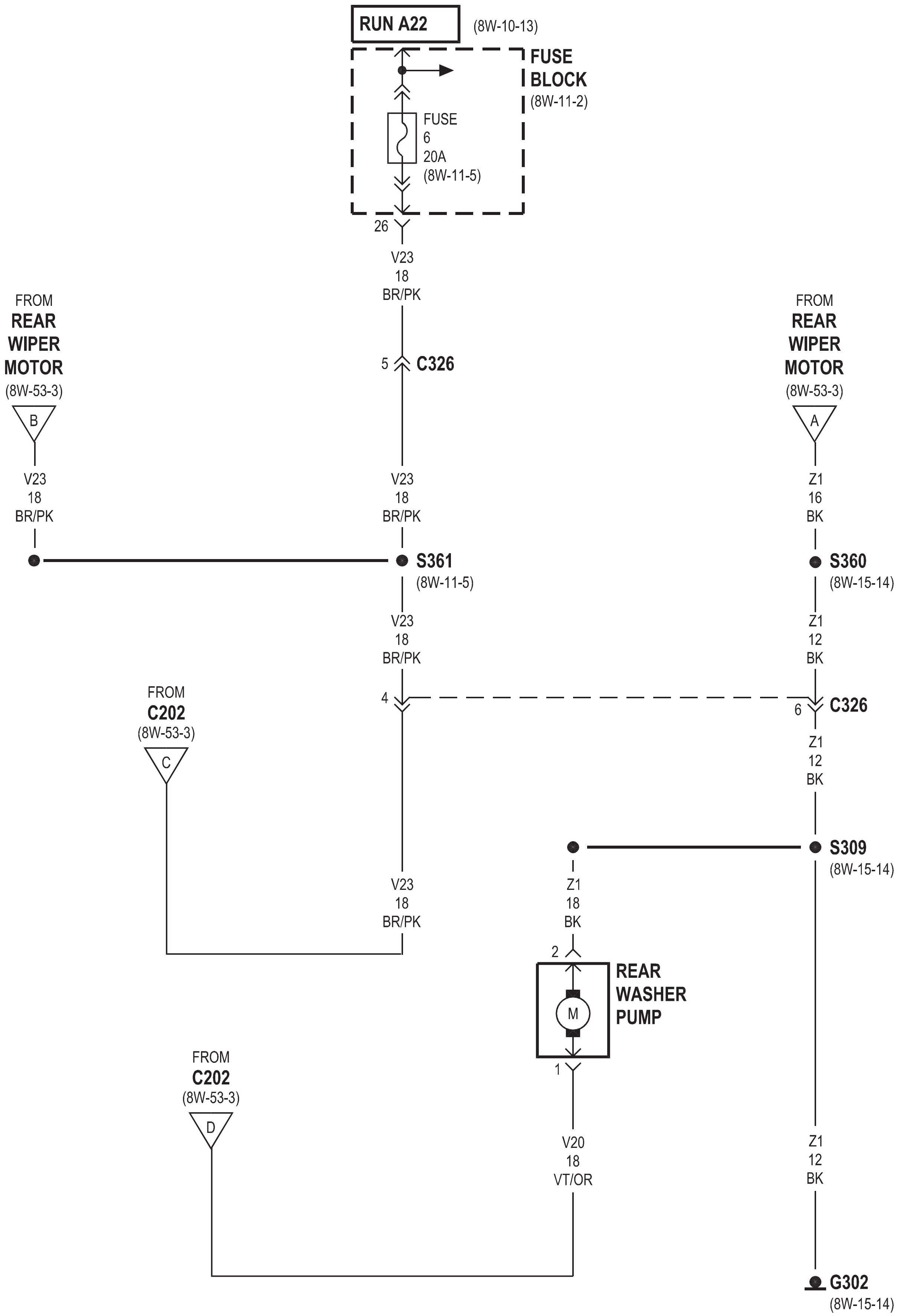


RUN-ACC A31
(8W-10-14)
FUSE BLOCK
(8W-11-2)
FUSE
17
25A
(8W-11-10)
37
V6
16
PK/BK
V6
16
PK/BK
4 C2
MULTI-FUNCTION SWITCH
0 OFF
1 MIST
2 DELAY
3 LOW
4 HIGH
5 WASH
6 MIN
7 MAX
DELAY LOGIC AND RELAY CONTROL
INTERNAL DELAY RELAY
2 C2
1 C2
6 C2
5 C2
3 C2
V5
16
DG/YL
V3
16
BR/WT
V4
16
RD/YL
V10
16
BR
C1 C107
V10
16
BR
8 C110
V10
16
BR
A
FRONT WASHER PUMP
M
B
Z1
18
BK
S117
(8W-15-3)
(8W-15-4)
Z1
16
BK
G102
(8W-15-3)
(8W-15-4)
FRONT WIPER MOTOR
1 PARK
2 RUN
3 LOW
4 HIGH
M
EXPORT
EXCEPT EXPORT
Z1
18
BK
Z1
20
BK
Z1
18
BK
S302
(8W-15-13)
Z1
16
BK/WT
G300
(8W-15-13)

HARD TOP

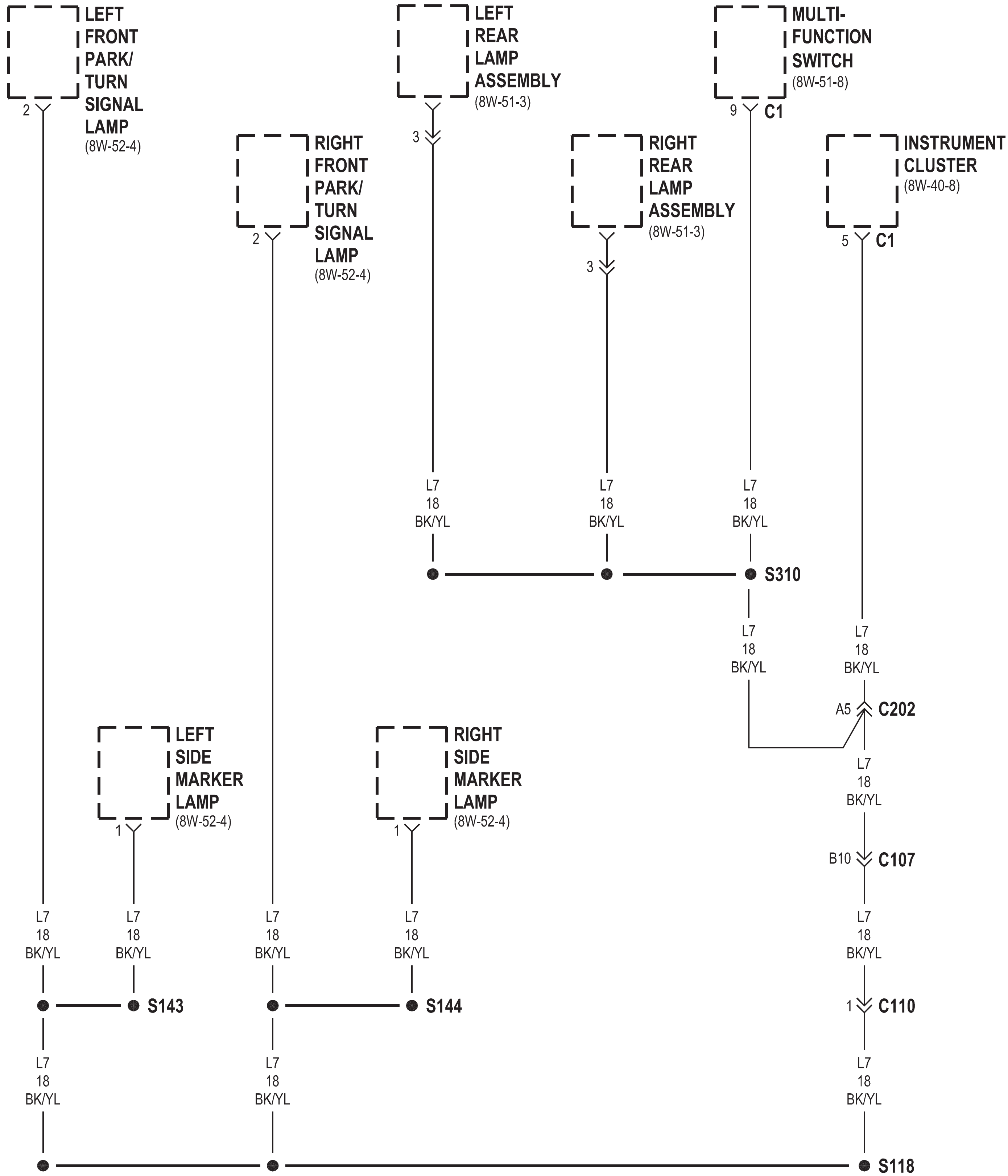

REAR WIPER MOTOR
1 PARK
2 RUN
M
1
2
3
1
2
V13
18
BK/LG
V23
18
BR/PK
Z1
16
BK
INSTRUMENT CLUSTER
(8W-40-9)
PANEL LAMPS FEED
B
TO S361
(8W-53-4)
A
TO S360
(8W-53-4)
3
C326
6
C2
V23
18
BR/PK
E2
20
OR
V13
18
BR/LG
S206
(8W-44-5)
C3
C6
C202
C
TO C326
(8W-53-4)
E2
20
OR
V13
18
BR/LG
V23
18
BR/PK
3
4
5
REAR WIPER/ WASHER SWITCH
0 OFF
1 WIPE
2 WASH
ILLUMINATION LAMP
2
1
0
2
1
0
1
2
Z1
18
BK
V20
18
VT/OR
S207
(8W-15-11)
(8W-15-12)
B9
C202
Z1
16
BK
V20
18
VT/OR
D
TO REAR WASHER PUMP
(8W-53-4)
G200
(8W-15-11)
(8W-15-12)

HARD TOP

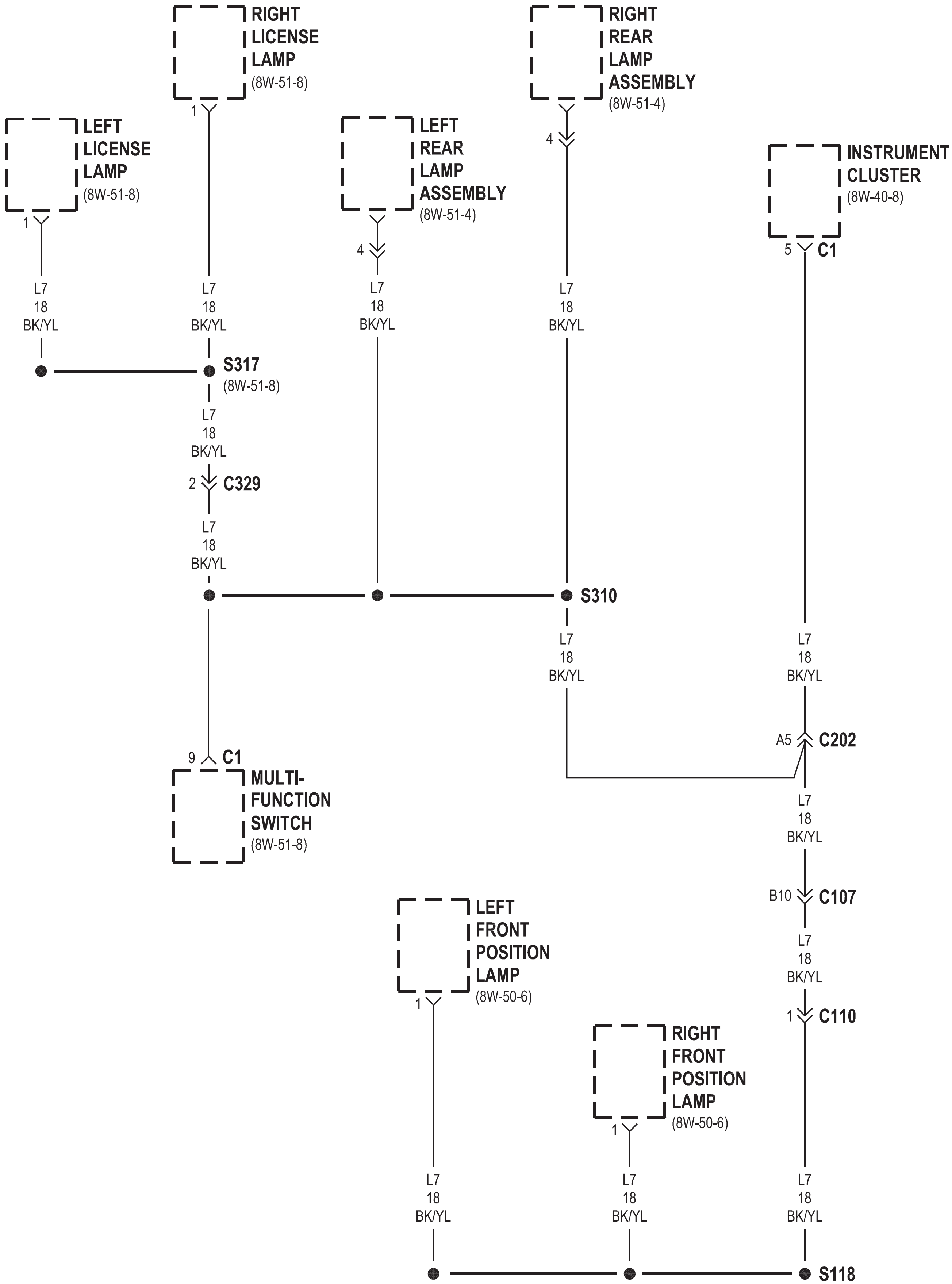

RUN A22
(8W-10-13)
FUSE
BLOCK
(8W-11-2)
FUSE
6
20A
(8W-11-5)
26
V23
18
BR/PK
FROM
REAR
WIPER
MOTOR
(8W-53-3)
B
5
C326
FROM
REAR
WIPER
MOTOR
(8W-53-3)
A
V23
18
BR/PK
V23
18
BR/PK
Z1
16
BK
S361
(8W-11-5)
S360
(8W-15-14)
V23
18
BR/PK
Z1
12
BK
FROM
C202
(8W-53-3)
C
4
6
C326
Z1
12
BK
S309
(8W-15-14)
V23
18
BR/PK
Z1
18
BK
2
REAR
WASHER
PUMP
M
1
FROM
C202
(8W-53-3)
D
V20
18
VT/OR
Z1
12
BK
G302
(8W-15-14)

8W-70 SPLICE INFORMATION

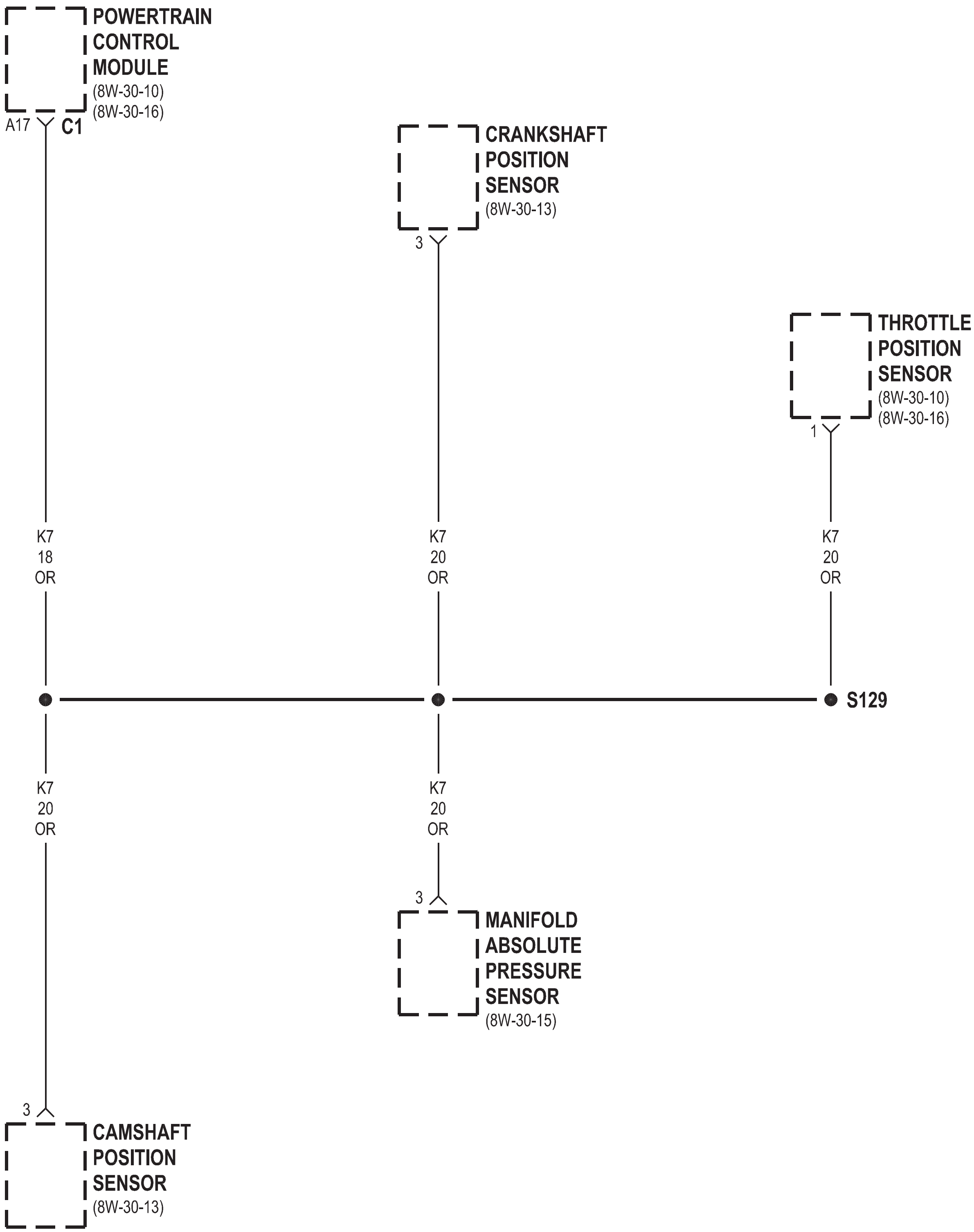
EXCEPT EXPORT



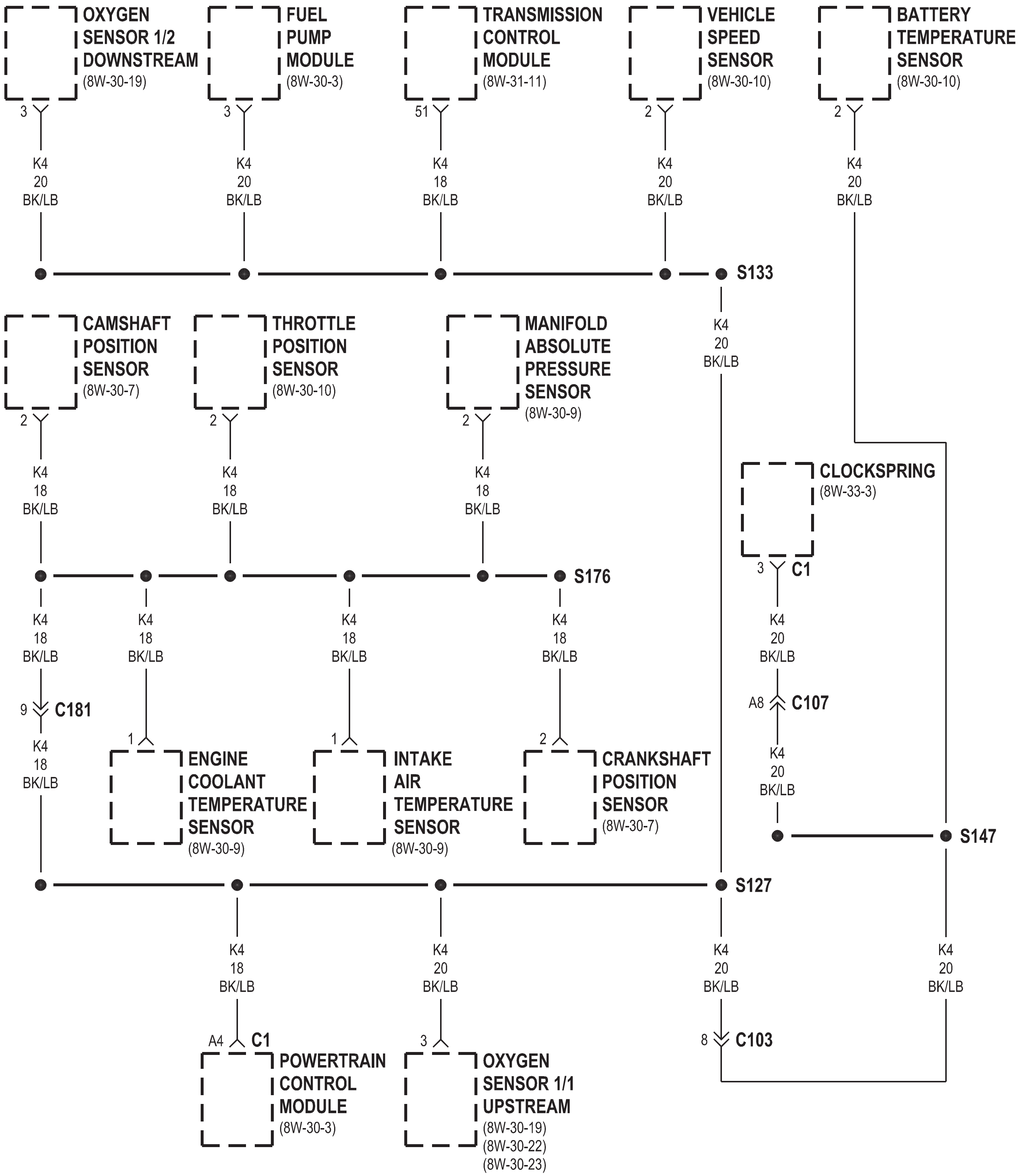
EXPORT


RIGHT
LICENSE
LAMP
(8W-51-8)
RIGHT
REAR
LAMP
ASSEMBLY
(8W-51-4)
LEFT
LICENSE
LAMP
(8W-51-8)
LEFT
REAR
LAMP
ASSEMBLY
(8W-51-4)
INSTRUMENT
CLUSTER
(8W-40-8)
5 C1
L7
18
BK/YL
S317
(8W-51-8)
2 C329
S310
A5 C202
9 C1
MULTI-
FUNCTION
SWITCH
(8W-51-8)
B10 C107
LEFT
FRONT
POSITION
LAMP
(8W-50-6)
1 C110
RIGHT
FRONT
POSITION
LAMP
(8W-50-6)
S118

4.0L

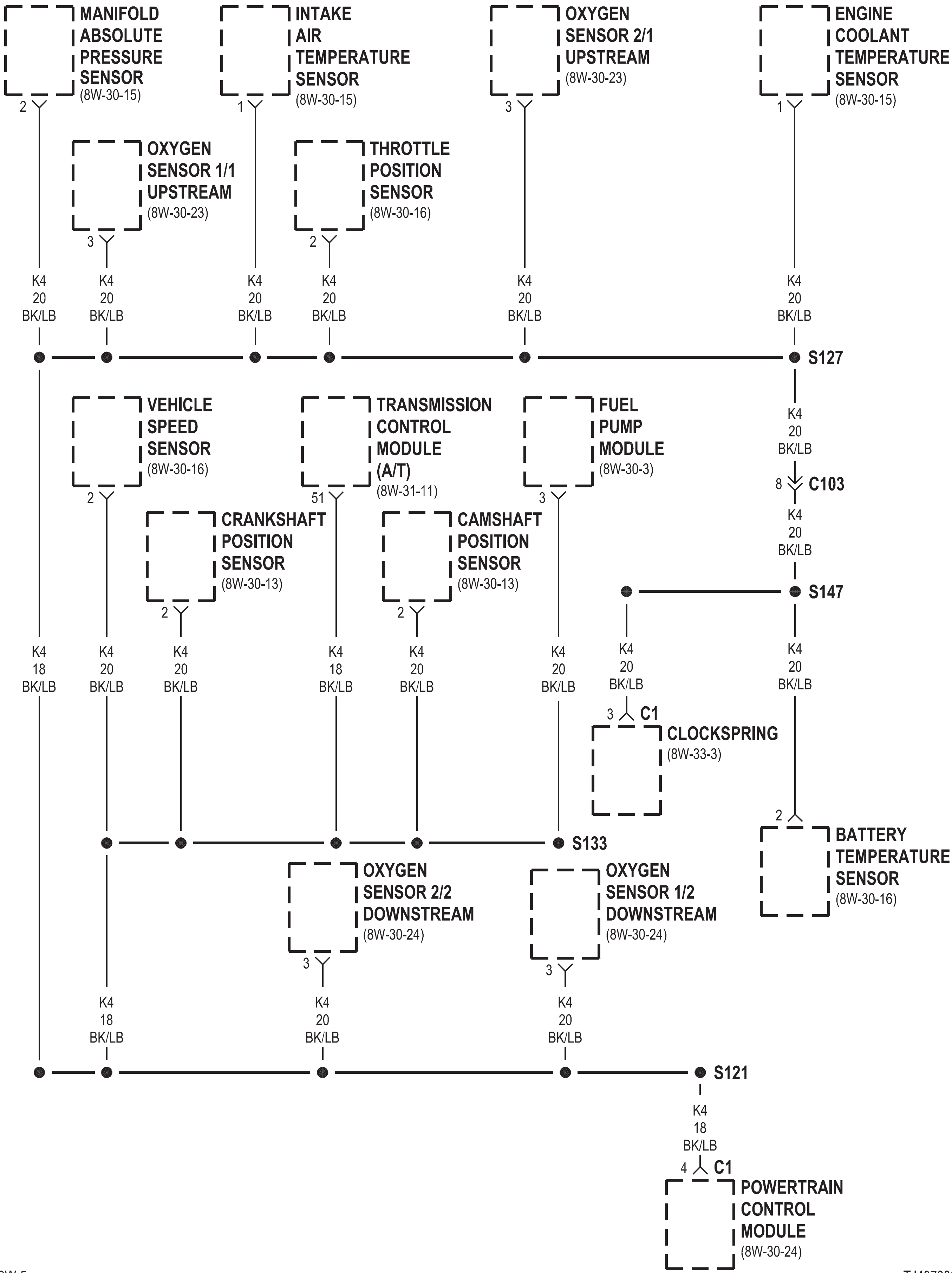

POWERTRAIN
CONTROL
MODULE
(8W-30-10)
(8W-30-16)
A17
C1
CRANKSHAFT
POSITION
SENSOR
(8W-30-13)
3
THROTTLE
POSITION
SENSOR
(8W-30-10)
(8W-30-16)
1
K7
18
OR
K7
20
OR
K7
20
OR
S129
K7
20
OR
K7
20
OR
3
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
(8W-30-15)
3
CAMSHAFT
POSITION
SENSOR
(8W-30-13)

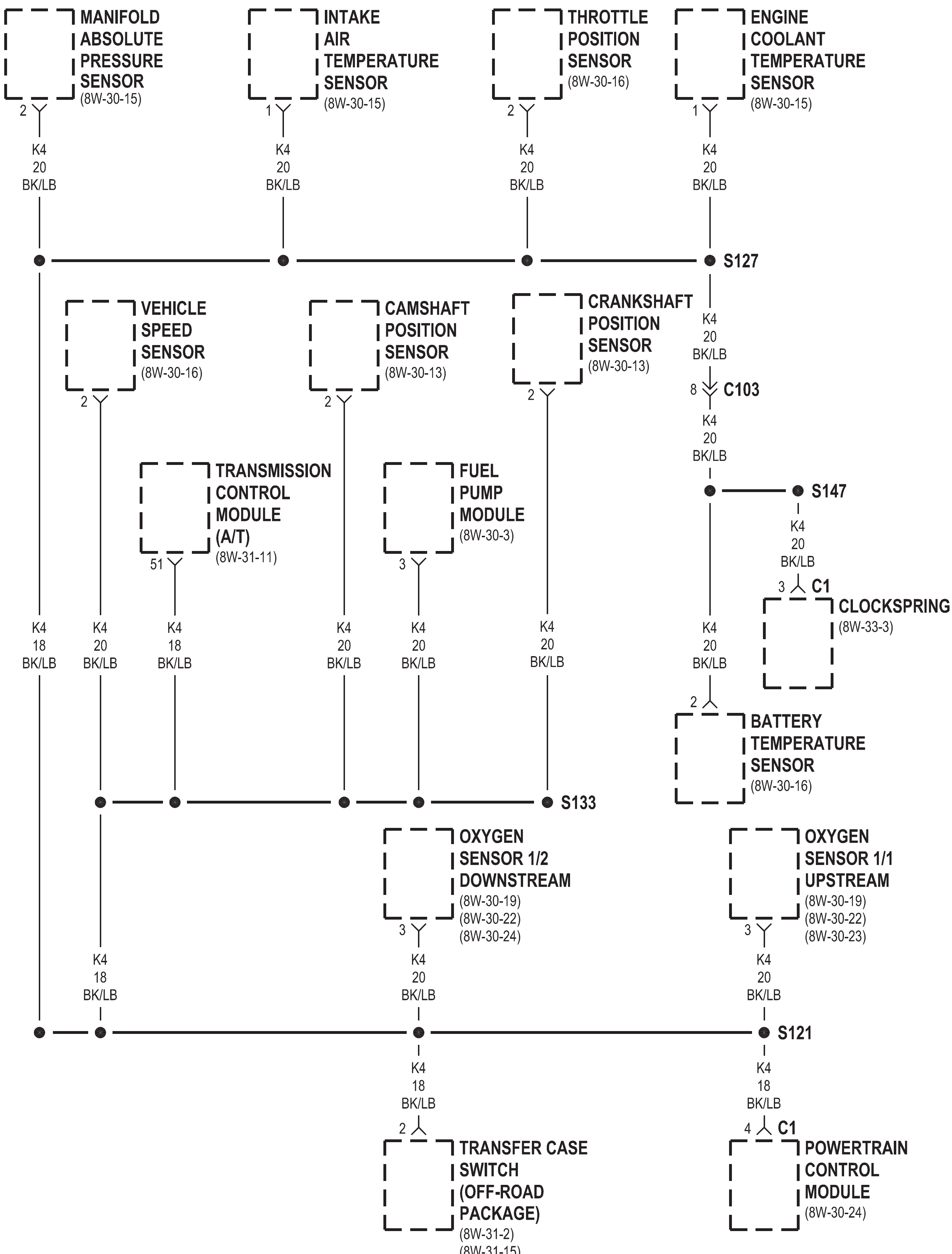
2.4L



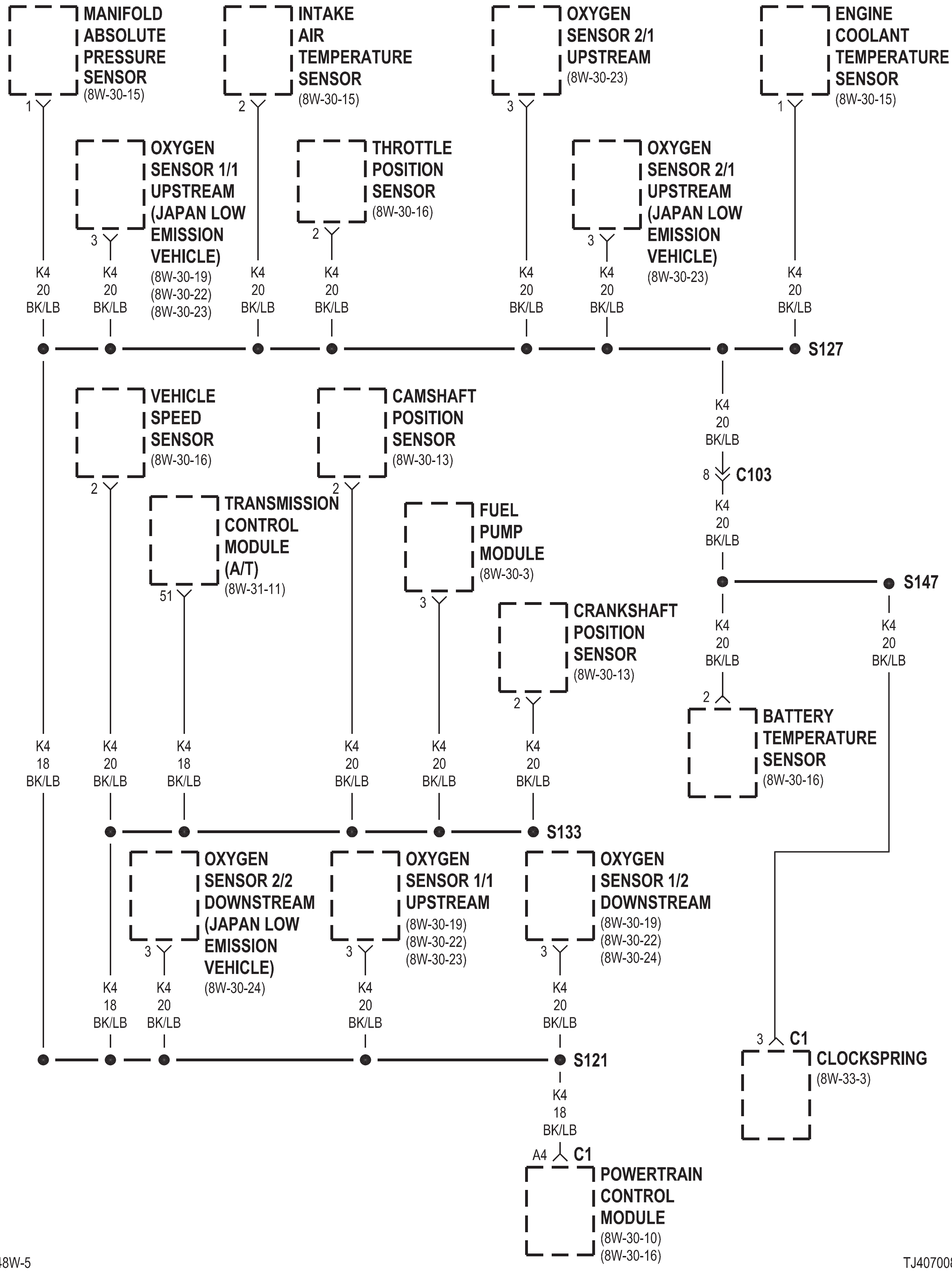
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-19)
FUEL PUMP MODULE
(8W-30-3)
TRANSMISSION CONTROL MODULE
(8W-31-11)
VEHICLE SPEED SENSOR
(8W-30-10)
BATTERY TEMPERATURE SENSOR
(8W-30-10)
K4
20
BK/LB
K4
18
BK/LB
S133
CAMSHAFT POSITION SENSOR
(8W-30-7)
THROTTLE POSITION SENSOR
(8W-30-10)
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-9)
CLOCKSPRING
(8W-33-3)
C1
S176
C181
C107
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-9)
INTAKE AIR TEMPERATURE SENSOR
(8W-30-9)
CRANKSHAFT POSITION SENSOR
(8W-30-7)
S147
S127
C103
POWERTRAIN CONTROL MODULE
(8W-30-3)
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-19)
(8W-30-22)
(8W-30-23)

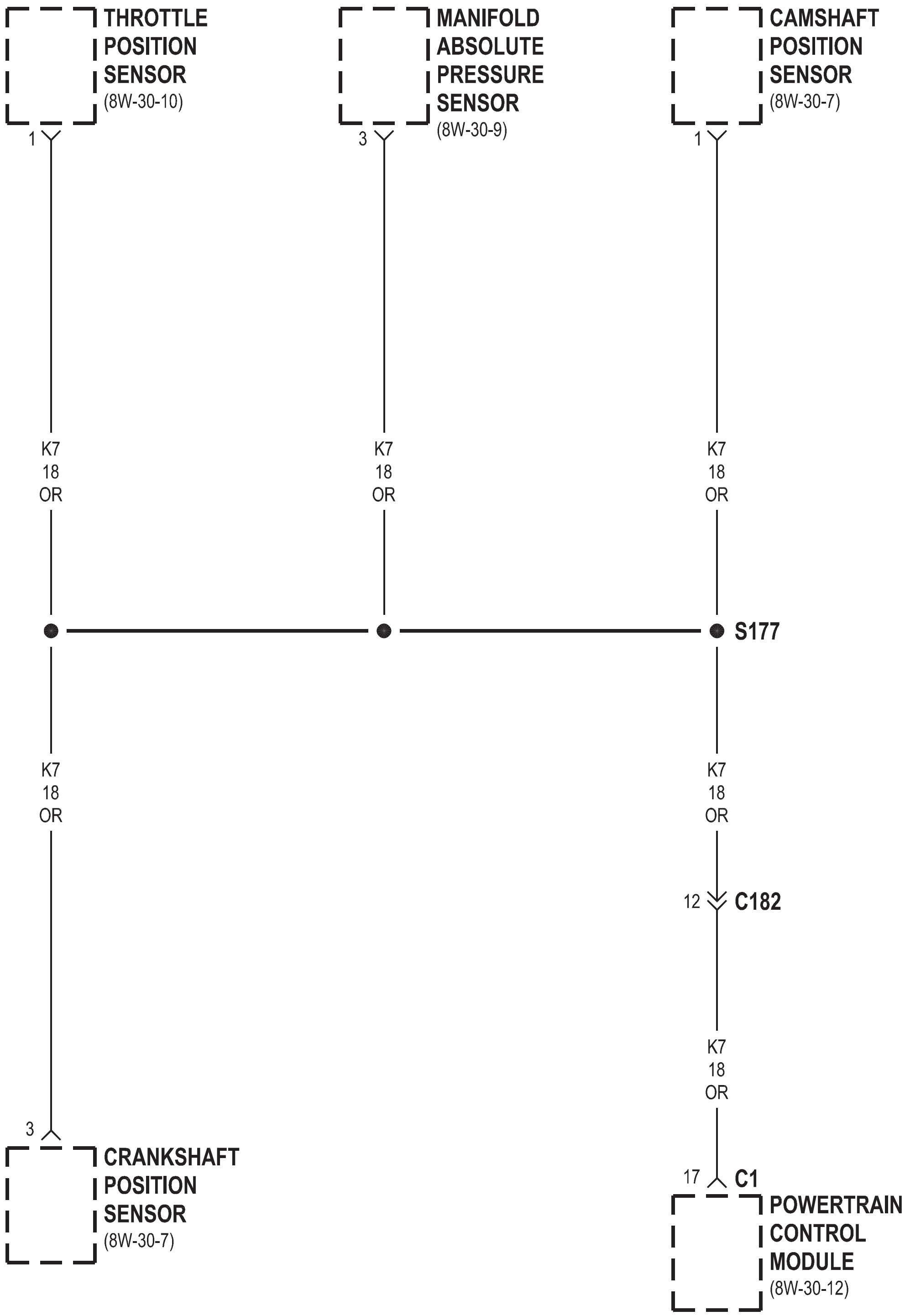
4.0L EXCEPT EXPORT



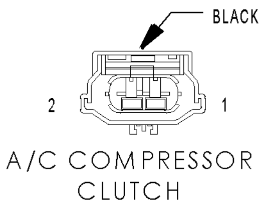

MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-15)
2
K4 20 BK/LB
INTAKE AIR TEMPERATURE SENSOR
(8W-30-15)
1
K4 20 BK/LB
THROTTLE POSITION SENSOR
(8W-30-16)
2
K4 20 BK/LB
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-15)
1
K4 20 BK/LB
S127
K4 20 BK/LB
8 C103
K4 20 BK/LB
S147
K4 20 BK/LB
3 C1
CLOCKSPRING
(8W-33-3)
VEHICLE SPEED SENSOR
(8W-30-16)
2
CAMSHAFT POSITION SENSOR
(8W-30-13)
2
CRANKSHAFT POSITION SENSOR
(8W-30-13)
2
TRANSMISSION CONTROL MODULE (A/T)
(8W-31-11)
51
FUEL PUMP MODULE
(8W-30-3)
3
K4 18 BK/LB
K4 20 BK/LB
K4 18 BK/LB
K4 20 BK/LB
K4 20 BK/LB
K4 20 BK/LB
K4 20 BK/LB
2
BATTERY TEMPERATURE SENSOR
(8W-30-16)
S133
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-19)
(8W-30-22)
(8W-30-24)
3
K4 20 BK/LB
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-19)
(8W-30-22)
(8W-30-23)
3
K4 20 BK/LB
K4 18 BK/LB
S121
K4 18 BK/LB
2
TRANSFER CASE SWITCH (OFF-ROAD PACKAGE)
(8W-31-2)
(8W-31-15)
K4 18 BK/LB
4 C1
POWERTRAIN CONTROL MODULE
(8W-30-24)

4.0L RHD EXPORT



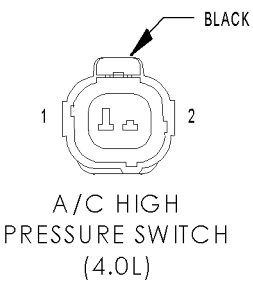

THROTTLE POSITION SENSOR
(8W-30-10)
1
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-9)
3
CAMSHAFT POSITION SENSOR
(8W-30-7)
1
K7
18
OR
K7
18
OR
K7
18
OR
S177
K7
18
OR
K7
18
OR
12
C182
K7
18
OR
3
CRANKSHAFT POSITION SENSOR
(8W-30-7)
17
C1
POWERTRAIN CONTROL MODULE
(8W-30-12)

8W-80 CONNECTOR PIN-OUTS



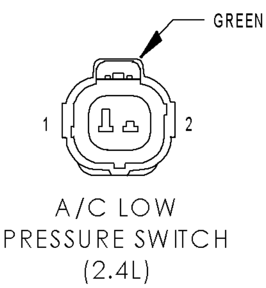
A/C COMPRESSOR CLUTCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK (2.4L)	A/C CLUTCH RELAY OUTPUT
1	C3 20DB/BK (4.0L)	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z246 18BK/OR (2.4L)	GROUND
2	Z1 20BK (4.0L)	GROUND



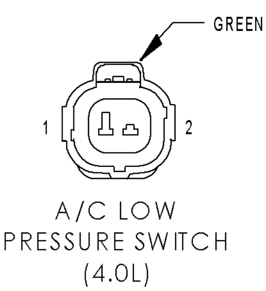
A/C HIGH PRESSURE SWITCH (4.0L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	C90 20LG	A/C SELECT SIGNAL
2	C22 20DB/WT	A/C SWITCH SIGNAL



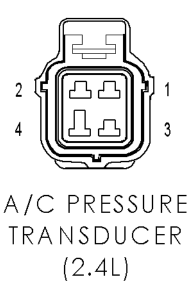
A/C LOW PRESSURE SWITCH (2.4L) - GREEN 2 WAY

CAV	CIRCUIT	FUNCTION
1	C21 18DB/OR	A/C SWITCH SENSE
2	C90 20LG	A/C SELECT INPUT



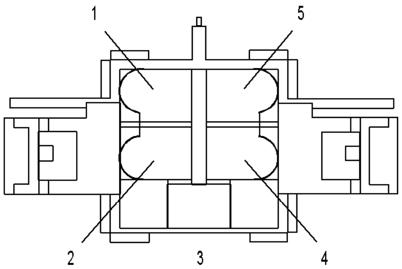
A/C LOW PRESSURE SWITCH (4.0L) - GREEN 2 WAY

CAV	CIRCUIT	FUNCTION
1	C21 20DB/OR	A/C REQUEST SIGNAL
2	C22 20DB/WT	A/C SWITCH SIGNAL



A/C PRESSURE TRANSDUCER (2.4L) - 4 WAY

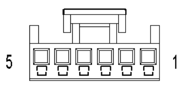
CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND 1
2	K6 20VT/WT	5 VOLT SUPPLY
3	C18 18DB	A/C PRESSURE SIGNAL
4	-	-



A/C
HEATER
CONTROL C1

A/C-HEATER CONTROL C1 - 5 WAY

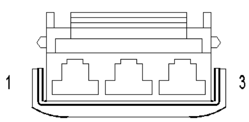
CAV	CIRCUIT	FUNCTION
1	C7 12BR/TN	BLOWER MOTOR HIGH SPEED
2	C6 14LB	BLOWER MOTOR M2 SPEED
3	C5 16LG/LB	BLOWER MOTOR M1 SPEED
4	C4 18TN	BLOWER MOTOR LOW SPEED
5	C1 12DG	BLOWER MOTOR FEED



A/C-HEATER
CONTROL C2

A/C-HEATER CONTROL C2 - 5 WAY

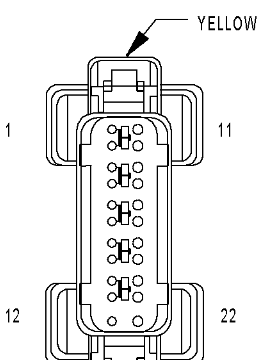
CAV	CIRCUIT	FUNCTION
1	Z11 20BK/WT (LHD)	GROUND
1	F24 20RD/DG (RHD)	FUSED IGNITION SWITCH OUTPUT (RUN)
2	C36 20DB/RD	BLEND DOOR FEEDBACK SIGNAL
3	F24 20RD/DG (LHD)	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z11 20BK/WT (RHD)	GROUND
4	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
5	Z1 20BK	GROUND



A/C-HEATER
CONTROL C3

A/C-HEATER CONTROL C3 - 3 WAY

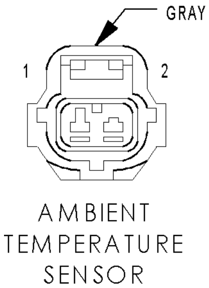
CAV	CIRCUIT	FUNCTION
1	C90 20LG	A/C SELECT INPUT
2	C1 12DG	BLOWER MOTOR FEED
3	Z1 12BK	GROUND



AIRBAG
CONTROL
MODULE

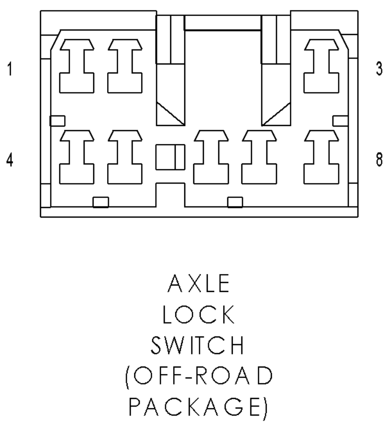
AIRBAG CONTROL MODULE - YELLOW 22 WAY

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1
3	-	-
4	-	-
5	R42 18BK/YL	PASSENGER SQUIB 1 LINE 1
6	R44 18DG/YL	PASSENGER SQUIB 1 LINE 2
7	-	-
8	R166 18LG/BR (PAD)	PASSENGER AIRBAG INDICATOR DRIVER
9	-	-
10	Z6 18BK/PK	GROUND
11	R65 18LG/OR (PAD)	PASSENGER AIRBAG MUX SWITCH SENSE
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
18	D25 18VT/YL	PCI BUS
19	-	-
20	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	-	-
22	R66 18YL/LG (PAD)	PASSENGER AIRBAG MUX SWITCH RETURN



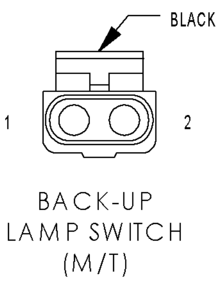
AMBIENT TEMPERATURE SENSOR - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
2	G32 20BK/LB	SENSOR GROUND



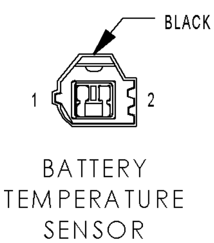
AXLE LOCK SWITCH (OFF-ROAD PACKAGE) - 8 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	E2 20OR	PANEL LAMPS FEED
3	M1 20PK/WT	FUSED B(+)
4	G302 20RD/WT	LOCKER ENABLE SIGNAL 1
5	G303 20VT/DG	LOCKER ENABLE SIGNAL 2
6	G305 20VT/LG	REAR LOCKER REQUEST
7	G304 20VT/DB	FRONT LOCKER REQUEST
8	-	-



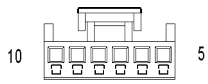
BACK-UP LAMP SWITCH (M/T) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
2	L1 20VT/BK	BACK-UP LAMP FEED



BATTERY TEMPERATURE SENSOR - BLACK 2 WAY

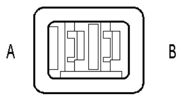
CAV	CIRCUIT	FUNCTION
1	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1



BLEND DOOR ACTUATOR

BLEND DOOR ACTUATOR - 6 WAY

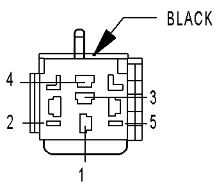
CAV	CIRCUIT	FUNCTION
5	-	-
6	-	-
7	Z11 20DB/WT	GROUND
8	C36 20YL	BLEND DOOR FEEDBACK SIGNAL
9	-	-
10	F24 20OR	FUSED IGNITION SWITCH OUTPUT (RUN)



BLOWER MOTOR

BLOWER MOTOR - 2 WAY

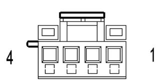
CAV	CIRCUIT	FUNCTION
A	C1 12DG	BLOWER MOTOR RELAY OUTPUT
B	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER



BLOWER MOTOR RELAY

BLOWER MOTOR RELAY - BLACK

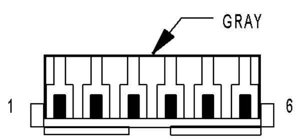
CAV	CIRCUIT	FUNCTION
1	C1 12DG	BLOWER MOTOR RELAY OUTPUT
2	Z1 20BK	GROUND
3	-	-
4	A111 12RD/LG	FUSED B(+)
5	F24 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN)



BLOWER MOTOR RESISTOR BLOCK

BLOWER MOTOR RESISTOR BLOCK - 4 WAY

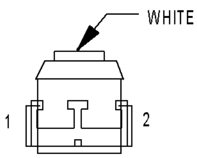
CAV	CIRCUIT	FUNCTION
1	C4 14TN	BLOWER MOTOR LOW DRIVER
2	C5 14LG	BLOWER MOTOR M1 DRIVER
3	C6 14LB	BLOWER MOTOR M2 DRIVER
4	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

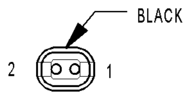
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	Z1 20BK/WT	GROUND
3	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
5	F32 18PK/DB	FUSED B(+)
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID

BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID - WHITE 2 WAY

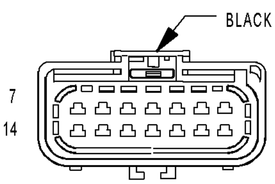
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)



BRAKE WARNING INDICATOR SWITCH

BRAKE WARNING INDICATOR SWITCH - BLACK 2 WAY

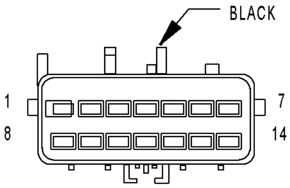
CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	BRAKE WARNING INDICATOR DRIVER
2	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER



C103

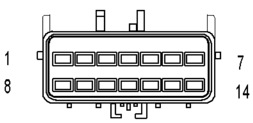
C103 - BLACK (DASH SIDE)

CAV	CIRCUIT
1	F142 18OR/DG
2	K125 18WT/DB
3	K6 20VT/WT (2.4L A/C)
3	C90 20LG (4.0L)
4	K99 18BR/OR
5	K299 18BR/WT
7	A242 18VT/OR (4.0L)
8	K4 20BK/LB
9	F15 20DB
10	-
11	Z12 20BK/TN
12	G7 20WT/OR (DRL)
13	T141 18YL/RD
14	C3 20DB/BK (A/C)



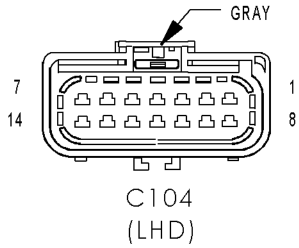
C103 - BLACK (ENGINE SIDE)

CAV	CIRCUIT
1	F142 18OR/DG
2	K125 18WT/DB
3	K6 20VT/WT (2.4L)
3	C90 20LG (4.0L)
4	K99 18BR/OR
5	K299 18BR/WT
6	-
7	A242 18VT/OR (4.0L EXCEPT EXPORT/ 4.0L JAPAN LOW EMISSION VEHICLE)
8	K4 20BK/LB
9	F15 18DB/WT
10	- -
11	Z12 20BK/TN
12	G7 20WT/OR (DRL)
13	T141 18YL/RD
14	C3 20DB/BK



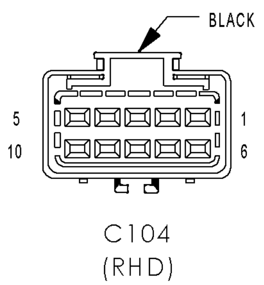
C104 (LHD) - (ENGINE SIDE)

CAV	CIRCUIT
1	A14 14RD/WT
2	C18 18DB (2.4L)
2	C21 20DB/OR (4.0L)
3	B1 18YL/DB (4.0L ABS)
3	G301 20VT/LB (4.0L OFF-ROAD PACK-AGE)
4	B2 18YL (4.0L ABS)
4	A850 18RD/WT (4.0L OFF-ROAD PACK-AGE)
5	T41 20BK/WT
6	B3 18LG/DB (4.0L ABS)
6	G300 20VT/WT (4.0L OFF-ROAD PACK-AGE)
7	B4 18LG (4.0L ABS)
7	A750 18TN/RD (4.0L OFF-ROAD PACK-AGE)
8	K226 20DB/LG
9	L1 20VT/BK
10	F20 20VT/WT
11	F42 18DG/LG
12	T40 12BR
13	G107 20BK/RD (4X4)
14	A141 18DG/WT



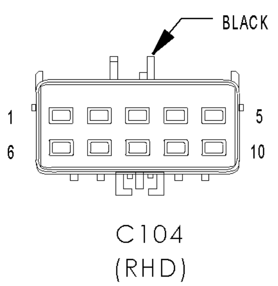
C104 (LHD) - GRAY (DASH SIDE)

CAV	CIRCUIT
1	A14 14RD/WT
2	C18 18DB (2.4L A/C)
2	C21 18DB/OR (4.0L)
3	B1 18YL/DB (ABS)
3	G301 20VT/LB (OFF-ROAD PACKAGE)
4	B2 18YL (ABS)
4	A850 18RD/WT (OFF-ROAD PACKAGE)
5	T41 20BR/LB
6	B3 18LG/DB (ABS)
6	G300 20VT/WT (OFF-ROAD PACKAGE)
7	B4 18LG (ABS)
7	A750 18TN/RD (OFF-ROAD PACKAGE)
8	K226 18DB/LG
9	L1 20VT/BK
10	F20 20VT/WT
11	F42 18DG/LG
12	T40 14BR
13	G107 20BK/RD
14	A141 18DG/WT



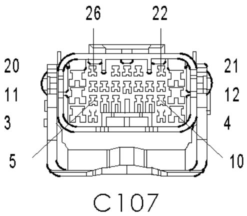
C104 (RHD) - BLACK (DASH SIDE)

CAV	CIRCUIT
1	A14 14RD/WT
2	C21 18DB/OR
3	A141 18DG/WT
4	F42 18DG/LG
5	T41 20BR/LB
6	T40 14BR
7	G107 20BK/RD
8	K226 18DB/LG
9	L1 20VT/BK
10	F20 20VT/WT



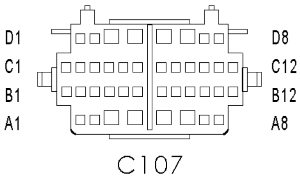
C104 (RHD) - BLACK (ENGINE SIDE)

CAV	CIRCUIT
1	A14 14RD/WT
2	C21 20DB/OR
3	A141 18DG/WT
4	F42 18DG/LG
5	T41 20BK/WT
6	T40 12BR
7	G107 20BK/RD
8	K226 20DB/LG
9	L1 20VT/BK
10	F20 20VT/WT



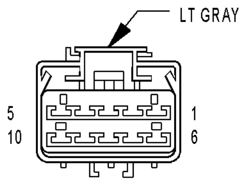
C107 - (BODY SIDE)

CAV	CIRCUIT
A1	V32 20YL/RD
A2	B41 20YL/VT (LHD)
A3	L3 14RD/OR
A4	L4 14VT/WT
A5	F3 14LB/OR
A6	F30 12RD/PK
A7	K125 18WT/DB (EXCEPT EXPORT)
A8	K4 20BK/LB
B1	V37 20RD/LG (EXCEPT RHD HARDTOP SUBWOOFER)
B1	V37 20RD/LB (RHD HARDTOP SUB-WOOFER)
B2	L9 18BK/WT
B3	M1 20PK/WT
B4	K29 20WT/PK
B5	G107 20BK/RD
B6	L60 18TN
B7	A1 18RD
B8	L1 20VT/BK
B9	L61 18GY
B10	L7 18BK/YL
B11	L50 18WT/TN
B12	X3 20RD/YL
C1	V10 16BR
C2	F61 16WT/OR (LHD EXCEPT EXPORT)
C3	V30 20DB/RD
C4	K106 18WT/DG (EXCEPT EXPORT)
C5	K107 18OR (EXCEPT EXPORT)
C6	L22 20LG/DG (EXPORT)
C7	F20 20VT/WT
C8	F15 20DB
C9	F39 16PK/LG (EXCEPT POSTAL)
C10	F12 20RD/LG
C11	G9 20GY/BK (LHD)
C12	B43 20PK/OR (LHD)
D1	T141 18YL/RD
D2	B42 20TN/WT (LHD)
D3	A6 12RD/BK
D4	A3 12RD/WT
D5	C15 12BK/WT (HARD TOP)
D6	A2 14BK/PK
D7	D25 20VT/YL
D8	-



C107 - (DASH SIDE)

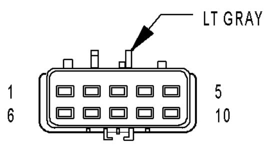
CAV	CIRCUIT
A1	V32 18YL/RD (SPEED CONTROL)
A2	B41 18YL/VT (ABS)
A3	L3 14RD/OR
A4	L4 14VT/WT
A5	F3 14LB/OR (DRL)
A6	F30 12RD/PK
A7	K125 18WT/DB
A8	K4 20 BK/LB
B1	V37 18RD/LB (SPEED CONTROL)
B2	L9 18BK/WT
B3	M1 20PK/WT
B3	M1 20PK/WT (ABS EXCEPT CANADA)
B4	K29 18WT/PK
B5	G107 20BK/RD
B6	L60 18TN
B7	A1 18RD
B8	L1 20VT/BK
B9	L61 18GY
B10	L7 18BK/YL
B11	L50 18WT/TN (ABS)
B12	X3 20RD/YL
C1	V10 16BR
C2	F61 16WT/OR (4.0L)
C3	V30 20DB/RD (SPEED CONTROL)
C4	K106 18WT/DG
C5	K107 18OR
C6	L22 20 LG/DG (EXCEPT CANADA)
C7	F20 20VT/WT
C8	F15 20DB
C9	F39 16PK/LG
C10	F12 20RD/LG
C11	G9 20GY/BK
C12	B43 18PK/OR (ABS)
D1	T141 18YL/RD
D2	B42 18TN/WT (ABS)
D3	A6 12RD/BK
D4	A3 12RD/WT
D5	C15 12BK/WT
D6	A2 14PK/BK
D7	D25 18VT/YL
D8	-



C109
(A/T)

C109 (A/T) - LT GRAY (DASH SIDE)

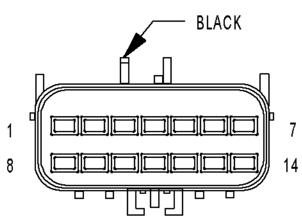
CAV	CIRCUIT
1	A30 16RD/WT
2	K30 18PK
3	T16 16RD
4	D21 18PK
5	D20 18LG/PK
6	D25 18VT/YL
7	T56 18DG/LB
8	-
9	T10 18YL/DG
10	T6 18OR/WT



C109
(A/T)

C109 (A/T) - LT GRAY (ENGINE SIDE)

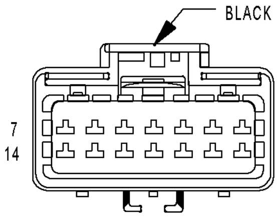
CAV	CIRCUIT
1	A30 16RD/WT
2	K30 18PK
3	T16 14RD
4	D21 18PK
5	D20 18LG
6	D25 18VT/YL
7	T56 18DG/LB
8	-
9	T10 18YL/DG
10	T6 18OR/WT



C110

C110 - BLACK (DASH SIDE)

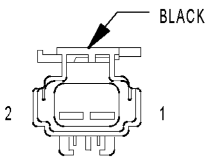
CAV	CIRCUIT
1	L7 18BK/YL
2	L60 18TN
3	L61 18GY
4	L3 14RD/OR
5	L4 14VT/WT
6	X2 18WT/RD
7	-
8	V10 16BR
9	L22 20LG/DG (HEADLAMP LEVELING)
10	G31 20VT/LG
11	G32 20BK/LB
12	-
13	L39 16LB (FRONT FOG LAMPS)
14	L13 20BR/YL (HEADLAMP LEVELING)



C110

C110 - BLACK (HEADLAMP SIDE)

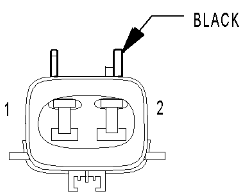
CAV	CIRCUIT
1	L7 18BK/YL
2	L60 18TN
3	L61 18GY
4	L3 14RD/OR
5	L4 14VT/WT
6	X2 18WT/RD
7	-
8	V10 16BR
9	L22 20LG/DG (EXPORT)
10	G31 20VT/LG
11	G32 20BK/LB
12	-
13	L39 16LB (FRONT FOG LAMPS)
14	L13 20BR/YL (EXPORT)



C115 (OFF-ROAD PACKAGE)

C115 (OFF-ROAD PACKAGE) - BLACK (ENGINE SIDE)

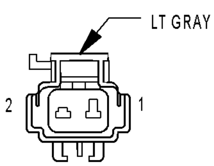
CAV	CIRCUIT
1	Z1 20BK
2	G300 20VT/WT



C115 (OFF-ROAD PACKAGE)

C115 (OFF-ROAD PACKAGE) - BLACK (FRONT FEEDBACK OVERLAY SIDE)

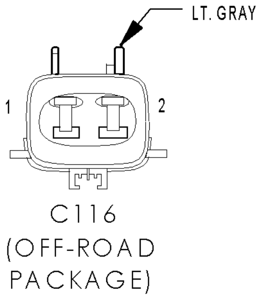
CAV	CIRCUIT
1	Z1 16BK
2	G300 16VT/WT



C116 (OFF-ROAD PACKAGE)

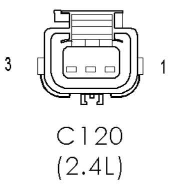
C116 (OFF-ROAD PACKAGE) - LT GRAY (ENGINE SIDE)

CAV	CIRCUIT
1	Z1 20BK
2	G301 20VT/LB



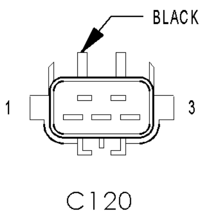
C116 (OFF-ROAD PACKAGE) - LT GRAY (REAR FEEDBACK OVERLAY SIDE)

CAV	CIRCUIT
1	Z1 16BK
2	G301 16VT/LB



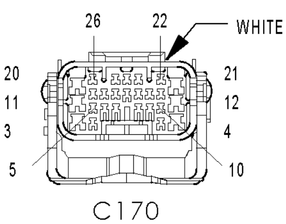
C120 (2.4L) - (DASH SIDE)

CAV	CIRCUIT
1	C23 12DG
2	Z213 12BK
3	C25 12YL



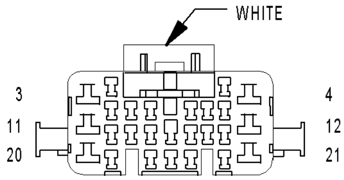
C120 (2.4L) - BLACK (ELECTRIC FAN JUMPER)

CAV	CIRCUIT
1	C25 12DG
2	Z213 12BK
3	C23 12DB



C170 - WHITE (DASH SIDE)

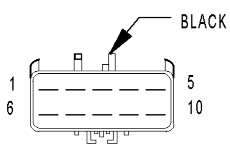
CAV	CIRCUIT
1	L13 20BR/YL (HEADLAMP LEVELING)
2	C81 20LB/WT
3	A111 12RD/LB
4	F60 16RD/WT
5	T56 18DG/LB (A/T)
6	C90 20LG (A/C)
7	T6 18OR/WT (A/T)
8	G31 20VT/LG
9	D32 18LG/WT
10	D21 18PK
11	F70 16PK/BK
12	G34 14RD/GY (CANADA)
12	L3 14RD/OR (EXCEPT CANADA)
13	G305 20VT/LG (OFF-ROAD PACKAGE)
14	Z12 20BK/TN
15	L3 14RD/OR
16	G300 20VT/WT (OFF-ROAD PACKAGE)
17	G301 20VT/LB (OFF-ROAD PACKAGE)
18	G32 20BK/LB
19	G19 20LG/OR (ABS)
20	L39 16LB
21	-
22	G99 20GY/WT
23	D20 18LG/PK (A/T)
24	G304 20VT/DB (OFF-ROAD PACKAGE)



C170

C170 - WHITE (I/P SIDE)

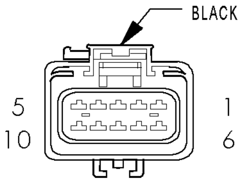
CAV	CIRCUIT
1	L13 20BR/YL (EXPORT)
2	C81 20LB/WT (HARD TOP)
3	A111 12RD/LB
4	F60 16RD/WT
5	T56 18DG/LB
6	C90 20LG
7	T6 18OR/WT
8	G31 20VT/LG
9	D32 20LG/WT
10	D21 20PK
11	F70 16PK/BK
12	G34 16RD/GY (EXCEPT RHD EXPORT)
12	L3 16RD/OR (RHD EXPORT)
13	G305 20VT/LG (OFF-ROAD PACKAGE)
14	Z12 20BK/TN
15	G34 16RD/GY
16	G300 20VT/WT (OFF-ROAD PACKAGE)
17	G301 20VT/LB (OFF-ROAD PACKAGE)
18	G32 20BK/LB
19	G19 20LG/OR (ABS)
20	Z12 20BK/TN
21	L39 16LB (EXCEPT EXPORT)
22	G99 20GY/WT
23	D20 20LG/PK
24	G304 20VT/DB (OFF-ROAD PACKAGE)



C181
(2.4L)

C181 (2.4L) - BLACK (ENGINE INTAKE SIDE)

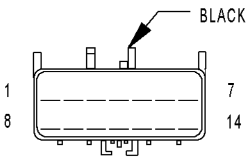
CAV	CIRCUIT
1	F142 18OR/DG
2	C3 18DB/BK
3	Z246 18BK/GR
4	K11 18WT/DB
5	K12 18TN
6	K13 18YL/WT
7	K14 18LB/BR
8	K44 18TN/YL
9	K4 18BK/LB
10	-



C181
(2.4L)

C181 (2.4L) - BLACK (ENGINE SIDE)

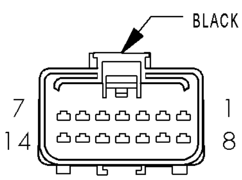
CAV	CIRCUIT
1	F42 18DG/LG
2	C3 20DB/BK
3	Z1 20BK
4	K11 18WT/DB
5	K12 18TN
6	K13 18YL/WT
7	K14 18LB/BR
8	K44 18TN/YL
9	K4 18TN/YL
10	-



C182
(2.4L)

C182 (2.4L) - BLACK (ENGINE INTAKE SIDE)

CAV	CIRCUIT
1	K59 18VT/BK
2	K40 18BR/WT
3	K60 18YL/BK
4	K39 18GY/RD
5	K21 18BK/RD
6	K2 18TN/BK
7	K1 18DG/RD
8	K22 18OR/DB
9	-
10	G60 18GY/YL
11	K24 18GY/BK
12	K7 18OR
13	-
14	-

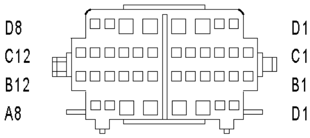


C182

(2.4L)

C182 (2.4L) - BLACK (ENGINE SIDE)

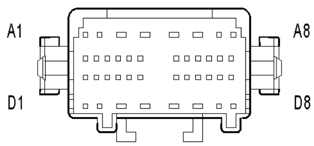
CAV	CIRCUIT
1	K59 18VT/BK
2	K40 18BR/WT
3	K60 18/YL/BK
4	K39 18GY/RD
5	K21 18BK/RD
6	K2 18TN/BK
7	K1 18DG/RD
8	K22 18OR/DB
9	K6 18VT/WT
10	G60 18GY/YL
11	K24 18GY/BK
12	K7 18OR
13	-
14	-



C202

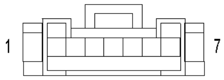
C202 - (BODY SIDE)

CAV	CIRCUIT
A1	-
A2	G75 20TN
A3	X55 18BR/RD (SUBWOOFER)
A4	X53 18DG (SUBWOOFER)
A5	L7 18BK/YL
A5	L7 18BK/YL
A6	L61 18GY
A6	L61 18GY
A7	L1 20VT/BK
A8	F38 16LB/WT
B1	F14 18LG/YL (RHD)
B2	G5 20DB/WT
B3	X52 18GY/DB
B4	X58 18DB/PK
B5	L60 18TN
B6	-
B7	G26 20LB
B8	R166 18LG/BR (PAD)
B9	V20 18VT/OR (HARD TOP)
B10	G107 20BK/RD
B11	F81 20DB/RD (HARD TOP)
B12	L38 18BR/WT (EXPORT)
C1	X12 20PK
C2	X16 20LG (SUBWOOFER)
C3	V13 18BR/LG (HARD TOP)
C4	G10 20LG/RD (EXCEPT LHD EXPORT)
C5	M2 20YL
C6	V23 18BR/PK (HARD TOP)
C7	E19 20RD
C8	-
C9	R66 18YL/LG (PAD)
C10	X51 18BR/YL
C11	X57 18BR/LB
C12	D25 20VT/YL
D1	L22 20LG/DG (EXPORT)
D2	G76 20TN/YL
D3	M1 20PK/WT
D3	M1 20PK/WT
D4	F24 20RD/DG
D5	X54 18VT (SUBWOOFER)
D6	X56 18DB (SUBWOOFER)
D7	E2 20OR
D8	R65 18LG/OR (PAD)



C202 - (I/P SIDE)

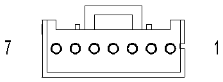
CAV	CIRCUIT
A1	-
A2	G75 20TN
A3	X55 18BR/RD (EXCEPT POSTAL)
A3	X55 18BR/RD (EXCEPT POSTAL)
A4	X53 18DG (EXCEPT POSTAL)
A4	X53 18DG (EXCEPT POSTAL)
A5	L7 18BK/YL
A6	L61 18GY
A7	L1 20VT/BK (EXCEPT POSTAL)
A8	F38 16LB/WT
B1	F14 18LG/YL (PAD)
B2	G5 20DB/WT
B3	X52 18DB/WT
B4	X58 18DB/PK
B5	L60 18TN
B6	-
B7	G26 20LB
B8	R166 18LG/BR (PAD)
B9	V20 18VT/OR (HARD TOP)
B10	G107 20BK/RD (4X4)
B11	F81 20DB/RD (HARD TOP)
B12	L38 16BR/WT (EXPORT)
C1	X12 20PK
C2	X16 20LG
C3	V13 18BR/LG (HARD TOP)
C4	G10 20LG/RD
C5	M2 20YL
C6	V23 18BR/PK (HARD TOP)
C7	E19 20RD
C8	-
C9	R66 18YL/DG (PAD)
C10	X51 18BR/YL
C11	X57 18BR/LB
C12	D25 20VT/YL
D1	L22 20LG/DG (EXPORT)
D2	G76 20TN/YL
D3	M1 20PK/WT
D4	F24 20RD/DG
D4	F24 20RD/DG
D5	X54 18VT (EXCEPT POSTAL)
D5	X54 18VT (EXCEPT POSTAL)
D6	X56 18DB (EXCEPT POSTAL)
D6	X56 18DB (EXCEPT POSTAL)
D7	E2 20OR
D8	R65 18LG/OR (PAD)



C203

C203 - (I/P SIDE)

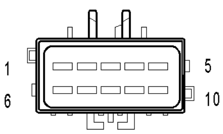
CAV	CIRCUIT
1	G5 20DB/WT
2	Z10 20BK
3	L1 20VT/BK
4	G31 20VT/LG
5	G32 20BK/LB
6	M2 20YL
7	M1 20PK/WT



C203

C203 - (MIRROR SIDE)

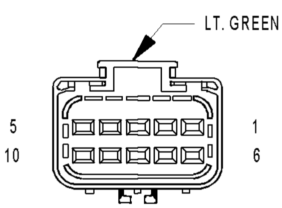
CAV	CIRCUIT
1	G5 20DB/WT
2	Z2 20BK/LG
3	L1 20VT/BK
4	G31 20VT/LG
5	G32 20BK/LB
6	M2 20YL
7	M1 20PK/WT



C205

C205 - (HVAC SIDE)

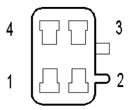
CAV	CIRCUIT
1	Z11 20DB/WT
2	C4 14TN
3	C5 14LG
4	C6 14LB
5	F24 20OR
6	C36 20YL
7	C7 12BK/TN
8	A111 12RD/LG
9	F24 20DB/WT
10	Z1 20BK



C205

C205 - LT GREEN (I/P SIDE)

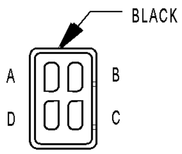
CAV	CIRCUIT
1	Z11 20BK/WT
2	C4 18TN
3	C5 16LG/LB
4	C6 14LB
5	F24 20RD/DG
5	F24 20RD/DG
6	C36 20DB/RD
7	C7 12BR/TN
8	A111 12RD/LB
9	F24 20RD/DG
10	Z1 20BK



C324

C324 - (BODY SIDE)

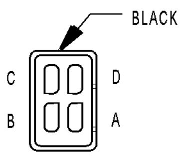
CAV	CIRCUIT
1	M1 20PK/WT
2	M2 20YL
3	X58 18DB/PK
4	X52 18GY/DB



C324

C324 - BLACK (SPEAKER POD JUMPER)

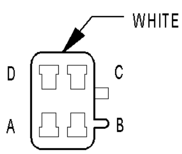
CAV	CIRCUIT
A	M1 20PK/WT
B	M2 20YL
C	X58 18DB/PK
D	X52 18GY/DB



C325

C325 - BLACK (SPEAKER POD JUMPER)

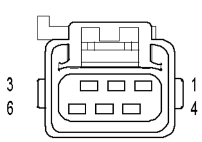
CAV	CIRCUIT
A	M1 20PK/WT
B	M2 20YL
C	X57 18BR/LB
D	X51 18BR/YL



C325

C325 - WHITE (BODY SIDE)

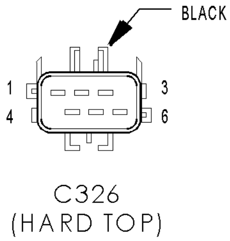
CAV	CIRCUIT
A	M1 20PK/WT
B	M2 20YL
C	X57 18BR/LB
D	X51 18BR/YL



C326
(HARDTOP)

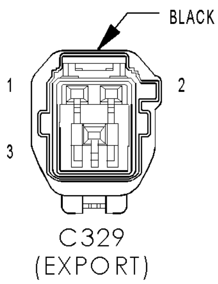
C326 (HARD TOP) - (BODY SIDE)

CAV	CIRCUIT
1	C15 12BK/WT
2	-
3	V13 18BR/LG
4	V23 18BR/PK
5	V23 18BR/PK
6	Z1 12BK



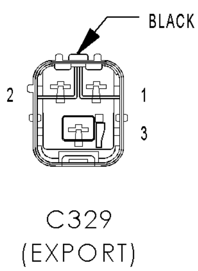
C326 (HARD TOP) - BLACK (HARD TOP SIDE)

CAV	CIRCUIT
1	C15 12BK/WT
2	-
3	V13 18BR/LG
4	V23 18BR/PK
5	V23 18BR/PK
6	Z1 12BK



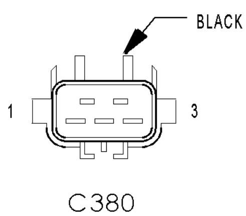
C329 (EXPORT) - BLACK (BODY SIDE)

CAV	CIRCUIT
1	L38 18BR/WT
2	L7 18BK/YL
3	Z1 20BK



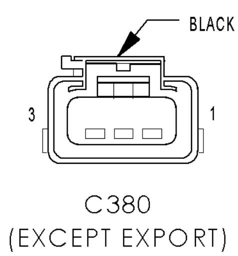
C329 (EXPORT) - BLACK (BUMPER SIDE)

CAV	CIRCUIT
1	L38 18BR/WT
2	L7 18BK/YL
3	Z1 20BK



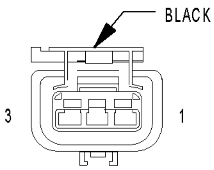
C380 - BLACK (LEAK DETECTION PUMP)

CAV	CIRCUIT
1	K107 18OR
2	K106 18WT/DG
3	K125 18WT/DB



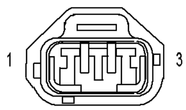
C380 (EXCEPT EXPORT) - BLACK (BODY SIDE)

CAV	CIRCUIT
1	K107 18OR
2	K106 18WT/DG
3	K125 18WT/DB



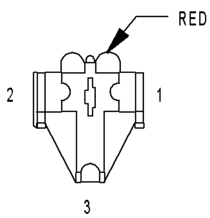
CAMSHAFT POSITION SENSOR (2.4L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND 1
3	K44 18TN/YL	CMP SIGNAL



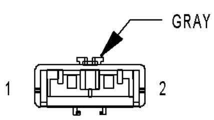
CAMSHAFT POSITION SENSOR (4.0L) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	K44 18TN/YL	CMP SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5V SUPPLY



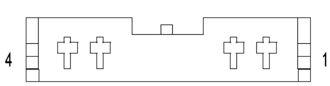
CIGAR LIGHTER/POWER OUTLET - RED 3 WAY

CAV	CIRCUIT	FUNCTION
1	F38 16LB/WT	FUSED CIGAR LIGHTER/ACCESSORY RELAY OUTPUT
2	-	-
3	Z1 16BK/WT	GROUND



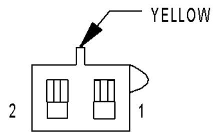
CIRCUIT BREAKER - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	A3 12RD/WT	HEADLAMP SWITCH RELAY FEED
2	F3 14LB/OR	DAYTIME RUNNING LAMP MODULE



CLOCKSPRING C1 - 4 WAY

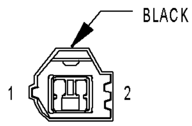
CAV	CIRCUIT	FUNCTION
1	X3 20RD/YL	HORN RELAY CONTROL
2	V37 20RD/LG (EXCEPT RHD HARDTOP SUBWOOFER)	SPEED CONTROL SWITCH SIGNAL
2	V37 20RD/LB (RHD HARDTOP SUB-WOOFER)	SPEED CONTROL SWITCH SIGNAL
3	K4 20BK/LB	SENSOR GROUND 1
4	-	-



CLOCKSPRING C2

CLOCKSPRING C2 - YELLOW 2 WAY

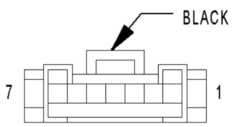
CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1



CLUTCH PEDAL POSITION SWITCH (M/T)

CLUTCH PEDAL POSITION SWITCH (M/T) - BLACK 2 WAY

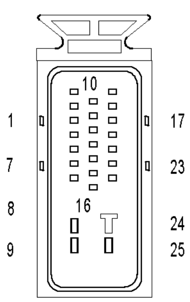
CAV	CIRCUIT	FUNCTION
1	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
2	A41 18YL	FUSED IGNITION SWITCH OUTPUT (START)



COMPASS/ TEMPERATURE MIRROR

COMPASS/TEMPERATURE MIRROR - BLACK 7 WAY

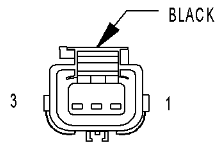
CAV	CIRCUIT	FUNCTION
1	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	Z2 20BK/LG	GROUND
3	L1 20VT/BK	BACK-UP LAMP FEED
4	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
5	G32 20BK/LB	SENSOR GROUND
6	M2 20YL	COURTESY LAMPS DRIVER
7	M1 20PK/WT	FUSED B(+)



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - 25 WAY

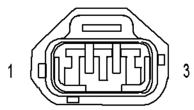
CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	B41 18YL/VT	G-SWITCH NO. 1 SENSE
7	B42 18TN/WT	G-SWITCH NO. 2 SENSE
8	Z22 12BK/PK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
13	B43 18PK/OR	G-SWITCH TEST SIGNAL
14	-	-
15	-	-
16	G83 18GY/BK	ABS RELAY CONTROL
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	-	-
20	D21 18PK	SCI TRANSMIT
21	-	-
22	-	-
23	F20 18VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
24	Z22 12BK/PK	GROUND
25	A10 12RD/DG	FUSED B(+)



CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T)

CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T) - BLACK 3 WAY

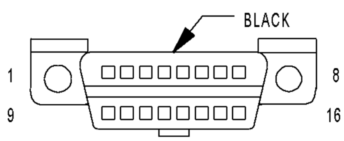
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK (2.4L)	CRANKSHAFT POSITION SENSOR SIGNAL
1	K7 20OR (4.0L)	5V SUPPLY
2	K4 18BK/LB (2.4L)	SENSOR GROUND 1
2	K4 20BK/LB (4.0L)	SENSOR GROUND 1
3	K7 18OR (2.4L)	5V SUPPLY
3	K24 18GY/BK (4.0L)	CRANKSHAFT POSITION SENSOR SIGNAL



CRANKSHAFT POSITION SENSOR (4.0L M/T)

CRANKSHAFT POSITION SENSOR (4.0L M/T) - 3 WAY

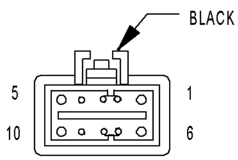
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5 VOLT SUPPLY



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

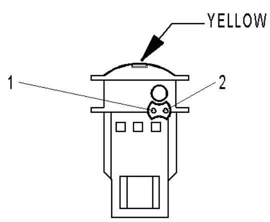
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D23 20WT/BR	FLASH PROGRAM ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



DAYTIME RUNNING LAMP MODULE (EXCEPT EXPORT)

DAYTIME RUNNING LAMP MODULE (EXCEPT EXPORT) - BLACK 10 WAY

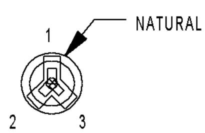
CAV	CIRCUIT	FUNCTION
1	L3 14RD/OR	HIGH BEAM INDICATOR DRIVER
2	-	-
3	-	-
4	G34 14RD/GY	HIGH BEAM INDICATOR DRIVER
5	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	F3 14LB/OR	FUSED B(+)
7	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
8	Z1 18BK	GROUND
9	-	-
10	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT



DRIVER AIRBAG SQUIB 1

DRIVER AIRBAG SQUIB 1 - YELLOW 2 WAY

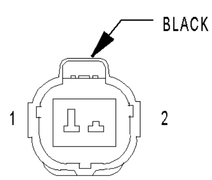
CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1



DRIVER DOOR AJAR SWITCH

DRIVER DOOR AJAR SWITCH - NATURAL 3 WAY

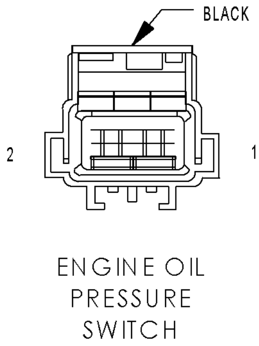
CAV	CIRCUIT	FUNCTION
1	M23 20YL/BK	DOOR AJAR SWITCH OUTPUT
2	-	-
3	G75 20TN	DRIVER DOOR AJAR SWITCH SENSE



ENGINE COOLANT TEMPERATURE SENSOR

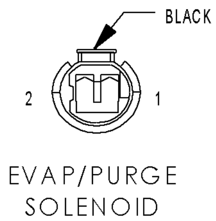
ENGINE COOLANT TEMPERATURE SENSOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (2.4L)	SENSOR GROUND 1
1	K4 20BK/LB (4.0L)	SENSOR GROUND 1
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



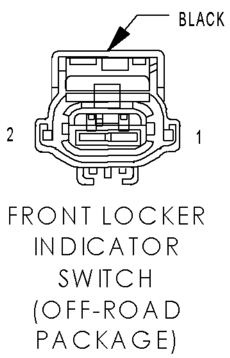
ENGINE OIL PRESSURE SWITCH - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	G60 18GY/YL	OIL PRESSURE SIGNAL
2	-	-



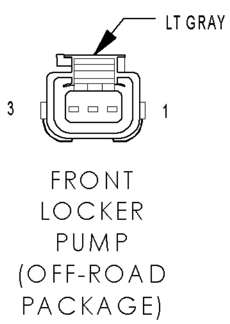
EVAP/PURGE SOLENOID - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
2	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)



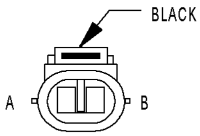
FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G300 16VT/WT	FRONT LOCKER INDICATOR SWITCH SENSE



FRONT LOCKER PUMP (OFF-ROAD PACKAGE) - LT GRAY 3 WAY

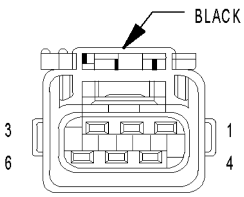
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT



FRONT
WASHER PUMP

FRONT WASHER PUMP - BLACK 2 WAY

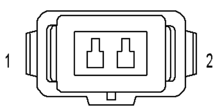
CAV	CIRCUIT	FUNCTION
A	V10 16BR	WASHER PUMP CONTROL SWITCH OUTPUT
B	Z1 18BK	GROUND



FRONT
WIPER MOTOR

FRONT WIPER MOTOR - BLACK 6 WAY

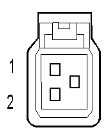
CAV	CIRCUIT	FUNCTION
1	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V5 16DG/YL	WIPER PARK SWITCH SENSE
3	-	-
4	Z1 18BK	GROUND
5	V3 16BR/WT	LOW SPEED WIPER SWITCH OUTPUT
6	V4 16RD/YL	WIPER SWITCH HIGH SPEED OUTPUT



FUEL INJECTOR NO. 1
(2.4L)

FUEL INJECTOR NO. 1 (2.4L) - 2 WAY

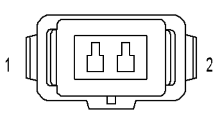
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER



FUEL INJECTOR NO. 1
(4.0L)

FUEL INJECTOR NO. 1 (4.0L) - 2 WAY

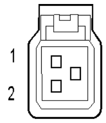
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER



FUEL INJECTOR NO. 2
(2.4L)

FUEL INJECTOR NO. 2 (2.4L) - 2 WAY

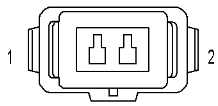
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	FUEL INJECTOR NO. 2 DRIVER



FUEL INJECTOR NO. 2 (4.0L)

FUEL INJECTOR NO. 2 (4.0L) - 2 WAY

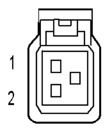
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	FUEL INJECTOR NO. 2 DRIVER



FUEL INJECTOR NO. 3 (2.4L)

FUEL INJECTOR NO. 3 (2.4L) - 2 WAY

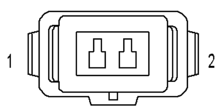
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER



FUEL INJECTOR NO. 3 (4.0L)

FUEL INJECTOR NO. 3 (4.0L) - 2 WAY

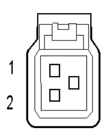
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER



FUEL INJECTOR NO. 4 (2.4L)

FUEL INJECTOR NO. 4 (2.4L) - 2 WAY

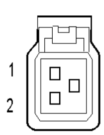
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER



FUEL INJECTOR NO. 4 (4.0L)

FUEL INJECTOR NO. 4 (4.0L) - 2 WAY

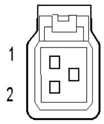
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER



FUEL INJECTOR NO. 5 (4.0L)

FUEL INJECTOR NO. 5 (4.0L) - 2 WAY

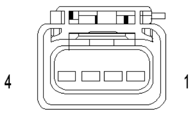
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K38 18GY	FUEL INJECTOR NO. 5 DRIVER



FUEL INJECTOR NO. 6
(4.0L)

FUEL INJECTOR NO. 6 (4.0L) - 2 WAY

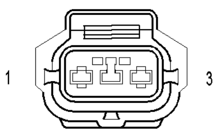
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER



FUEL
PUMP
MODULE

FUEL PUMP MODULE - 4 WAY

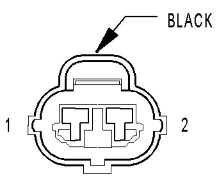
CAV	CIRCUIT	FUNCTION
1	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
2	K226 20DB/LG	FUEL LEVEL SENSOR SIGNAL
3	K4 20BK/LB	SENSOR GROUND 1
4	Z1 18BK	GROUND



G-SWITCH
(LHD)

G-SWITCH (LHD) - 3 WAY

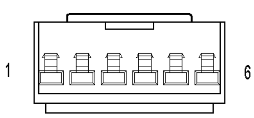
CAV	CIRCUIT	FUNCTION
1	B42 20TN/WT	G-SWITCH NO. 2 SENSE
2	B41 20YL/VT	G-SWITCH NO. 1 SENSE
3	B43 20PK/OR	G-SWITCH TEST SIGNAL



GENERATOR

GENERATOR - BLACK 2 WAY

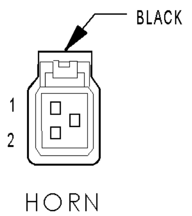
CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD



HEADLAMP
LEVELING
SWITCH
(EXPORT)

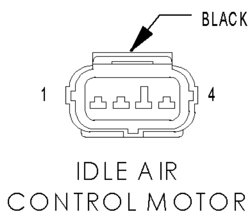
HEADLAMP LEVELING SWITCH (EXPORT) - 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	L22 20LG/DG	FUSED HEADLAMP SWITCH OUTPUT
3	-	-
4	Z1 20BK	GROUND
5	L13 20BR/YL	HEADLAMP ADJUST SIGNAL
6	-	-



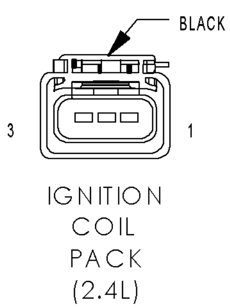
HORN - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18WT/RD	HORN RELAY OUTPUT



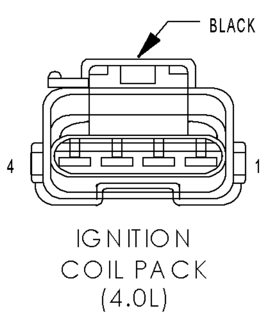
IDLE AIR CONTROL MOTOR - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
4	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER



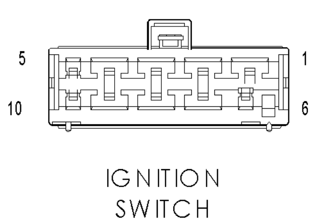
IGNITION COIL PACK (2.4L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K19 18GY	IGNITION COIL NO. 1 DRIVER



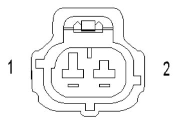
IGNITION COIL PACK (4.0L) - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
4	K18 18RD/YL	IGNITION COIL NO. 3 DRIVER



IGNITION SWITCH - 10 WAY

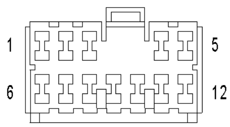
CAV	CIRCUIT	FUNCTION
1	A1 18RD	FUSED B(+)
2	A21 18DB	IGNITION SWITCH OUTPUT (RUN-START)
3	F22 12WT/PK	IGNITION SWITCH OUTPUT (RUN-ACC)
4	F30 12RD/PK	FUSED B(+)
5	G26 20LB	KEY-IN IGNITION SWITCH SENSE
6	A41 18YL	IGNITION SWITCH OUTPUT (START)
7	A31 18BK/DG	IGNITION SWITCH OUTPUT (RUN-ACC)
8	A22 14BK/OR	IGNITION SWITCH OUTPUT (RUN)
9	A2 14PK/BK	FUSED B(+)
10	Z1 16BK	GROUND



INPUT SPEED SENSOR

INPUT SPEED SENSOR - 2 WAY

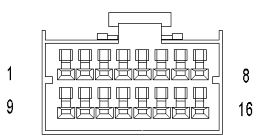
CAV	CIRCUIT	FUNCTION
1	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



INSTRUMENT CLUSTER C1

INSTRUMENT CLUSTER C1 - 12 WAY

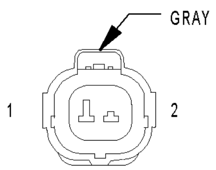
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	L60 18TN	RIGHT TURN SIGNAL
3	G34 16RD/GY (LHD)	HIGH BEAM INDICATOR DRIVER
3	L3 16RD/OR (RHD)	HIGH BEAM INDICATOR DRIVER
4	L39 16LB (EXCEPT EXPORT)	FOG LAMP FEED
4	L38 16BR/WT (EXPORT)	REAR FOG LAMP FEED
5	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
6	G305 20VT/LG (OFF-ROAD PACKAGE)	REAR LOCKER REQUEST
7	G301 20VT/LB (OFF-ROAD PACKAGE)	REAR LOCKER INDICATOR SWITCH SENSE
8	Z2 18BK/LG	GROUND
9	G303 20VT/DG (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 2
10	D23 20WT/BR	-
11	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	M1 20PK/WT	FUSED B(+)



INSTRUMENT CLUSTER C2

INSTRUMENT CLUSTER C2 - 16 WAY

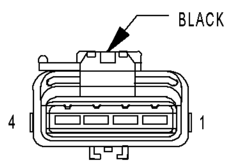
CAV	CIRCUIT	FUNCTION
1	C80 20DB/WT (HARD TOP)	REAR WINDOW DEFOGGER SWITCH SENSE
2	G10 20LG/RD	SEAT BELT SWITCH SENSE
3	G76 20TN/YL	PASSENGER DOOR AJAR SWITCH SENSE
4	G75 20TN	DRIVER DOOR AJAR SWITCH SENSE
5	M2 20YL	COURTESY LAMP FEED
6	E2 20OR	PANEL LAMPS FEED
7	C81 20LB/WT (HARD TOP)	REAR WINDOW DEFOGGER RELAY CONTROL
8	G19 20LG/OR (ABS)	ABS WARNING INDICATOR DRIVER
9	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER
10	G304 20VT/DB (OFF-ROAD PACKAGE)	FRONT LOCKER REQUEST
11	G107 20BK/RD (4X4)	4WD INDICATOR
12	D25 20VT/YL	PCI BUS
13	G26 20LB	KEY-IN IGNITION SWITCH SENSE
14	G302 20RD/WT (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 1
15	E19 20RD	PANEL LAMPS DIMMER SIGNAL
16	G300 20VT/WT (OFF-ROAD PACKAGE)	FRONT LOCKER INDICATOR SWITCH SENSE



INTAKE AIR TEMPERATURE SENSOR

INTAKE AIR TEMPERATURE SENSOR - GRAY 2 WAY

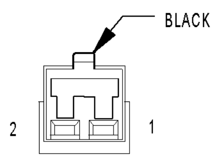
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (2.4L)	SENSOR GROUND 1
1	K4 20BK/LB (4.0L)	SENSOR GROUND 1
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL



LEAK DETECTION PUMP

LEAK DETECTION PUMP - BLACK 4 WAY

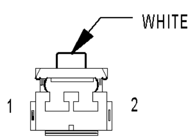
CAV	CIRCUIT	FUNCTION
1	-	-
2	K125 18WT/DB	GENERATOR SOURCE
3	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE



LEFT COURTESY LAMP

LEFT COURTESY LAMP - BLACK 2 WAY

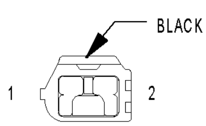
CAV	CIRCUIT	FUNCTION
1	M1 20PK/WT	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



LEFT DOME LAMP

LEFT DOME LAMP - WHITE 2 WAY

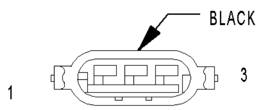
CAV	CIRCUIT	FUNCTION
1	M1 20PK/WT	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



LEFT FOG LAMP (EXCEPT EXPORT)

LEFT FOG LAMP (EXCEPT EXPORT) - BLACK 2 WAY

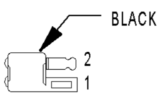
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L39 16LB	FOG LAMP RELAY NO. 1 OUTPUT



LEFT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT EXPORT)

LEFT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT EXPORT) - BLACK 3 WAY

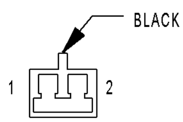
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
3	Z1 18BK	GROUND



LEFT FRONT POSITION LAMP (EXPORT)

LEFT FRONT POSITION LAMP (EXPORT) - BLACK 2 WAY

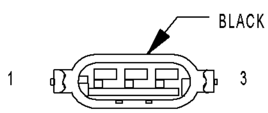
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



LEFT FRONT SPEAKER

LEFT FRONT SPEAKER - BLACK 2 WAY

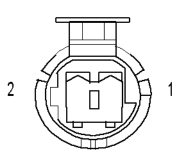
CAV	CIRCUIT	FUNCTION
1	X53 18DG	LEFT FRONT SPEAKER (+)
2	X55 18BR/RD	LEFT FRONT SPEAKER (-)



LEFT FRONT TURN SIGNAL LAMP (EXPORT)

LEFT FRONT TURN SIGNAL LAMP (EXPORT) - BLACK 3 WAY

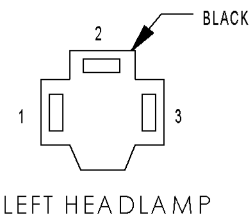
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	-	-
3	Z1 18BK	GROUND



LEFT FRONT WHEEL SPEED SENSOR

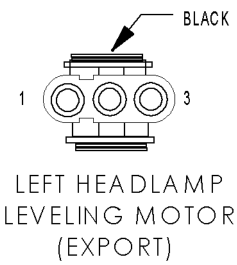
LEFT FRONT WHEEL SPEED SENSOR - 2 WAY

CAV	CIRCUIT	FUNCTION
1	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



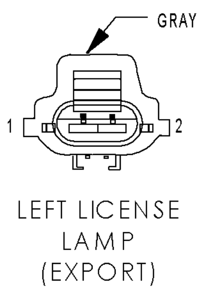
LEFT HEADLAMP - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
1	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
2	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
3	Z1 20BK	GROUND



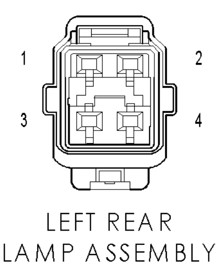
LEFT HEADLAMP LEVELING MOTOR (EXPORT) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	L22 20LG/DG	FUSED HEADLAMP SWITCH OUTPUT
2	L13 20BR/YL	HEADLAMP ADJUST SIGNAL
3	Z1 20BK	GROUND



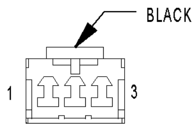
LEFT LICENSE LAMP (EXPORT) - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



LEFT REAR LAMP ASSEMBLY - 4 WAY

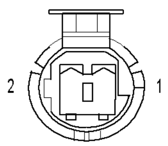
CAV	CIRCUIT	FUNCTION
1	L1 20VT/BK (EXCEPT EXPORT)	BACK-UP LAMP FEED
1	L63 18DG/RD (EXPORT)	LEFT TURN/STOP SIGNAL
2	L63 18DG/RD (EXCEPT EXPORT)	LEFT TURN/STOP SIGNAL
2	L1 20VT/BK (EXPORT)	BACK-UP LAMP FEED
3	L7 18BK/YL (EXCEPT EXPORT)	FUSED PARK LAMP RELAY OUTPUT
3	L50 18WT/TN (EXPORT)	BRAKE LAMP SWITCH OUTPUT
4	L7 18BK/YL (EXPORT)	FUSED PARK LAMP RELAY OUTPUT



LEFT REAR SPEAKER

LEFT REAR SPEAKER - BLACK 3 WAY

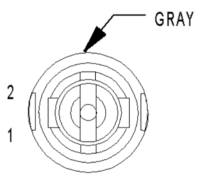
CAV	CIRCUIT	FUNCTION
1	X57 20BR/LB	LEFT REAR SPEAKER (-)
2	-	-
3	X51 18BR/YL	LEFT REAR SPEAKER (+)



LEFT REAR WHEEL SPEED SENSOR

LEFT REAR WHEEL SPEED SENSOR - 2 WAY

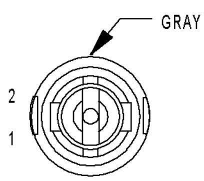
CAV	CIRCUIT	FUNCTION
1	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)



LEFT SIDE MARKER LAMP (EXCEPT EXPORT)

LEFT SIDE MARKER LAMP (EXCEPT EXPORT) - GRAY 2 WAY

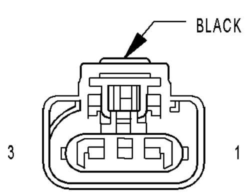
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	L61 18GY	LEFT TURN SIGNAL



LEFT SIDE REPEATER LAMP (EXPORT)

LEFT SIDE REPEATER LAMP (EXPORT) - GRAY 2 WAY

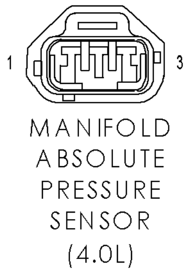
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	Z1 18BK	GROUND



MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L)

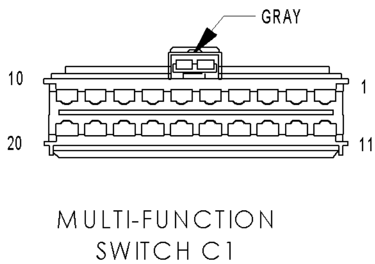
MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L) - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SIGNAL
2	K4 18BK/LB	SENSOR GROUND 1
3	K7 18OR	5 VOLT SUPPLY



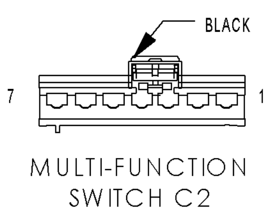
MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5V SUPPLY



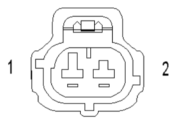
MULTI-FUNCTION SWITCH C1 - GRAY 20 WAY

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN (EXCEPT EXPORT)	BRAKE LAMP SWITCH OUTPUT
2	L61 18GY	LEFT TURN SIGNAL
3	L5 20BK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	L63 18DG/RD	LEFT TURN/STOP SIGNAL
5	L62 18BR/RD	RIGHT TURN/STOP SIGNAL
6	L60 18TN	RIGHT TURN SIGNAL
7	Z1 18BK (EXCEPT EXPORT)	GROUND
7	Z1 20BK (EXPORT)	GROUND
8	E19 20RD	PANEL LAMPS DRIVER
9	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
10	-	-
11	L9 18BK/WT	HAZARD FLASHER FEED
12	L38 18BR/WT (EXPORT)	REAR FOG LAMP FEED
13	F39 16PK/LG	FUSED B(+)
14	F61 16WT/OR (EXCEPT EXPORT)	FUSED FOG LAMP RELAY OUTPUT
15	-	-
16	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
17	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
18	F3 14LB/OR	FUSED B(+)
19	F3 14LB/OR	FUSED B(+)
20	F33 18PK/RD	FUSED B(+)



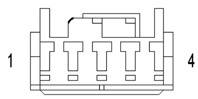
MULTI-FUNCTION SWITCH C2 - BLACK 7 WAY

CAV	CIRCUIT	FUNCTION
1	V5 16DG/YL	WIPER PARK SWITCH SENSE
2	Z1 20BK (EXCEPT EXPORT)	GROUND
2	Z1 18BK (EXPORT)	GROUND
3	V10 16BR	WASHER PUMP CONTROL SWITCH OUTPUT
4	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
5	V4 16RD/YL	WIPER SWITCH HIGH SPEED OUTPUT
6	V3 16BR/WT	LOW SPEED WIPER SWITCH OUTPUT
7	-	-



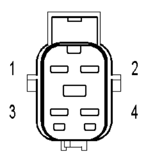
OUTPUT SPEED SENSOR - 2 WAY

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



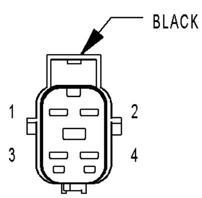
OVERDRIVE OFF SWITCH - 4 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
3	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
4	E2 20OR	PANEL LAMPS FEED



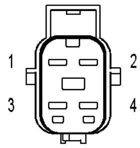
OXYGEN SENSOR 1/1 UPSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
3	K4 20BK/LB	SENSOR GROUND 1
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



OXYGEN SENSOR 1/2 DOWNSTREAM - BLACK 4 WAY

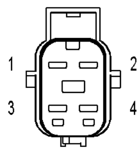
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
1	A242 18VT/OR (EXPORT/JAPAN LOW EMISSIONS VEHICLE)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	K299 18BR/WT (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 1/2 HEATER CONTROL
2	Z1 18BK (EXPORT/JAPAN LOW EMISSIONS VEHICLE)	GROUND
3	K4 20BK/LB	SENSOR GROUND 1
4	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL



OXYGEN SENSOR 2/1 UPSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)

OXYGEN SENSOR 2/1 UPSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE) - 4 WAY

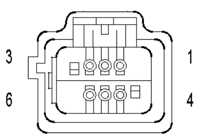
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K299 18BR/WT	O2 SENSOR 2/1 HEATER CONTROL
3	K4 20BK/LB	SENSOR GROUND 1
4	K241 18LG/RD	OXYGEN SENSOR 2/1 SIGNAL



OXYGEN SENSOR 2/2 UPSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)

OXYGEN SENSOR 2/2 DOWNSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE) - 4 WAY

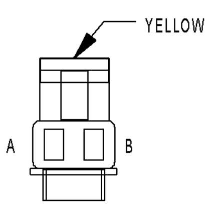
CAV	CIRCUIT	FUNCTION
1	A242 18VT/OR	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 20BK/LB	SENSOR GROUND 1
4	K341 18TN/WT	OXYGEN SENSOR 2/2 SIGNAL



PASSENGER AIRBAG ON-OFF SWITCH (LHD)

PASSENGER AIRBAG ON-OFF SWITCH (LHD) - 6 WAY

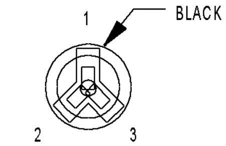
CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
2	R166 18LG/BR	PASSENGER AIRBAG INDICATOR DRIVER
3	R65 18LG/OR	PASSENGER AIRBAG MUX SWITCH SENSE
4	-	-
5	-	-
6	R66 18YL/LG	PASSENGER AIRBAG MUX SWITCH RETURN



PASSENGER AIRBAG SQUIB 1

PASSENGER AIRBAG SQUIB 1 - YELLOW 2 WAY

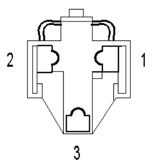
CAV	CIRCUIT	FUNCTION
A	R44 18DG/YL	PASSENGER SQUIB 1 LINE 2
B	R42 18BK/YL	PASSENGER SQUIB 1 LINE 1



PASSENGER DOOR AJAR SWITCH

PASSENGER DOOR AJAR SWITCH - BLACK 3 WAY

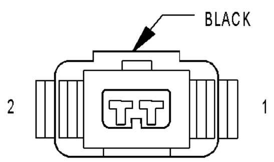
CAV	CIRCUIT	FUNCTION
1	M23 20YL/BK	DOOR AJAR SWITCH OUTPUT
2	-	-
3	G76 20TN/YL	PASSENGER DOOR AJAR SWITCH SENSE



POWER OUTLET

POWER OUTLET - 3 WAY

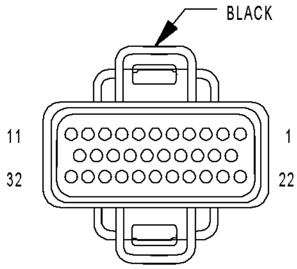
CAV	CIRCUIT	FUNCTION
1	F70 16PK/BK	FUSED B(+)
2	-	-
3	Z1 16BK	GROUND



POWER STEERING PRESSURE SWITCH (2.4L)

POWER STEERING PRESSURE SWITCH (2.4L) - BLACK 2 WAY

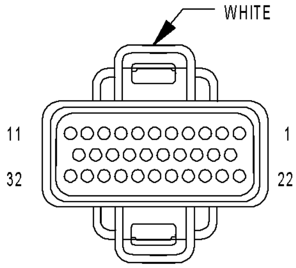
CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE
2	Z1 20BK	GROUND



POWERTRAIN CONTROL MODULE C1

POWERTRAIN CONTROL MODULE C1 - BLACK 32 WAY

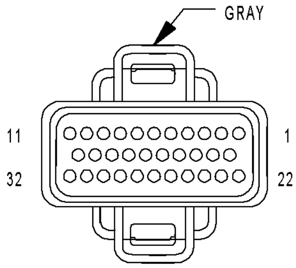
CAV	CIRCUIT	FUNCTION
1	K18 18RD/YL (4.0L)	IGNITION COIL NO. 3 DRIVER
2	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	-	-
4	K4 18BK/LB	SENSOR GROUND 1
5	-	-
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	-	-
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR (2.4L)	POWER STEERING PRESSURE SWITCH SENSE
13	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
14	K77 18BK/WT (OFF-ROAD PACKAGE)	TRANSFER CASE POSITION SENSOR INPUT
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5V SUPPLY
18	K44 18TN/YL	CMP SIGNAL
19	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	-	-
22	A14 14RD/WT	FUSED B(+)
23	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (4.0L EXCEPT EXPORT/ 4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT EXPORT/ 4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2

POWERTRAIN CONTROL MODULE C2 - WHITE 32 WAY

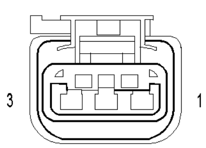
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY (4.0L)	FUEL INJECTOR NO. 5 DRIVER
7	-	-
8	-	-
9	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
10	K20 18DG	GENERATOR FIELD
11	-	-
12	K58 18BR/DB (4.0L)	FUEL INJECTOR NO. 6 DRIVER
13	-	-
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	-	-
18	-	-
19	C18 18DB (2.4L)	A/C PRESSURE SIGNAL
20	-	-
21	-	-
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SIGNAL
24	-	-
25	-	-
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	K6 18VT/WT	5V SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3

POWERTRAIN CONTROL MODULE C3 - GRAY 32 WAY

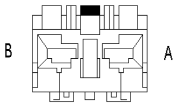
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR (A/C)	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	C24 18DB/PK (2.4L)	LOW SPEED RADIATOR FAN RELAY CONTROL
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD (SPEED CONTROL)	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD (SPEED CONTROL)	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.0L)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
10	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18YL/RD (SPEED CONTROL)	SPEED CONTROL ON/OFF SWITCH SENSE
12	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (A/T)	TORQUE MANAGEMENT REQUEST SENSE
14	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE
15	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR HEATER CONTROL
17	-	-
18	-	-
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
21	C27 18DB (2.4L)	HIGH SPEED RADIATOR FAN RELAY CONTROL
22	C21 18DB/OR (A/C)	A/C SWITCH SENSE
23	C90 18LG (A/C)	A/C SELECT INPUT
24	K29 18WT/PK	BRAKE LAMP SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18DB/LG (4.0L)	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/WT	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LB (SPEED CONTROL)	SPEED CONTROL SWITCH SIGNAL



RADIATOR FAN MOTOR (2.4L)

RADIATOR FAN MOTOR (2.4L) - 2 WAY

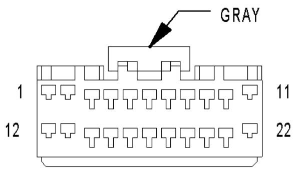
CAV	CIRCUIT	FUNCTION
1	C25 12DG	RADIATOR FAN RELAY OUTPUT
2	Z213 12BK	GROUND
3	C23 12DB	FUSED HIGH SPEED RADIATOR RELAY OUTPUT



RADIATOR FAN MOTOR CIRCUIT BREAKER (2.4L)

RADIATOR FAN MOTOR CIRCUIT BREAKER (2.4L) - 2 WAY

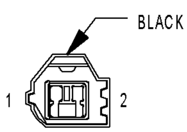
CAV	CIRCUIT	FUNCTION
A	Z213 12BK	GROUND
B	Z213 12BK	GROUND



RADIO

RADIO - GRAY 22 WAY

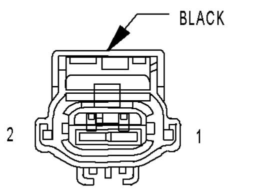
CAV	CIRCUIT	FUNCTION
1	F60 16RD/WT	FUSED B(+)
2	X12 20PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	E2 20OR	PANEL LAMPS DRIVER
4	-	-
5	-	-
6	-	-
7	X54 18VT	RIGHT FRONT SPEAKER (+)
8	X56 18DB	RIGHT FRONT SPEAKER (-)
9	X55 18BR/RD	LEFT FRONT SPEAKER (-)
10	X53 18DG	LEFT FRONT SPEAKER (+)
11	Z9 16BK	GROUND
12	F60 16RD/WT	FUSED B(+)
13	X16 20LG	RADIO 12V OUTPUT
14	D25 20VT/YL	PCI BUS
15	-	-
16	-	-
17	-	-
18	X51 18BR/YL	LEFT REAR SPEAKER (+)
19	X57 18BR/LB	LEFT REAR SPEAKER (-)
20	X58 18DB/PK	RIGHT REAR SPEAKER (-)
21	X52 18DB/WT	RIGHT REAR SPEAKER (+)
22	Z9 16BK	GROUND



REAR FOG LAMP (EXPORT)

REAR FOG LAMP (EXPORT) - BLACK 2 WAY

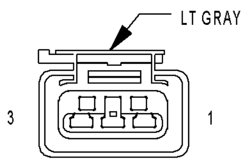
CAV	CIRCUIT	FUNCTION
1	L38 18BR/WT	REAR FOG LAMP FEED
2	Z1 20BK	GROUND



REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

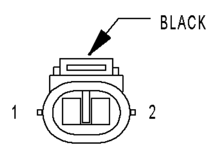
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G301 16VT/LB	REAR LOCKER INDICATOR SWITCH SENSE



REAR LOCKER PUMP (OFF-ROAD PACKAGE)

REAR LOCKER PUMP (OFF-ROAD PACKAGE) - LT GRAY 3 WAY

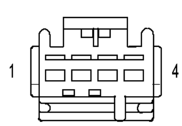
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A850 18RD/WT	REAR LOCKER RELAY OUTPUT



REAR WASHER PUMP (HARD TOP)

REAR WASHER PUMP (HARD TOP) - BLACK 2 WAY

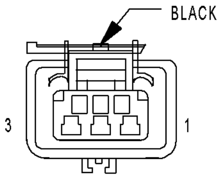
CAV	CIRCUIT	FUNCTION
1	V20 18VT/OR	REAR WASHER MOTOR CONTROL
2	Z1 18BK	GROUND



REAR WINDOW DEFOGGER SWITCH (HARD TOP)

REAR WINDOW DEFOGGER SWITCH (HARD TOP) - 4 WAY

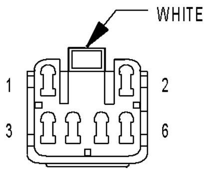
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	C80 20DB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
3	F81 20DB/RD	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL



REAR WIPER MOTOR (HARD TOP)

REAR WIPER MOTOR (HARD TOP) - BLACK 3 WAY

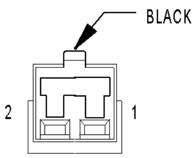
CAV	CIRCUIT	FUNCTION
1	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	Z1 16BK	GROUND
3	V13 18BK/LG	REAR WIPER MOTOR CONTROL



REAR WIPER/ WASHER SWITCH (HARD TOP)

REAR WIPER/WASHER SWITCH (HARD TOP) - WHITE 6 WAY

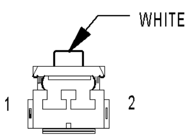
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V20 18VT/OR	REAR WASHER MOTOR CONTROL
3	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
4	V13 18BR/LG	REAR WIPER MOTOR CONTROL
5	V23 18BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
6	-	-



RIGHT COURTESY LAMP

RIGHT COURTESY LAMP - BLACK 2 WAY

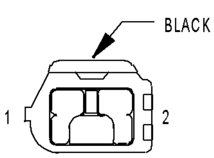
CAV	CIRCUIT	FUNCTION
1	M1 20PK/WT	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



RIGHT DOME LAMP

RIGHT DOME LAMP - WHITE 2 WAY

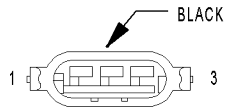
CAV	CIRCUIT	FUNCTION
1	M1 20PK/WT	FUSED B(+)
2	M2 20YL	COURTESY LAMPS DRIVER



RIGHT FOG LAMP (EXCEPT EXPORT)

RIGHT FOG LAMP (EXCEPT EXPORT) - BLACK 2 WAY

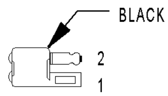
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L39 16LB	FOG LAMP RELAY NO. 1 OUTPUT



RIGHT FRONT PARK/
TURN SIGNAL LAMP
(EXCEPT EXPORT)

RIGHT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT EXPORT) - BLACK 3 WAY

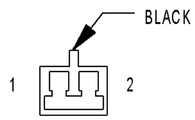
CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
3	Z1 18BK	GROUND



RIGHT FRONT
POSITION LAMP
(EXPORT)

RIGHT FRONT POSITION LAMP (EXPORT) - BLACK 2 WAY

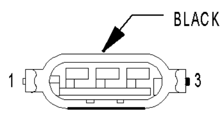
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



RIGHT FRONT
SPEAKER

RIGHT FRONT SPEAKER - BLACK 2 WAY

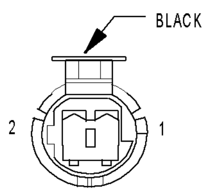
CAV	CIRCUIT	FUNCTION
1	X54 18VT	RIGHT FRONT SPEAKER (+)
2	X56 18DB	RIGHT FRONT SPEAKER (-)



RIGHT FRONT TURN
SIGNAL LAMP
(EXPORT)

RIGHT FRONT TURN SIGNAL LAMP (EXPORT) - BLACK 3 WAY

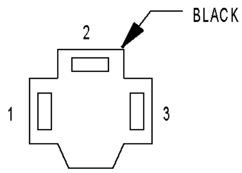
CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	-	-
3	Z1 18BK	GROUND



RIGHT FRONT
WHEEL SPEED
SENSOR

RIGHT FRONT WHEEL SPEED SENSOR - BLACK 2 WAY

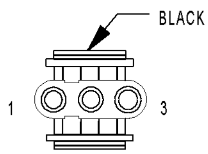
CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



RIGHT HEADLAMP

RIGHT HEADLAMP - BLACK 3 WAY

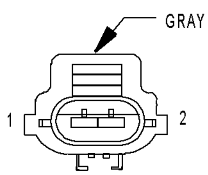
CAV	CIRCUIT	FUNCTION
1	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
2	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
3	Z1 18BK	GROUND



RIGHT HEADLAMP LEVELING MOTOR (EXPORT)

RIGHT HEADLAMP LEVELING MOTOR (EXPORT) - BLACK 3 WAY

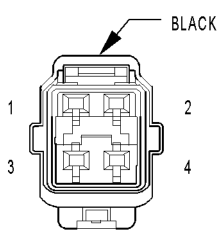
CAV	CIRCUIT	FUNCTION
1	L22 20LG/DG	FUSED HEADLAMP SWITCH OUTPUT
2	L13 20BR/YL	HEADLAMP ADJUST SIGNAL
3	Z1 20BK	GROUND



RIGHT LICENSE LAMP (EXPORT)

RIGHT LICENSE LAMP (EXPORT) - GRAY 2 WAY

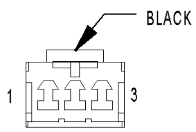
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	Z1 20BK	GROUND



RIGHT REAR LAMP ASSEMBLY

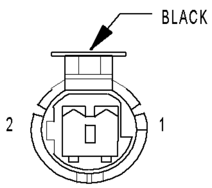
RIGHT REAR LAMP ASSEMBLY - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	L1 20VT/BK (EXCEPT EXPORT)	BACK-UP LAMP FEED
1	L62 18BR/RD (EXPORT)	RIGHT TURN/STOP SIGNAL
2	L62 18BR/RD (EXCEPT EXPORT)	RIGHT TURN/STOP SIGNAL
2	L1 20VT/BK (EXPORT)	BACK-UP LAMP FEED
3	L7 18BK/YL (EXCEPT EXPORT)	FUSED PARK LAMP RELAY OUTPUT
3	L50 18WT/TN (EXPORT)	BRAKE LAMP SWITCH OUTPUT
4	L63 18DG/RD (EXCEPT EXPORT)	LEFT TURN/STOP SIGNAL
4	L7 18BK/YL (EXPORT)	FUSED PARK LAMP RELAY OUTPUT



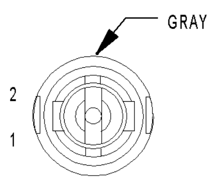
RIGHT REAR SPEAKER - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	X58 20DB/PK	RIGHT REAR SPEAKER (-)
2	-	-
3	X52 20DB/WT	RIGHT REAR SPEAKER (+)



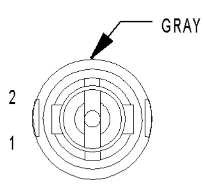
RIGHT REAR WHEEL SPEED SENSOR - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)



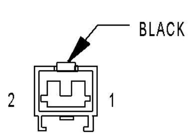
RIGHT SIDE MARKER LAMP (EXCEPT EXPORT) - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	FUSED PARK LAMP RELAY OUTPUT
2	L60 18TN	RIGHT TURN SIGNAL



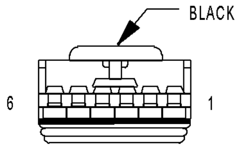
RIGHT SIDE REPEATER LAMP (EXPORT) - GRAY 2 WAY

CAV	CIRCUIT	FUNCTION
1	L60 18TN	RIGHT TURN SIGNAL
2	Z1 18BK	GROUND



SEAT BELT SWITCH (EXCEPT LHD EXPORT) - BLACK 2 WAY

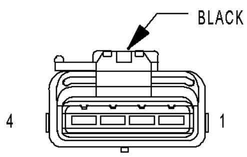
CAV	CIRCUIT	FUNCTION
1	G10 20LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



SENTRY KEY IMMOBILIZER MODULE

SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

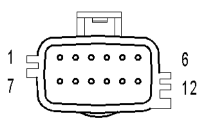
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	Z1 20BK	GROUND
6	F33 20PK/RD	FUSED B(+)



SPEED CONTROL SERVO

SPEED CONTROL SERVO - BLACK 4 WAY

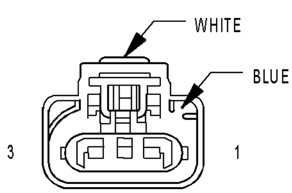
CAV	CIRCUIT	FUNCTION
1	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
4	Z1 18BK	GROUND



SUBWOOFER

SUBWOOFER - 12 WAY

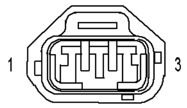
CAV	CIRCUIT	FUNCTION
1	X54 18VT	RIGHT FRONT SPEAKER (+)
2	X56 18DB	RIGHT FRONT SPEAKER (-)
3	X53 18DG	LEFT FRONT SPEAKER (+)
4	X55 18BR/RD	LEFT FRONT SPEAKER (-)
5	X16 20LG	RADIO 12V OUTPUT
6	X13 16BK/RD	FUSED IGNITION SWITCH OUTPUT
7	X52 18GY/DB	RIGHT REAR SPEAKER (+)
8	X58 18DB/PK	RIGHT REAR SPEAKER (-)
9	X51 18BR/YL	LEFT REAR SPEAKER (+)
10	X57 18BR/LB	LEFT REAR SPEAKER (-)
11	-	-
12	Z9 16BK/WT	GROUND



THROTTLE POSITION SENSOR (2.4L)

THROTTLE POSITION SENSOR (2.4L) - WHITE/BLUE 3 WAY

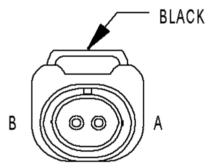
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO. 1 SIGNAL



THROTTLE POSITION SENSOR (4.0L)

THROTTLE POSITION SENSOR (4.0L) - 3 WAY

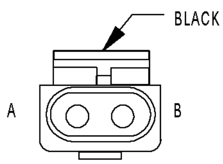
CAV	CIRCUIT	FUNCTION
1	K7 20OR	5-VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO. 1 SIGNAL



TORQUE CONVERTER CLUTCH SOLENOID

TORQUE CONVERTER CLUTCH SOLENOID - BLACK 2 WAY

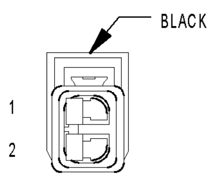
CAV	CIRCUIT	FUNCTION
A	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
B	T23 18OR/LG	TRANSMISSION LOW/OVERDRIVE SOLENOID



TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE)

TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE) - BLACK 2 WAY

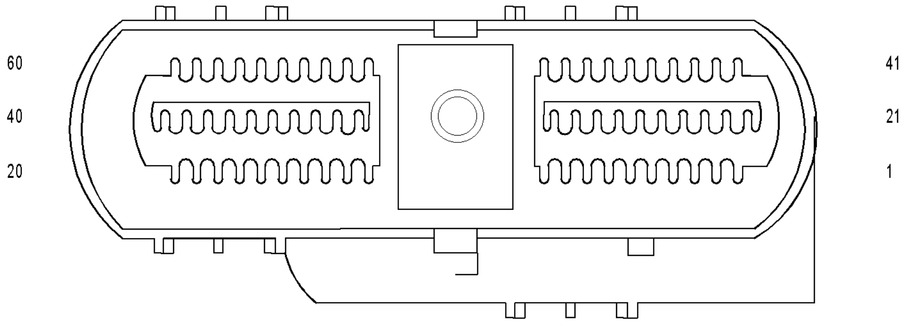
CAV	CIRCUIT	FUNCTION
A	G107 20BK/RD	4WD INDICATOR
B	Z1 18BK	GROUND



TRANSFER CASE SWITCH (OFF-ROAD PACKAGE)

TRANSFER CASE SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K77 18BR/WT	TRANSFER CASE POSITION SENSOR INPUT
2	K4 18BK/LB	SENSOR GROUND 1



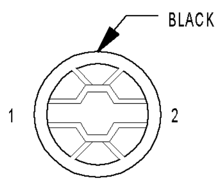
TRANSMISSION CONTROL MODULE

TRANSMISSION CONTROL MODULE - 60 WAY

CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	-	-
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK	TRANSMISSION CONTROL RELAY CONTROL
16	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
19	T19 16WT	2-4 SOLENOID CONTROL
20	T20 16LB	LOW/REVERSE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-

TRANSMISSION CONTROL MODULE - 60 WAY

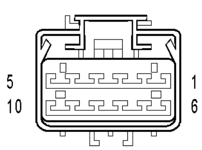
CAV	CIRCUIT	FUNCTION
41	T411 18WT/PK	TRS T41 SENSE
42	T42 16VT/WT	TRS T42 SENSE
43	D25 18VT/YL	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T47 18YL/BK	2-4 PRESSURE SWITCH SENSE
48	-	-
49	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
50	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND 1
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z112 16BK	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A30 16RD/WT	FUSED B(+)
57	Z113 16BK/YL	GROUND
58	-	-
59	T59 16PK	UNDERDRIVE SOLENOID CONTROL
60	T60 16BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION RANGE INDICATOR ILLUMINATION (PRNDL)

TRANSMISSION RANGE INDICATOR ILLUMINATION (PRNDL) - BLACK 2 WAY

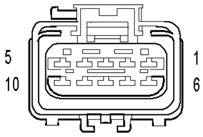
CAV	CIRCUIT	FUNCTION
1	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z1 20BK	GROUND



TRANSMISSION RANGE SENSOR

TRANSMISSION RANGE SENSOR - 10 WAY

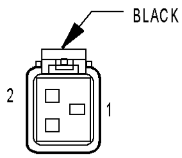
CAV	CIRCUIT	FUNCTION
1	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	T13 18DB/BK	SPEED SENSOR GROUND
4	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
6	L1 20VT/BK	BACK-UP LAMP FEED
7	T1 18LG/BK	TRS T1 SENSE
8	T3 18VT	TRS T3 SENSE
9	T42 16VT/WT	TRS T42 SENSE
10	T411 18WT/PK	TRS T41 SENSE



TRANSMISSION SOLENOID/ PRESSURE SWITCH ASSEMBLY

TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY - 10 WAY

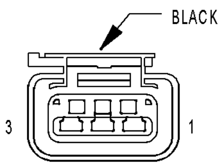
CAV	CIRCUIT	FUNCTION
1	T60 16BR	OVERDRIVE SOLENOID CONTROL
2	T59 16PK	UNDERDRIVE SOLENOID CONTROL
3	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
4	T19 16WT	2-4 SOLENOID CONTROL
5	T47 18YL/BK	2-4 PRESSURE SWITCH SENSE
6	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
7	T20 16LB	LOW/REVERSE SOLENOID CONTROL
8	-	-
9	-	-
10	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE



UNDERHOOD LAMP

UNDERHOOD LAMP - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	M1 20PK/WT	FUSED B(+)



VEHICLE SPEED SENSOR

VEHICLE SPEED SENSOR - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	5V SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL

8W-91 CONNECTOR/GROUND/SPLICE LOCATION

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CONNECTOR/GROUND/SPLICE LOCATION

DESCRIPTION

This section provides illustrations identifying connector, ground, and splice locations in the vehicle. Connector, ground, and splice indexes are provided. Use the wiring diagrams in each section for connector, ground, and splice identification. Refer to the index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

CONNECTORS

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	BK	At A/C Compressor Clutch	4, 5
A/C Heater Control - C1		Center of Instrument Panel	24, 27
A/C Heater Control - C2		Center of Instrument Panel	24, 27
A/C Heater Control - C3		Center of Instrument Panel	24, 27
A/C High Pressure Switch	BK	Left Side of Engine	4
A/C Low Pressure Switch	GN	Near Powertrain Control Module	5, 10, 16
A/C Pressure Transducer (2.4L)	BK	Near Compressor	5, 10
Airbag Control Module	YL	Front of Floor Pan Tunnel	18
Ambient Temperature Sensor	GY	Left Front Fender Side Shield	1
Axle Lock Switch(Off Road)		Near Cigar Lighter	24
Back-up Lamp Switch (M/T)	BK	Right Side of Transmission	32, 33, 34
Battery Temperature Sensor	BK	Under Battery Tray	7, 8
Blend Door Actuator		On HVAC Harness	N/S
Blower Motor		On HVAC Harness	N/S
Blower Motor Relay	BK	On HVAC Harness	N/S
Blower Motor Resistor Block		On HVAC Harness	N/S
Brake Lamp Switch	GY	Top of Brake Pedal Bracket	20
Brake Transmission Shift Interlock Solenoid	WT	Near Steering Column	N/S
Brake Warning Indicator Switch	BK	On Brake Master Cylinder	7
C103	BK	Rear of Engine Compartment	7, 8, 15, 16
C104 (LHD)	GY	Rear of Engine Compartment	7, 15, 16
C104 (RHD)	GY	Rear of Engine Compartment	8, 16
C107 (LHD)	YL	Left Kick Panel	19, 20, 35
C107 (RHD)	YL	Right Kick Panel, see LHD Similar	21

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/Number	Color	Location	Fig.
C109 (A/T)	LT-GY	Rear of Engine Compartment	7, 8, 15
C110	BK	Left Fender Side Shield	1, 7
C115 (Off Road)	BK	Top of Locker Pump Bracket	29
C116 (Off Road)	LT-GY	Top of Locker Pump Bracket	29
C120 (2.4L)	BK	Right side of Radiator Fan Shroud	5, 10
C154	BK	Top Right Side of Transmission	32
C170 (LHD)	NAT	Left Kick Panel	20, 22
C170 (RHD)	NAT	Right Kick Panel	22, 25
C180	BK	Below Evap/Purge Solenoid	N/S
C181	BK	Left Rear of Engine Head	3
C182	BK	Left Rear of Engine Head	3
C202 (LHD)	GY	Left Kick Panel	20, 22, 35
C202 (RHD)	GY	Right Kick Panel	21, 22,25
C203 (LHD)	GN	Left Kick Panel	24
C203 (RHD)	GN	Right Kick Panel	27
C205	LT GN	Left Kick Panel	23, 25
C324 (Speaker Pod)	WT/BK	Right Side of Sport Bar	N/S
C325 (Speaker Pod)	WT/BK	Left Side of Sport Bar	35, 36
C326 (Hard Top)	BK	Left Rear Quarter Panel	35, 36
C329 (Export)	BK	Left Rear of Rear Bumper	39
Camshaft Position Sensor (4.0L)	BK	Right Side of Engine	6
Camshaft Position Sensor (2.4L)	BK	Right Front Corner of Engine Head, behind Air Cleaner	N/S
Capacitor		At Right Rear of Engine	14
Center High Mounted Stop Lamp	BK	Near Right Rear Lamp Assembly	39, 40
Cigar Lighter/Power Outlet	RD	Rear of Cigar Lighter	24, 26
Circuit Breaker	GY	Near Day Time Running Lamp Module	17, 19
Clockspring - C1	NAT	Rear of Clockspring	28
Clockspring - C2	YL	Rear of Clockspring	28
Clutch Pedal Position Switch (M/T)	BK	Top of Clutch Pedal Bracket	19, 20
Compass/Temperature Mirror	BK	At Top Center of Windshield	N/S
Controller Anti-Lock Brake	BK	Rear Left Side of Dash Panel	7
Crankshaft Position Sensor (4.0L)	BK	At Rear of Intake Manifold	6, 12, 33
Crankshaft Position Sensor (2.4L)	BK	Left Bellhousing	N/S
Data Link Connector	BK	Bottom Driver Side of Instrument Panel	20, 25
Daytime Running Lamp Module (Except Export)	BK	Left Side of Engine Compartment	N/S
Driver Airbag Squib	YL	Under Horn Pad	N/S
Driver Door Ajar Switch	NAT	At ″A″ Pillar	20, 21

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/Number	Color	Location	Fig.
Engine Coolant Temperature Sensor	BK	On Thermostat Housing	4, 15
Engine Oil Pressure Switch (4.0L)	BK	Right Side of Engine Block	12
Engine Oil Pressure Switch (2.4L)	BK	Below A/C Compressor	N/S
Engine Starter Solenoid		At Starter Motor	3
Evap/Purge Solenoid	BK	Left Fender Side Shield	7, 9
Front Locker Indicator Switch (Off Road)	BK	Top of Front Differential	30
Front Locker Pump (Off Road)	BK	Top of Locker Pump Bracket	29
Front Washer Pump	BK	Under Washer Fluid Reservoir	1
Front Wiper Motor	BK	At Motor	11
Fuel Injector NO.1 (4.0L)	BK	At Injector	4
Fuel Injector NO.2(4.0L)	BK	At Injector	4
Fuel Injector NO.3(4.0L)	BK	At Injector	4
Fuel Injector NO.4(4.0L)	BK	At Injector	4
Fuel Injector NO.5(4.0L)	BK	At Injector	4
Fuel Injector NO.6(4.0L)	BK	At Injector	4
Fuel Pump Module	BK	Above Fuel Tank	37
G Switch	BK	Near T/O for Controller Anti-Lock Brake	18
Generator	BK	Rear of Generator	3, 6
Ground Strap		Attached to Center of Hood	7
Headlamp Leveling Switch (Export)	WT	At Switch	22, 25
Horn	BK	Left Front Fender Side Shield	1
Idle Air Control Motor	BK	Side of Throttle Body	3, 4
Ignition Coil Capacitor	BK	Right Rear of Engine Head	6, 14
Ignition Coil Pack (2.4L)	GY	Right Side of Engine	3
Ignition Coil Pack (4.0L)	BK	Right Rear of Engine	6, 12
Ignition Switch		On Steering Column	28
Input Speed Sensor	BK	Left Center of Trans	13
Instrument Cluster - C1		Rear of Cluster	22, 25
Instrument Cluster - C2		Rear of Cluster	22, 25
Intake Air Temperature Sensor	GY	Rear of Intake Manifold	4
Leak Detection Pump	BK	Right Rear Quarter, Forward of Tail Lamp Assembly	38
Left Courtesy Lamp	BK	Left Side of Instrument Panel	22, 25
Left Dome Lamp	WT	In Left Speaker Pod	N/S
Left Fog Lamp (Except Export)	BK	At Lamp, See Right	N/S
Left Front Park/Turn Signal Lamp (Except Export)	BK	At Lamp, See Right	N/S
Left Front Position Lamp (Export)	BK	At Lamp	1

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/Number	Color	Location	Fig.
Left Front Speaker	BK	At Speaker	22, 25
Left Front Turn Signal Lamp (Export)	BK	At Lamp, See Right	N/S
Left Front Wheel Speed Sensor	BK	Left Side of Engine Compartment Near Hydraulic Control Unit	7
Left Headlamp	BK	Rear of Lamp	1
Left Headlamp Leveling Motor (Export)	BK	Near Headlamp at Motor	1
Left License Lamp (Export)	GY	At Lamp	39, 40
Left Rear Lamp Assembly	BK	At Lamp	39, 40
Left Rear Speaker	BK	In Left Speaker/lamp Pod	N/S
Left Rear Wheel Speed Sensor	BK	Near Vehicle Speed Sensor T/O	37
Left Side Marker Lamp	GY	At Lamp, See Right	N/S
Left Side Repeater Lamp (Export)	GY	At Lamp, See Right	N/S
Manifold Absolute Pressure Sensor	BK	Side of Throttle Body	3, 4
Multi-Function Switch C1	GY	Steering Column	28
Multi-Function Switch C2	BK	Steering Column	28
Output Speed Sensor	BK	Rear Left Side of Trans	13
Overdrive Off Switch		Center of Instrument Panel	24, 26
Oxygen Sensor 1/1 Upstream		On Front Exhaust Pipe	4, 14
Oxygen Sensor 1/2 Downstream	BK	Rear of Catalytic Converter	4, 13, 34
Oxygen Sensor 2/1 Upstream (4.0L California/European III)		Near Idle Air Control Motor T/O	4, 13
Oxygen Sensor 2/2 Downstream (4.0L California/ European III)	GY	T/O near Ignition Coil Pack T/O	6, 12, 13
Park Brake Switch		Left of Seat Belt Switch	18
Passenger Airbag	YL	Rear of Airbag	17, 19
Passenger Airbag On/Off Switch		Lower Center of Instrument Panel	24
Passenger Door Ajar Switch	BK	Near Top Hinge of Passenger Door	17, 19
Power Distribution Center	BK	Engine Compartment Right or Left Fenter	7, 8
Power Outlet		Center of Instrument Panel	24, 26
Power Steering Pressure Switch (2.4L)	BK	Near Power Steering Pump	3
Powertrain Control Module - C1 (LHD)	BK	Right Rear of Engine Compartment	14, 16
Powertrain Control Module - C1 (RHD)	BK	Left Rear of Engine Compartment	N/S
Powertrain Control Module - C2 (LHD)	WT	Right Rear of Engine Compartment	14, 16
Powertrain Control Module - C2 (RHD)	WT	Left Rear of Engine Compartment	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/Number	Color	Location	Fig.
Powertrain Control Module - C3 (LHD)	GY	Right Rear of Engine Compartment	7, 14
Powertrain Control Module - C3 (RHD)	GY	Left Rear of Engine Compartment	8
Radiator Fan Motor Circuit Breaker (2.4L)	BK	On Right Radiator Fan Shroud	5
Radiator Fan Motor (2.4L)	BK	On Right Radiator Fan Shroud	5
Radiator Fan Relay (2.4L)	BK	On exterior of PDC, Engine side	10
Radio	GY	Rear of Radio	24, 27
Rear Fog Lamp (Export)	BK	At Lamp	39, 40
Rear Locker Indicator Switch (Off Road)	BK	Top of Rear Differential	31
Rear Locker Pump (Off Road)	LT-GY	Top of Locker Pump Bracket	29
Rear Washer Pump (Hard Top)	BK	Under Washer Fluid Reservoir	1, 9
Rear Window Defogger		At Rear Window	35, 36
Rear Window Defogger Switch (Hard Top)	GY	Behind Rear Window Defogger Switch	24, 26
Rear Wiper Motor (Hard Top)	BK	At Rear Wiper Motor	35, 36
Rear Wiper/Washer Switch (Hard Top)	WT	Behind Rear Wiper/Washer Switch	24, 26
Right Courtesy Lamp	BK	Right Side of Instrument Panel	23, 25
Right Dome Lamp	WT	In Right Speaker Pod	
Right Fog Lamp (Except Export)	BK	At Lamp	2
Right Front Park/Turn Signal Lamp (Except Export)	BK	At Lamp	2
Right Front Position Lamp (Export	BK	At Lamp	2
Right Front Speaker	BK	At Speaker	23, 25
Right Front Turn Signal Lamp (Export)	BK	At Lamp	2
Right Front Wheel Speed Sensor	BK	Rear of Engine	N/S
Right Headlamp	BK	Rear of Lamp	2
Right Headlamp Leveling Motor (Export)	BK	Near Headlamp at Motor	2
Right License Lamp	GY	At Lamp	39, 40
Right Rear Lamp Assembly	BK	At Lamp	39, 40
Right Rear Speaker	BK	In Right Speaker/lamp Pod	N/S
Right Rear Wheel Speed Sensor	BK	Near Vehicle Speed Sensor T/O	37
Right Side Marker Lamp (Except Export)	GY	At Lamp	2
Right Side Repeater Lamp	GY	At Lamp	2
Seat Belt Switch	BK	Near Park Brake Switch	18, 36

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/Number	Color	Location	Fig.
Sentry Key Immobilizer Module	BK	At Immobilizer	28
Speed Control Servo	BK	Left Side Engine Compartment	7, 9
Subwoofer	LT-GY	Floor Pan	18
Throttle Position Sensor	WT	Side of Throttle Body	4, 15
Transfer Case Position Switch	BK	Left Side of Transfer Case	29
Transmission Control Module	BK	On Left Fender Shield	9
Transmission Range Indicator Illumination (PRNDL)	BK	Between Seats	18
Transmission Range Sensor	GN	Left Center of Transmission	13
Transmission Solensid/ Pressure Switch Assembly	NAT	Right Center of Transmission	12
Underhood Lamp	BK	Under Hood	7, 8, 15
Vehicle Speed Sensor	BK	Left Rear of Transfer Case	29

GROUNDS

Connector Name/ Number	Location	Fig.
G100	Rear Center of Engine Compartment	7, 8
G101	Rear Center of Engine Compartment	7
G102	Left Radiator Closure Panel	1
G103	Right Radiator Closure Panel	2
G104	Near Generator	N/S
G105	Right Rear of Engine Block (4.0L) Near Left Engine Mount (2.4L)	36, 12
G106	Right Rear of Engine Block	N/S
G107	Right Rear of Engine Block	N/S
G110 (2.4L)	Near Left Engine Mount	3, 12
G111	Near Right Rear of Engine	6
G190	Near Right Headlamp	10
G191	Near Right Headlamp	10
G200 (LHD)	Left Rear of Instrument Panel	20
G200 (RHD)	Right Rear of Instrument Panel	25
G201 (LHD)	Left Rear of Instrument Panel	20
G201 (RHD)	Right Rear of Instrument Panel	25
G202 (LHD)	Right Rear of Instrument Panel	23
G202 (RHD)	Left Rear of Instrument Panel	25
G203 (LHD)	Right Rear of Instrument Panel	23
G203 (RHD)	Left Rear of Instrument Panel	25
G204 (RHD)	Center of Instrument Panel	25
G300 (LHD)	Left Kick Panel	20
G300 (RHD)	Right Kick Panel	21
G301 (LHD)	At Base of Center Stack	18
G301 (RHD)	Left Kick Panel	19

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Connector Name/ Number	**Location**	**Fig.**
G302 (LHD)	Left Kick Panel	20
G302 (RHD)	Right Kick Panel	21
G303 (LHD)	Near Steering Column Mounting Bracket	N/S
G303 (RHD)	Near Right Kick Panel	N/S

SPLICES

Splice Number	**Location**	**Fig.**
S101	Near T/O for Power Distribution Center	7, 8
S102	Near T/O for G100 or Daytime Running Lamp Module	7, 8
S103	Near T/O for G101	7, 8
S105	Near T/O for Daytime Running Lamp Module	N/S
S106	Near T/O for G100	7, 8
S108	Near T/O for Power Distribution Center	7, 8
S111	Near T/O for Battery Temperature Sensor or Power Distribution Center	7, 8
S113	Near T/O for G100	7, 8
S115	At Left Fender Shield Harness Tie Down	1
S116 (Except-Export)	Near T/O for Front Washer Pump	1
S117	Near T/O for Horn	1
S118	Near Left Headlamp T/O	1
S121	Near T/O for Powertrain Control Module - C2	16
S122	Near Grommet for Left Front Turn Signal Lamp, See Right	N/S
S123 (4.0L)	Near T/O for G105	12
S123 (2.4L)	Near T/O for Ignition Coil Pack	N/S
S124 (4.0L)	Near T/O for 2/1 Oxygen Sensor	4
S124 (2.4L)	Near T/O for Ignition Coil Pack	N/S
S125 (Export)	Near Grommet for Right Front Turn Signal Lamp	2
S126	Near T/O for C104	16
S127	Near T/O for Idle Air Control Motor(4.0L)	4
S128 (4.0L)	Between Fuel Injector NO. 2 and Fuel Injector NO. 3	4
S128 (2.4L)	Near T/O for C103 on Engine Harness	N/S
S129	Near T/O for C104	16
S130 (4.0L)	Near T/O for C104	16
S130 (2.4L)	Near T/O for C103 on Engine Harness	N/S
S132 (4.0L)	Trans Harness	6, 12
S132 (2.4L)	Near T/O for Engine Starter Solenoid	N/S
S133 (4.0L)	Trans Harness	6, 12
S133 (2.4L)	Near T/O for Input Speed Sensor, See 4.0L	N/S
S134 (4.0L)	Near T/O for C154	16
S134 (2.4L)	Between Engine Starter Solenoid and C182	N/S
S135 (4.0L)	Near T/O for Oxygen Sensor 1/2 Downstream	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Splice Number	Location	Fig.
S135 (2.4L)	Between Engine Starter Solenoid and C182	N/S
S136	In Battery harness near PDC	16
S137	Near T/O for Throttle Position Sensor	4
S138	Middle of Radiator Closure Panel	2
S140	Near T/O for C104	N/S
S141	Near T/O for Left Front Turn Signal Lamp, See Right	N/S
S142	Near T/O for Right Front Turn Signal Lamp	2
S143	Near T/O for Left Front Park/Turn Signal Lamp, See Right	N/S
S144	Near T/O for Right Front Park/Turn Signal Lamp	2
S145 (Export)	Near T/O for Left Front Turn Signal Lamp	N/S
S147	Between T/O's for Underhood Lamp and C103, C104	7, 8
S150	Right Headlamp T/O	2
S151	Left Headlamp T/O	N/S
S152	Near Left Headlamp T/O	N/S
S153	Near T/O for Camshaft Position Sensor	6
S155 (Day Time Running Lamps)	Near T/O for Day Time Running Lamp Module	7
S156	Near T/O for ABS Pump Motor	7
S157 (2.4L)	Between Engine Starter Solenoid and C181	N/S
S157 (4.0L)	Near T/O For PCM	16
S158 (2.4L)	Near T/O For Power Steering Pressure Switch	N/S
S159 (2.4L)	Near T/O For Power Steering Pressure Switch	N/S
S160 (2.4L)	In T/O for Transmission Control Module	N/S
S161 (2.4L)	Near T/O for Ignition Coil Pack	N/S
S162 (2.4L)	Near T/O for Oxygen jSensor 1/1 Upstream	N/S
S162 (4.0L)	Near T/O For A/C Low Pressure Switch	16
S163	Between G101 and Right Front Wheel Speed Sensor	16
S164	Near T/O For Rer Locker Indicator Switch Inline C116	29
S170	6″(150 mm) From G100 T/O toward Brake Booster	N/S
S171	8″(200 mm) From Batt Temp Sensor T/O toward G101	N/S
S172	Between G100 and C103	N/S
S173	Near G100	N/S
S176	In Fuel InjectorHarness	N/S
S177	n Fuel InjectorHarness	N/S
S178	Near T/O for C103 on Engine Harness	N/S
S202 (LHD)	Center of Instrument Panel	20
S202 (RHD)	Center Rear of Instrument Panel	25
S204	Center Rear of Instrument Panel	24, 25
S206	Center Rear of Instrument Panel	24, 25
S207	Near Cigar Lighter T/O	24
S208	Near Blower Motor	N/S
S209	Near T/O for C202, C203, and C204	20, 25, 26

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

Splice Number	Location	Fig.
S210	Near T/O for A/C Heater Control C3	24, 27
S211	Near T/O for C202	20, 25
S212	Near T/O to Right Courtesy Lamp	20, 25
S213	Center Rear of Instrument Panel	23, 25
S214	Center Rear of Instrument Panel	23, 25
S215	Center Rear of Instrument Panel	23, 25
S216	Left Side of Instrument Panel	20
S217	Left Side of Instrument Panel	20
S302(LHD)	In T/O to Steering Column	17
S302(RHD)	Between S315 and S331, near T/O to ACM	19
S304 (LHD)	Center Rear of Dash Panel, Near Front Wiper Motor T/O	17
S304 (RHD)	Near T/O for C202 and C107	20
S309	Front of Left Door Opening	35
S310	Left Rear Quarter Panel, Near Body Grommet	19, 35
S311	Near Left Rear Lamp Assembly Connector	35, 36, 40
S315	Above Steering Column	17, 19
S316	In T/O for Rear Fog Lamp	39,40
S317	Near T/O for Left License Lamp	39, 40
S320 (LHD)	Near T/O for C107	19 35
S320 (RHD)	Near T/O for Fuse Block	19
S331 (LHD)	Near T/O to Steering Column	17
S331 (RHD)	Near T/O for Fuse Block	19
S335 (Except-Export)	Near Left Rear Lamp Assembly Connector	35
S350	Near Fuse Block	19, 35
S351	Near T/O to Sport Bar	19, 35
S352	Forward of S351	19, 35
S353	Near T/O to Body Harness	17, 40
S354(Export)	At Top of Right Kick Panel	19, 20, 35
S355 (LHD)	Near T/O to Steering Column	17
S355 (RHD)	Near T/O to Steering Column	20
S356	10″(254 mm) Forward from T/O to Rear Washer	19, 35
S357	20″(508 mm) Forward from T/O to Rear Washer	19, 35
S358	30″(762 mm) Forward from T/O to Rear Washer	19, 35
S359	Near Fuse Block	35
S360	Near T/O for Rear Window Defogger Feed	35, 36
S361	Near T/O for Rear Window Defogger Feed	35, 36

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

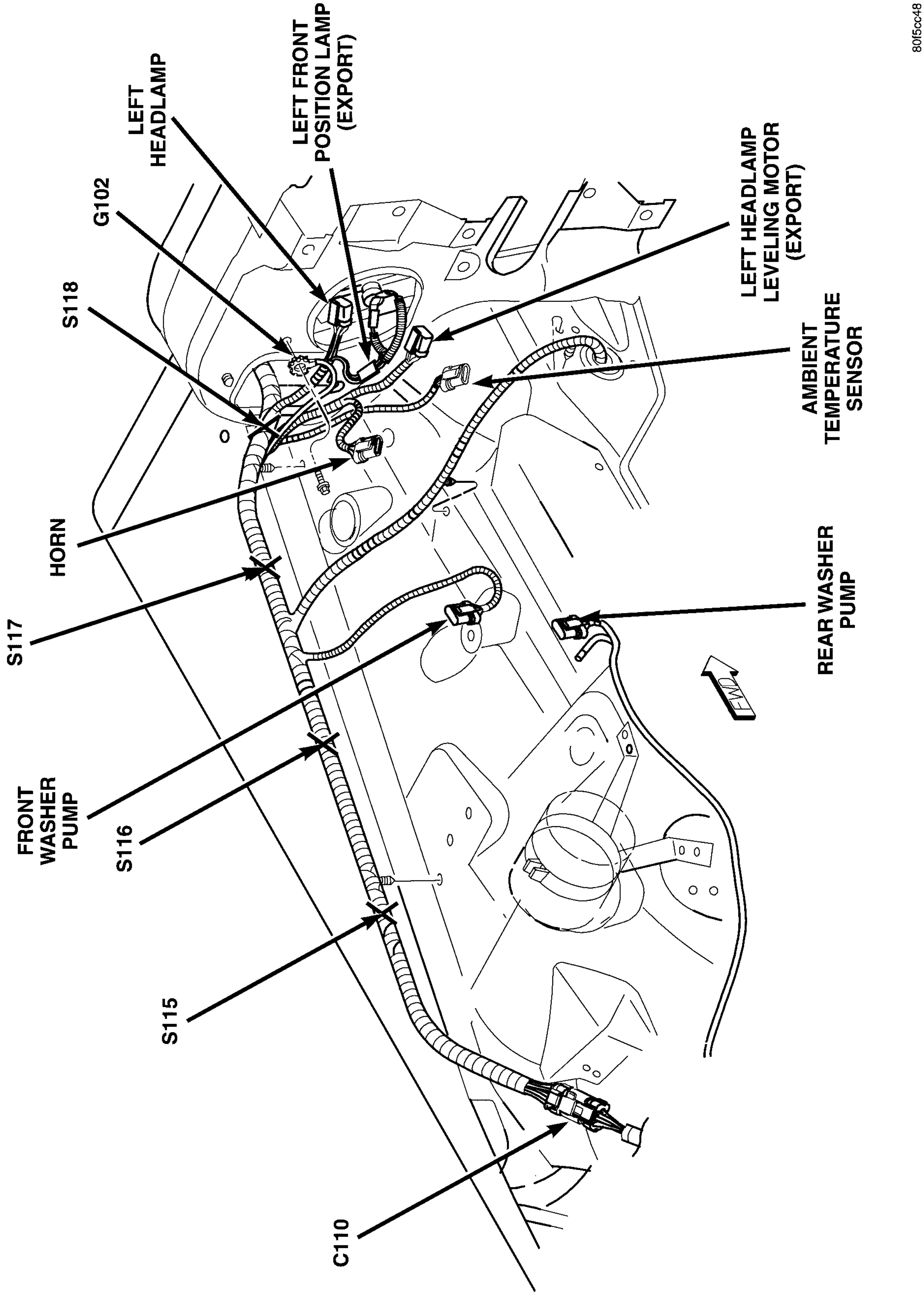

Fig. 1 LEFT HEADLAMP

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

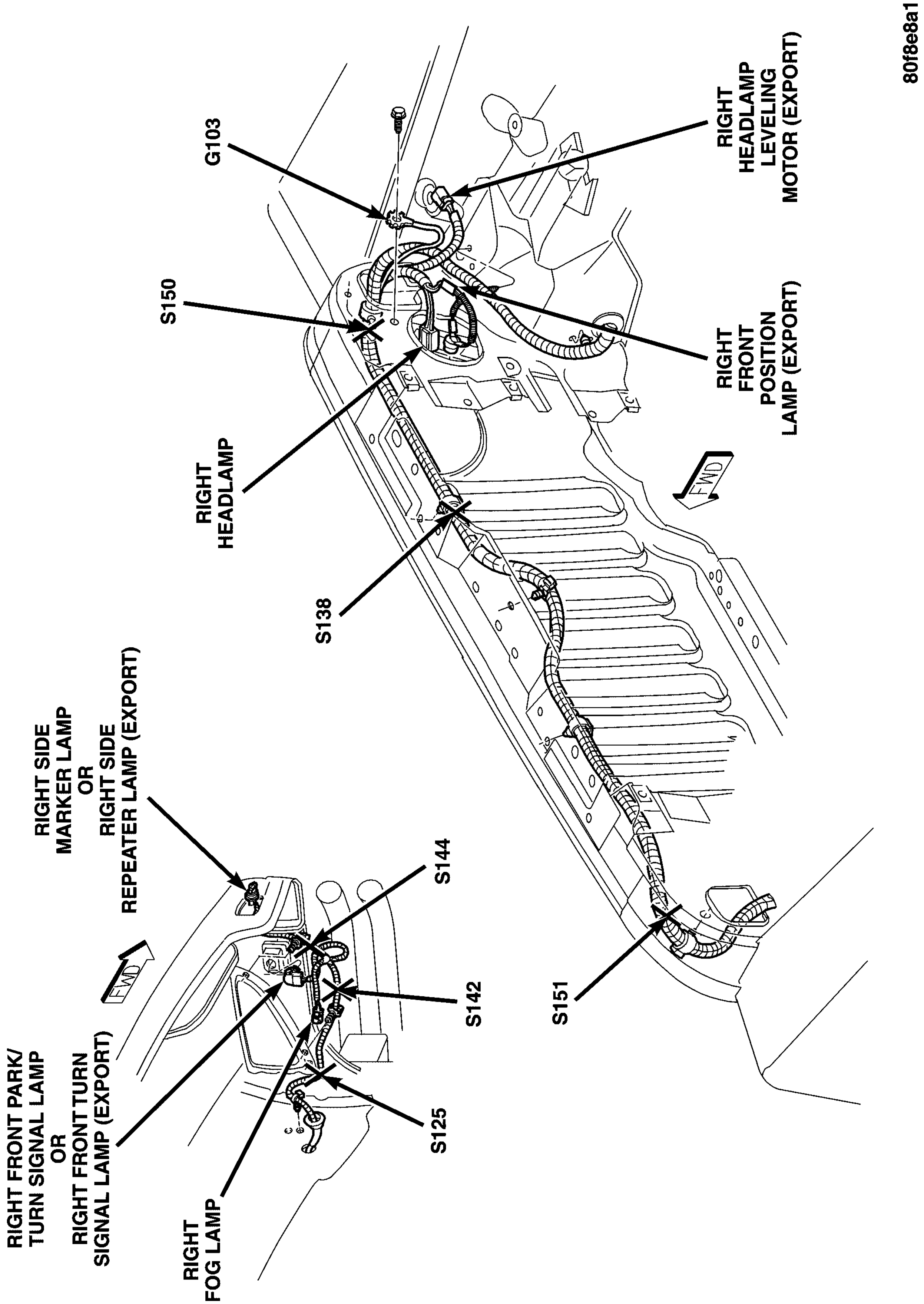

Fig. 2 RIGHT HEADLAMP

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

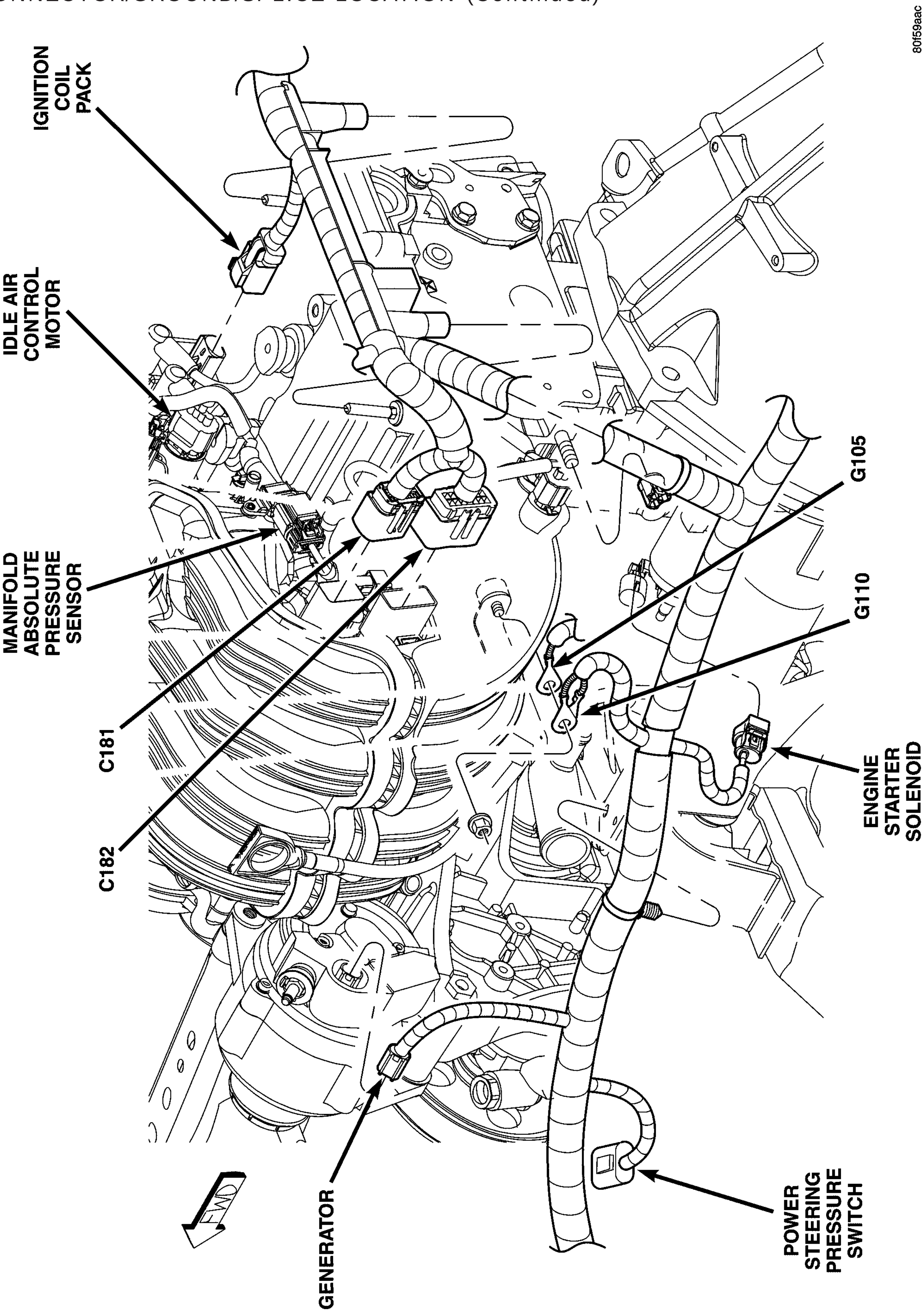

Fig. 3 2.4 LITER ENGINE LEFT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

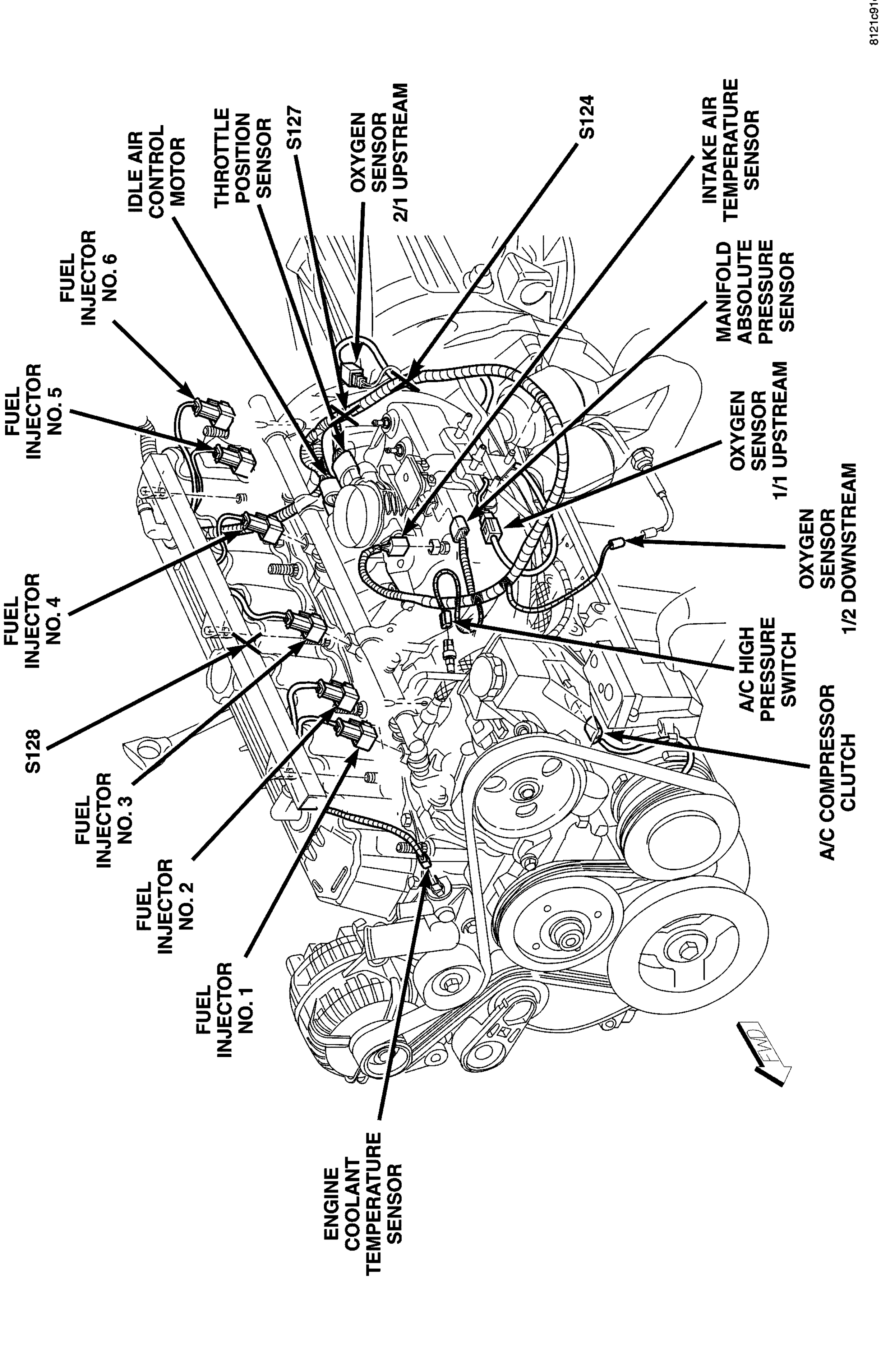

Fig. 4 4.0 LITER ENGINE LEFT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

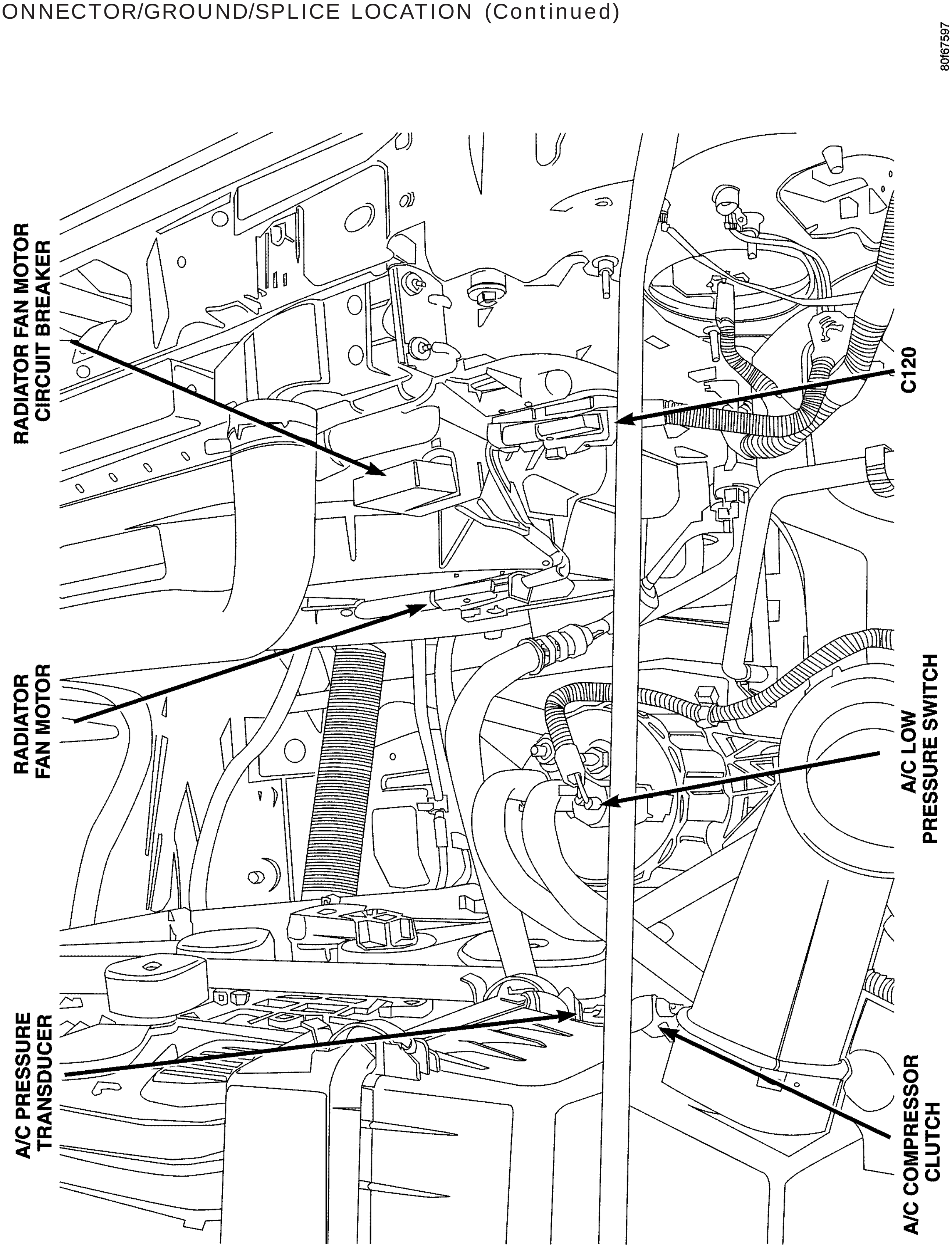

Fig. 5 2.4L A/C RIGHT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

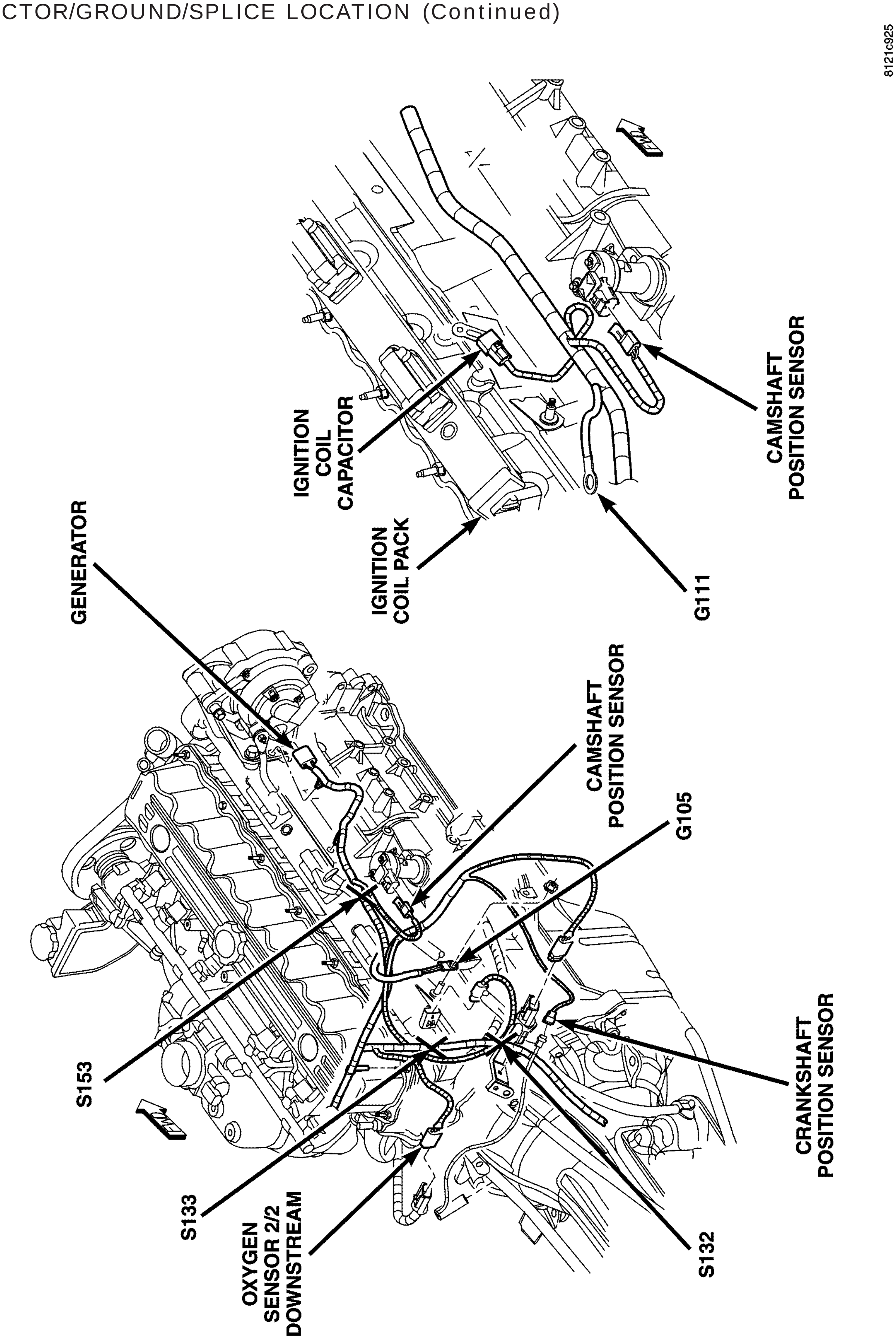

Fig. 6 4.0 LITER ENGINE RIGHT SIDE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

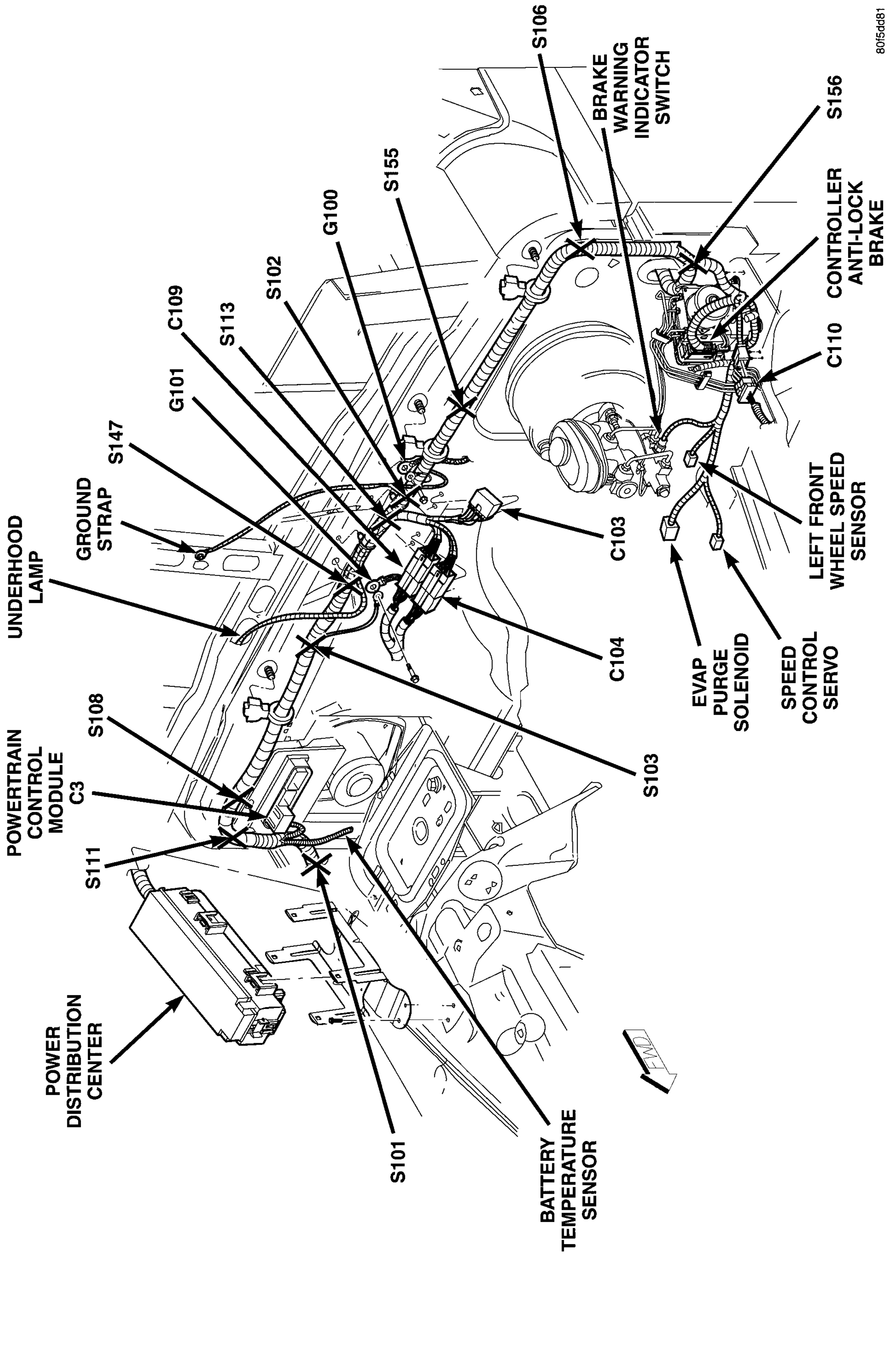

Fig. 7 ENGINE COMPARTMENT REAR LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

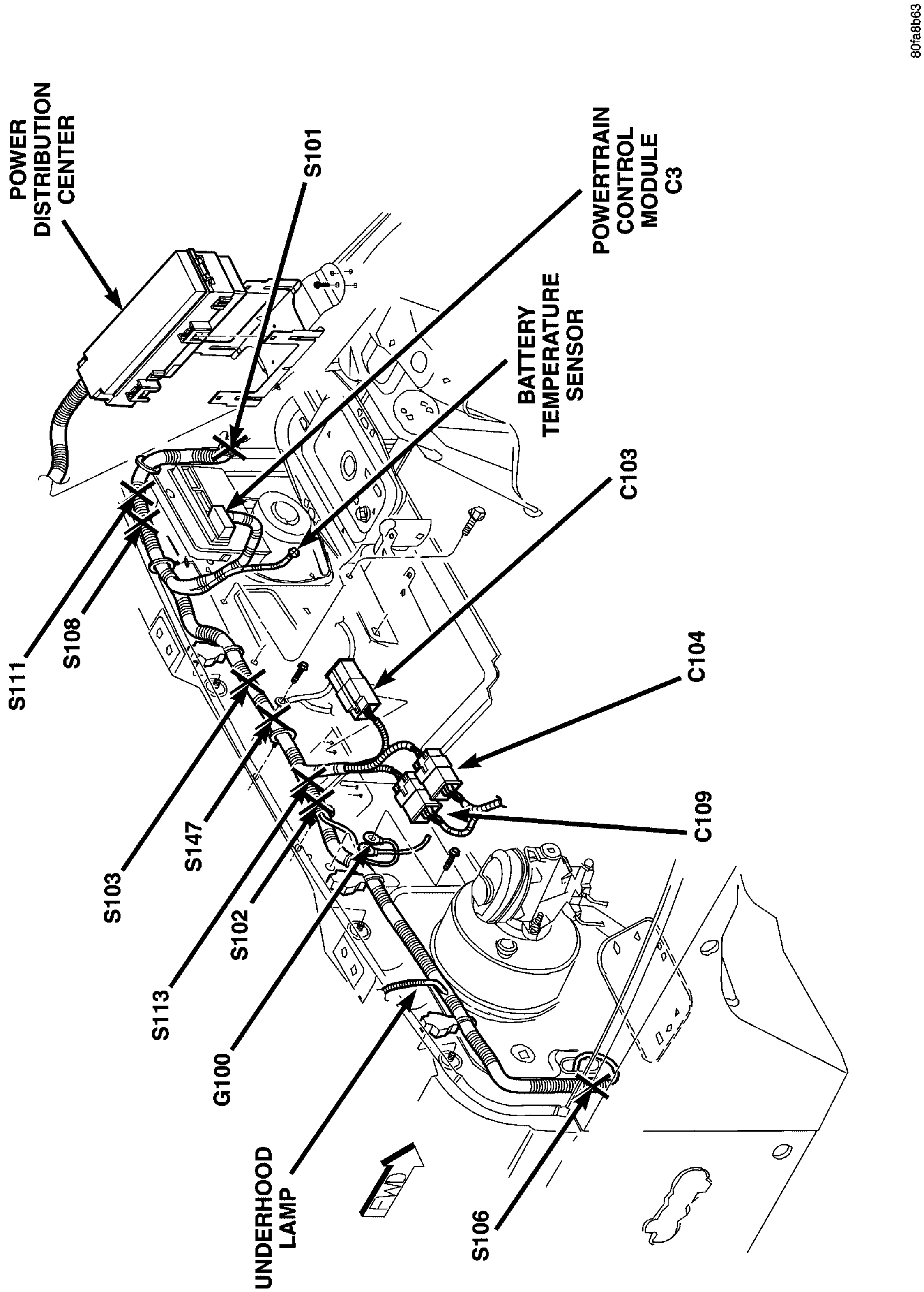

Fig. 8 ENGINE COMPARTMENT REAR RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

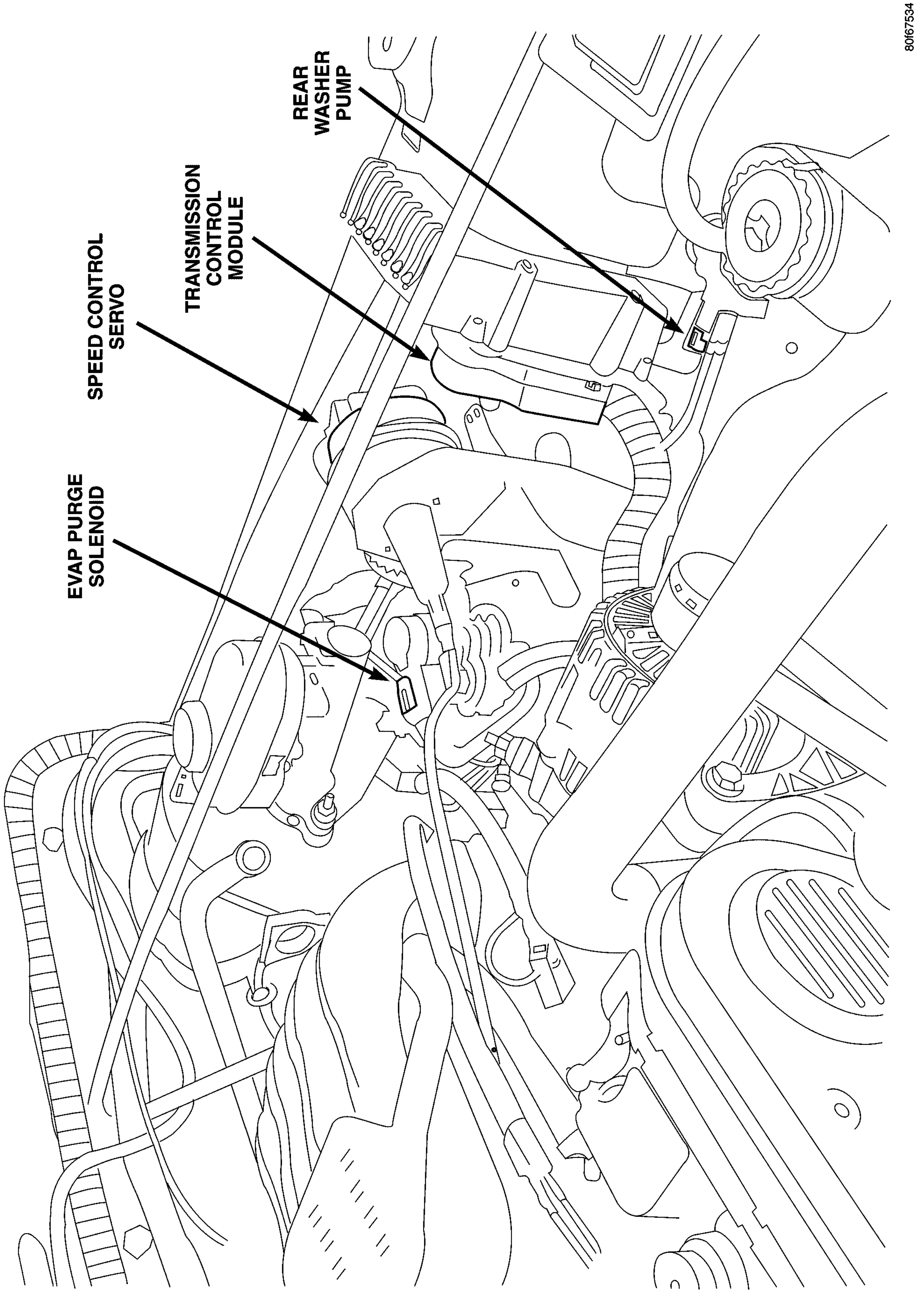

Fig. 9 LEFT FENDER SHIELD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

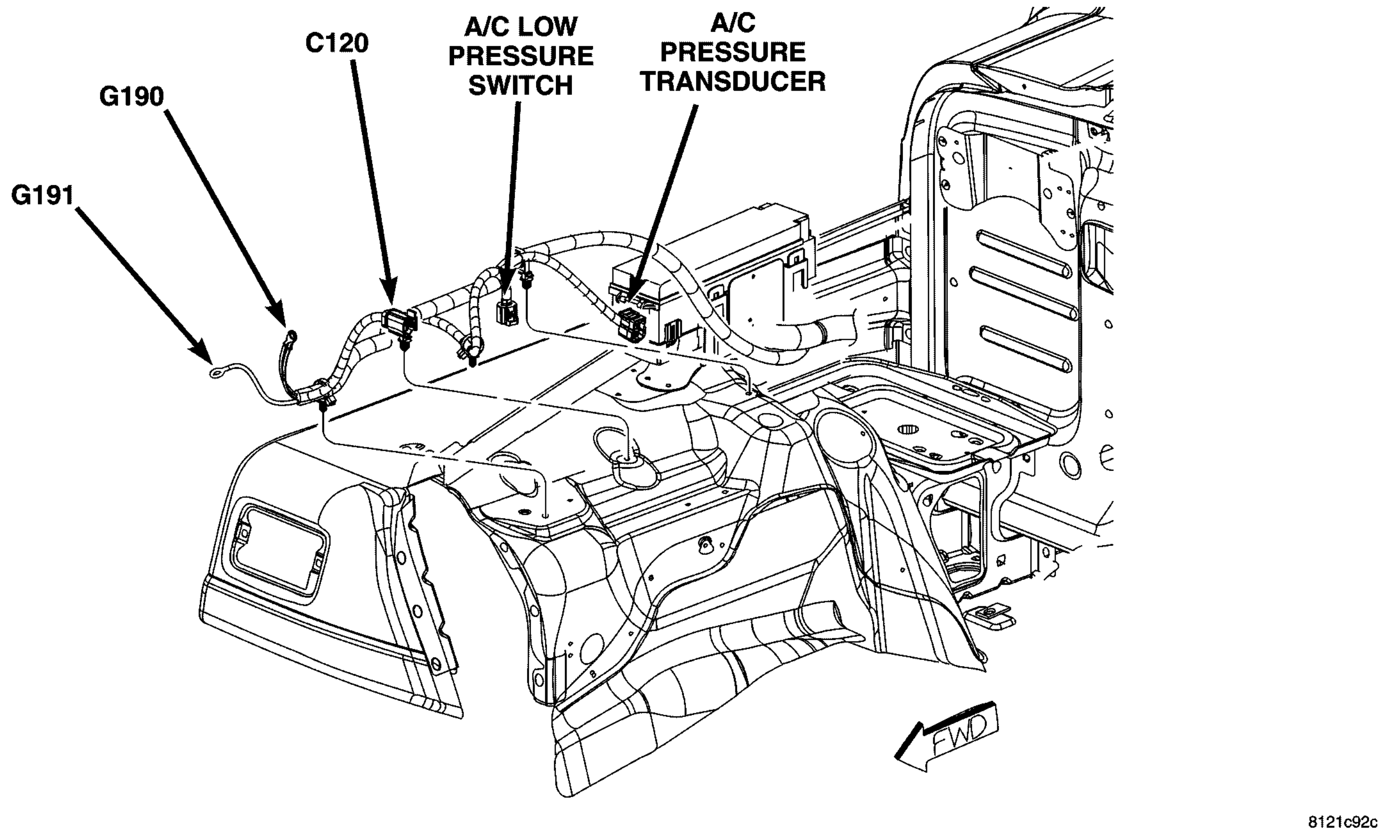

Fig. 10 2.4 LITER RIGHT FENDER SHIELD

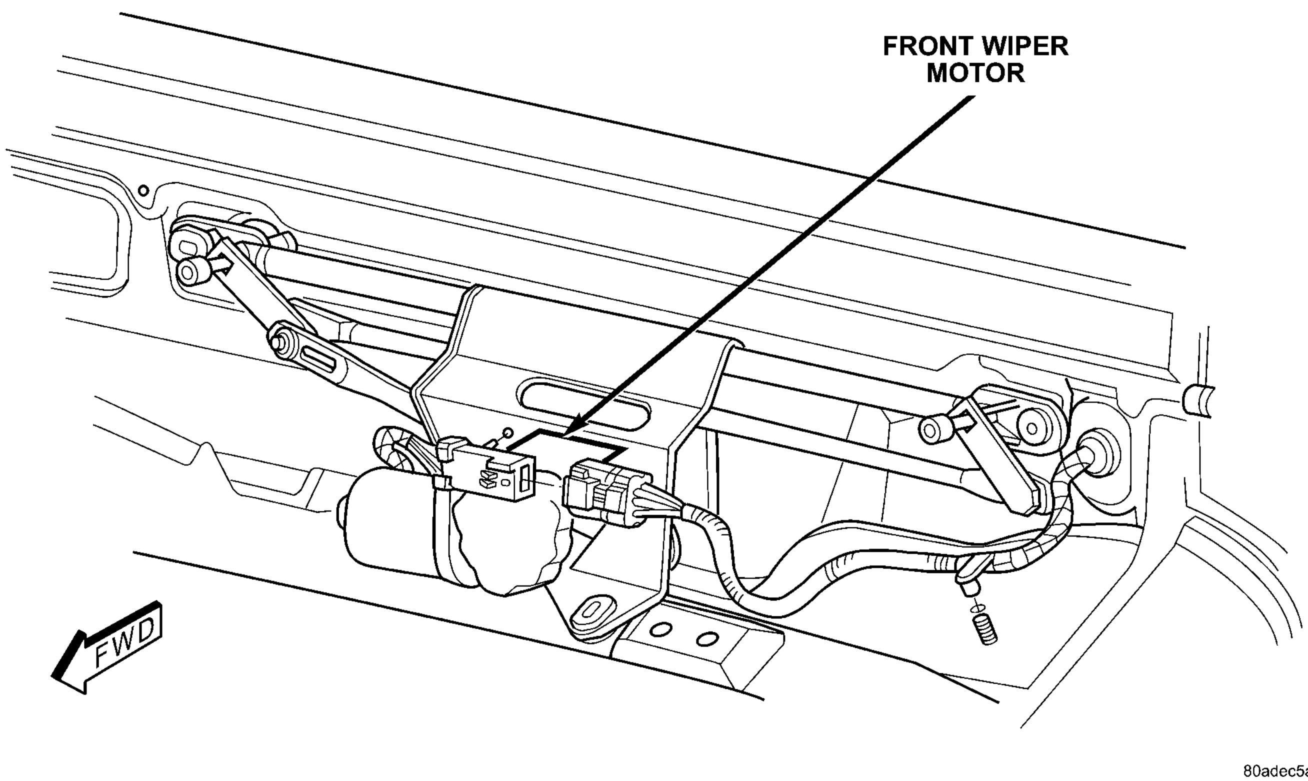

Fig. 11 FRONT WIPER MOTOR

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

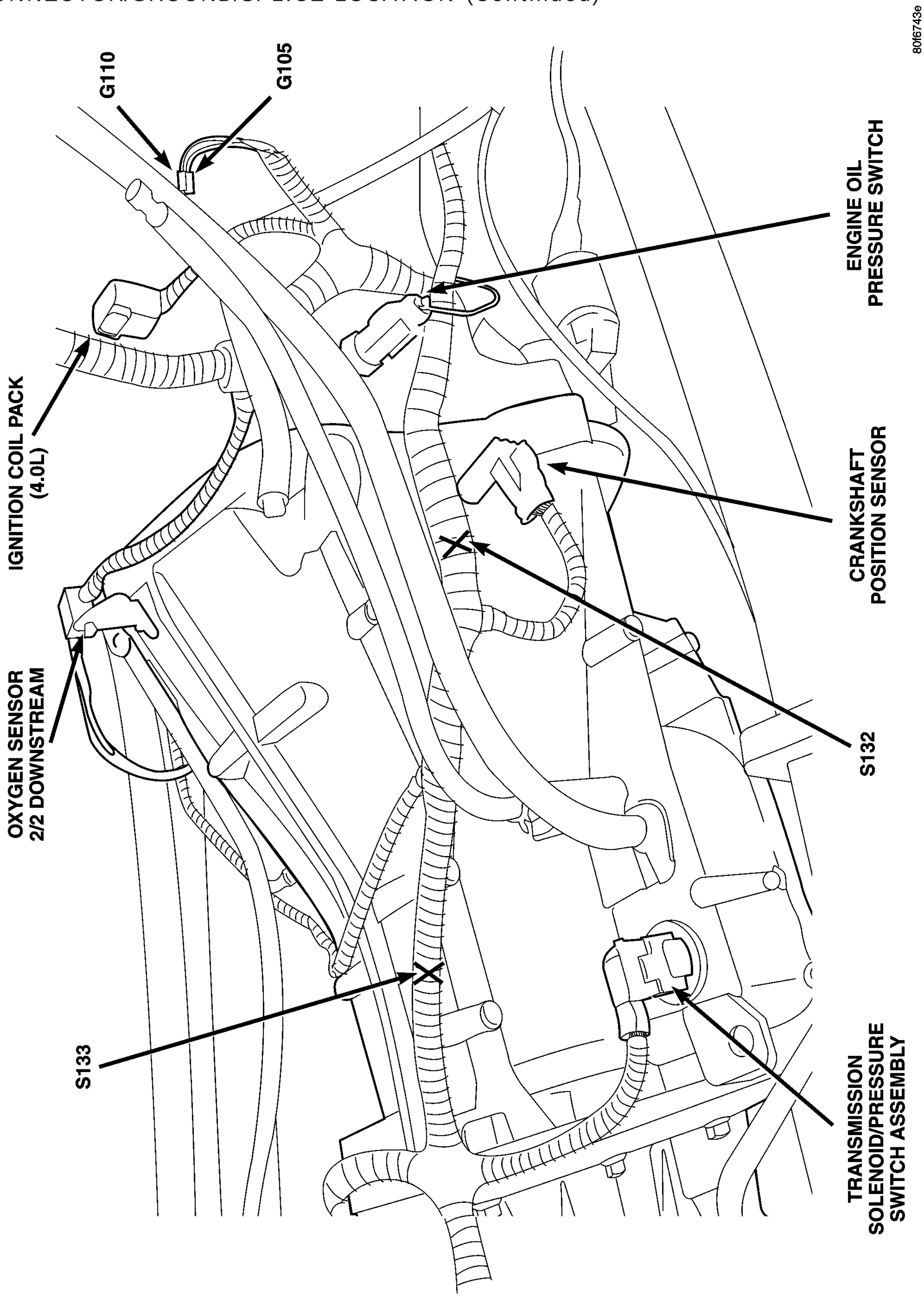

Fig. 12 4.0 LITER ENGINE AND TRANS

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

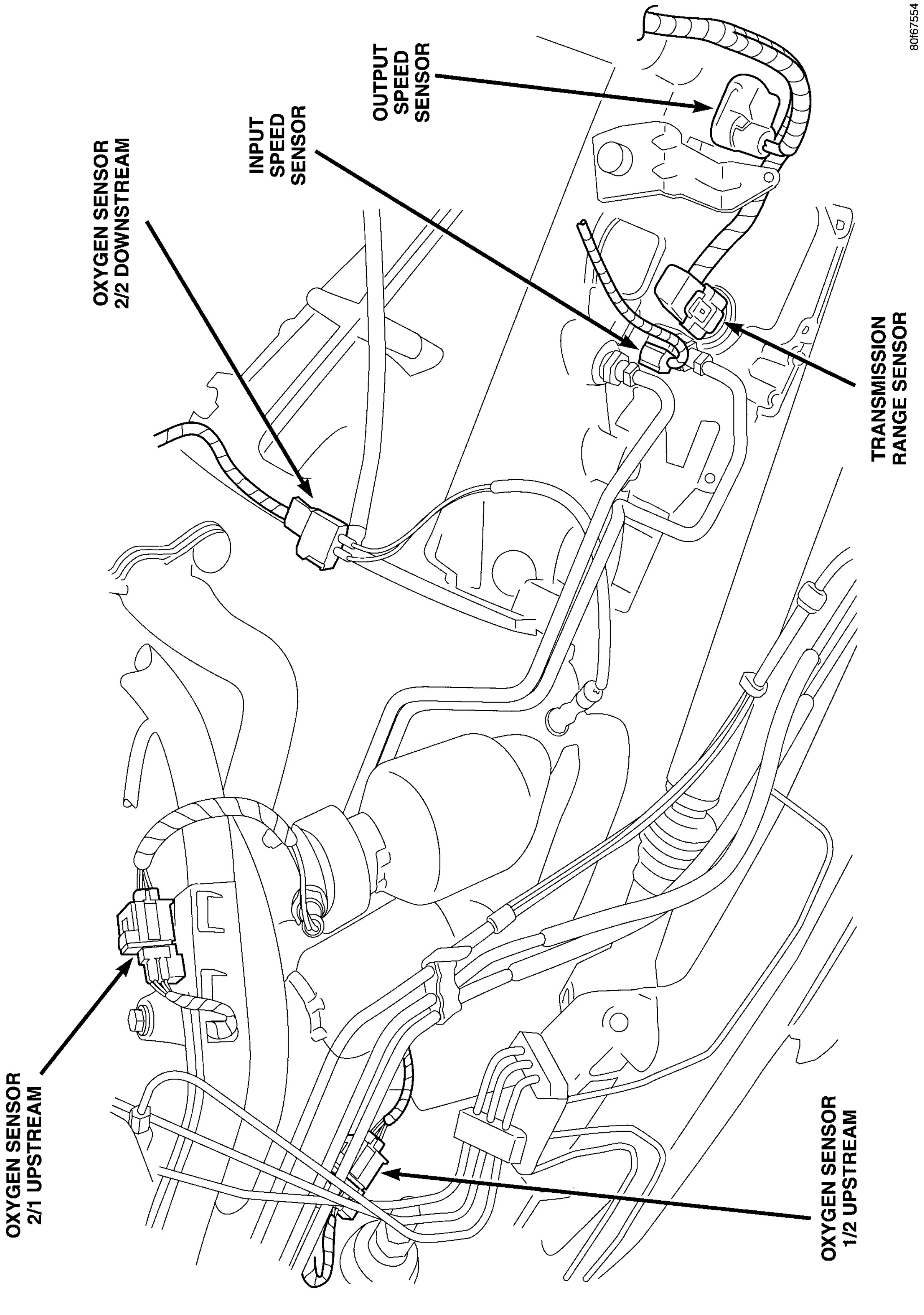

Fig. 13 4.0 LITER ENGINE AND TRANS LEFT

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

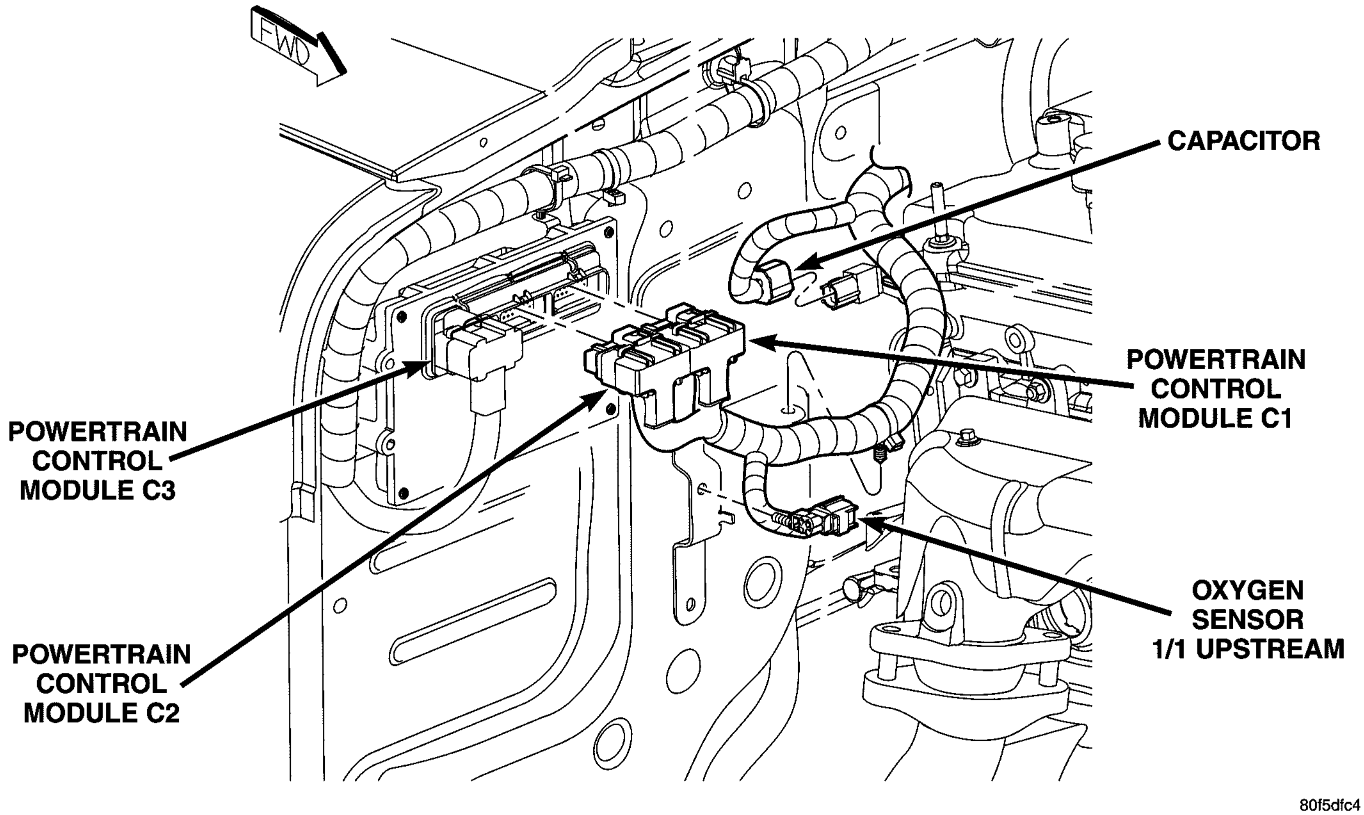

Fig. 14 2.4 LITER ENGINE PCM

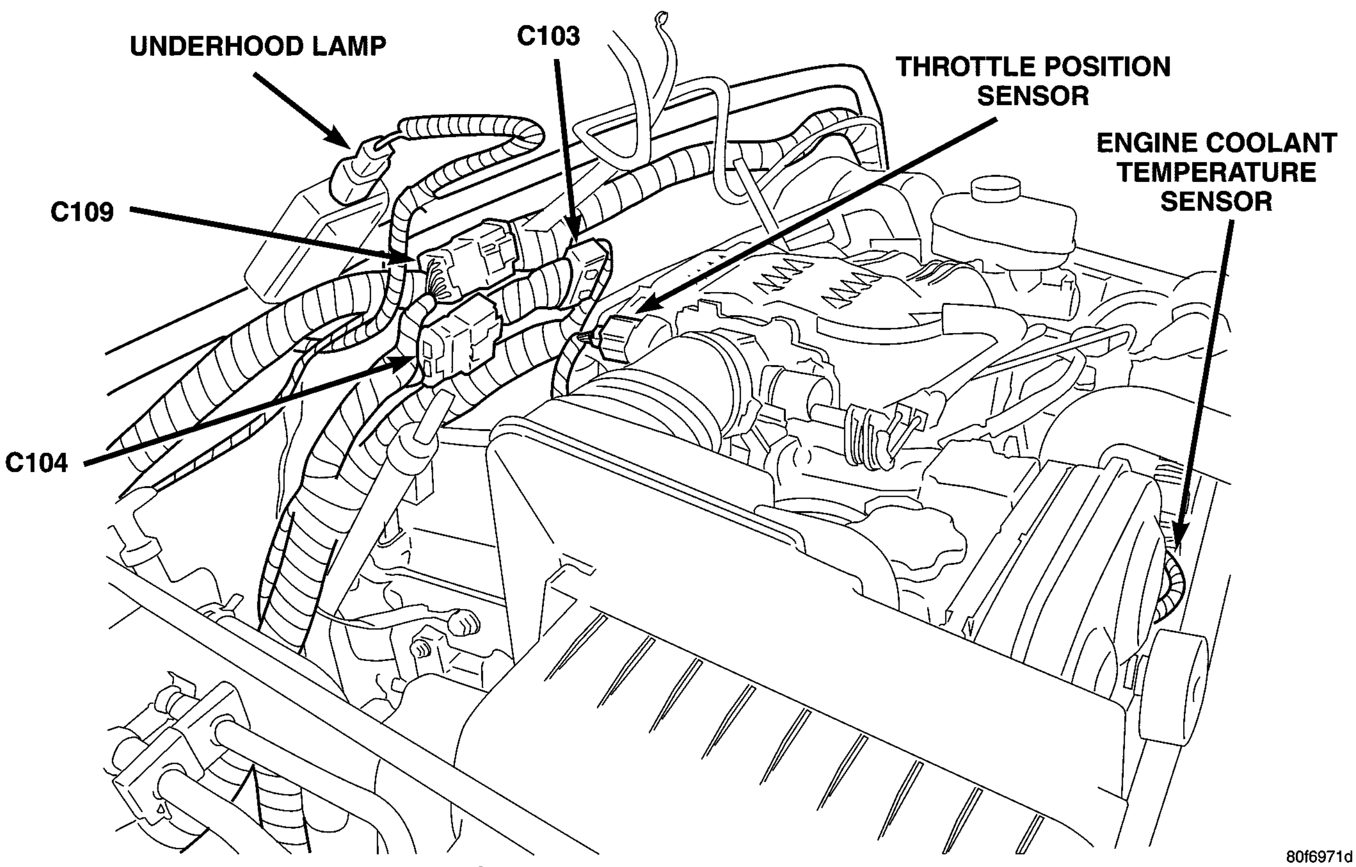

Fig. 15 2.4 LITER REAR ENGINE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

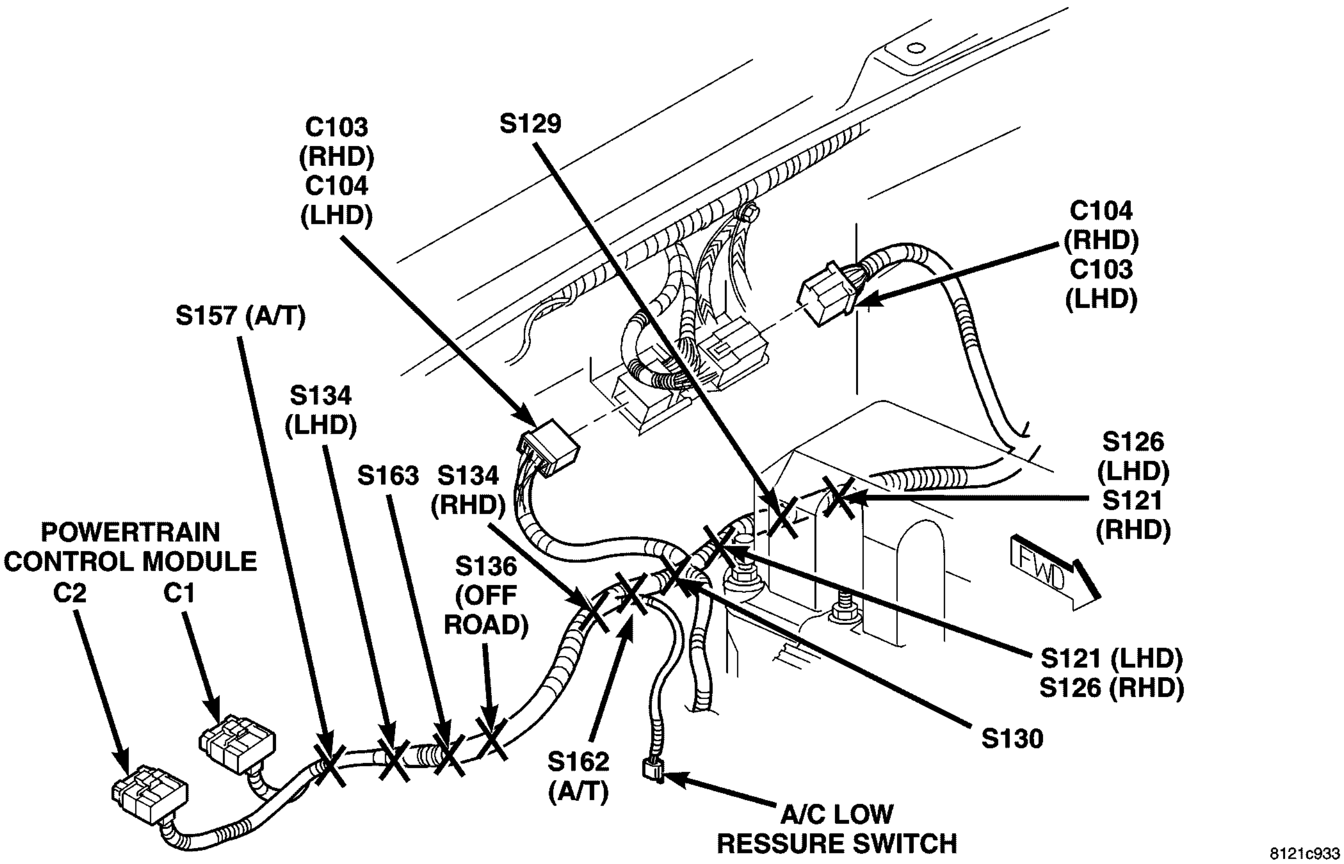

Fig. 16 4.0 LITER ENGINE REAR

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

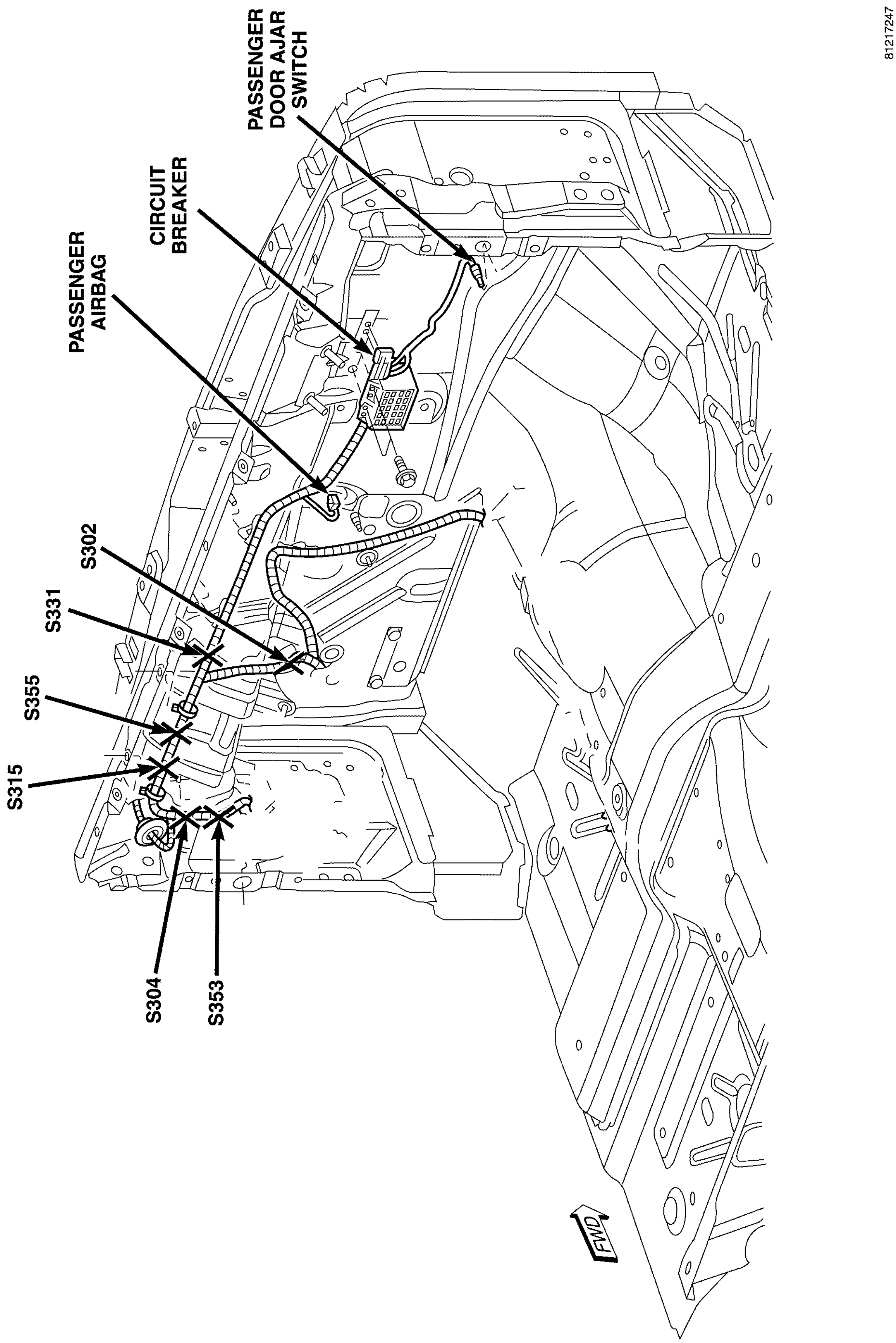

Fig. 17 DASH PANEL LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

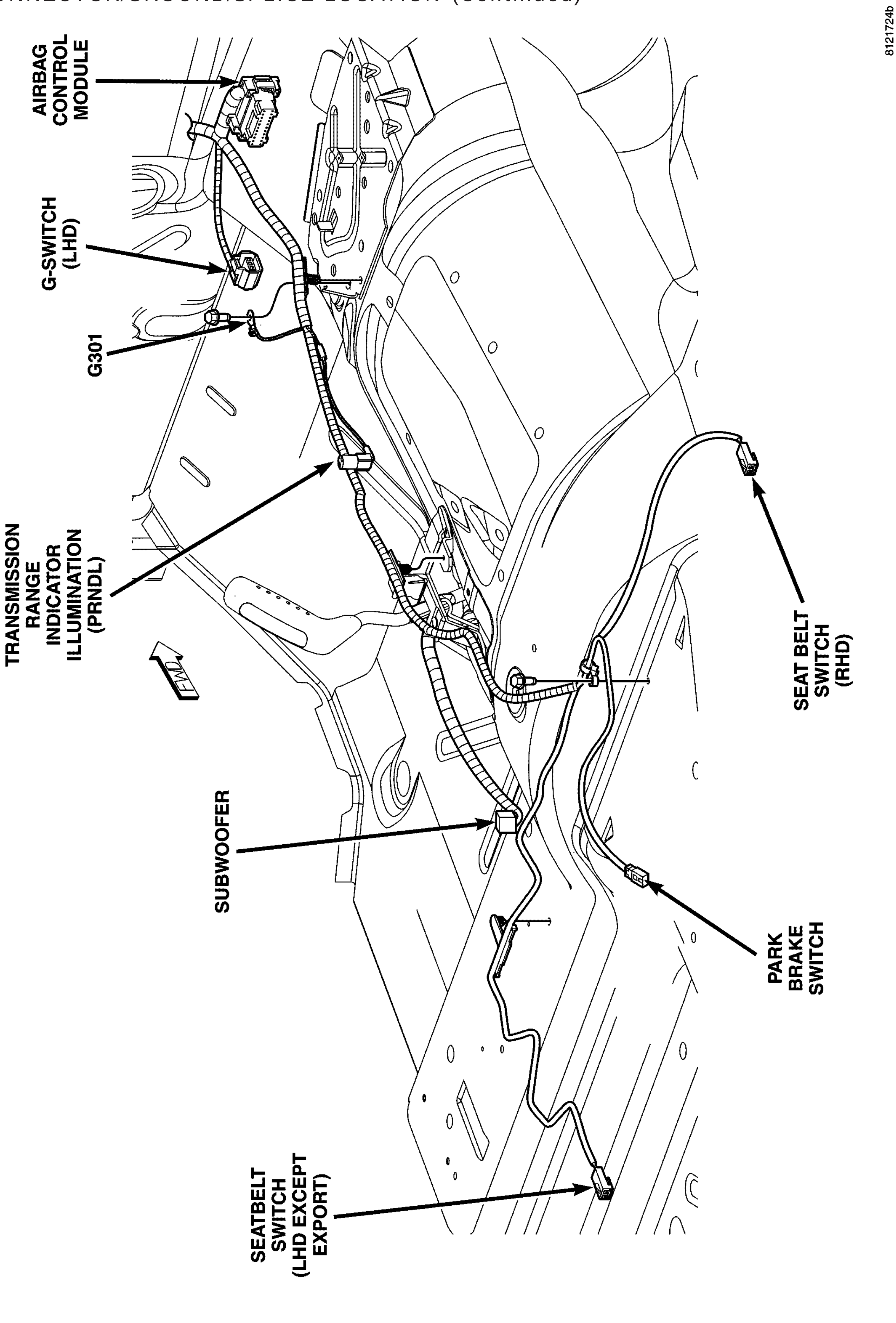

Fig. 18 BODY HARNESS

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

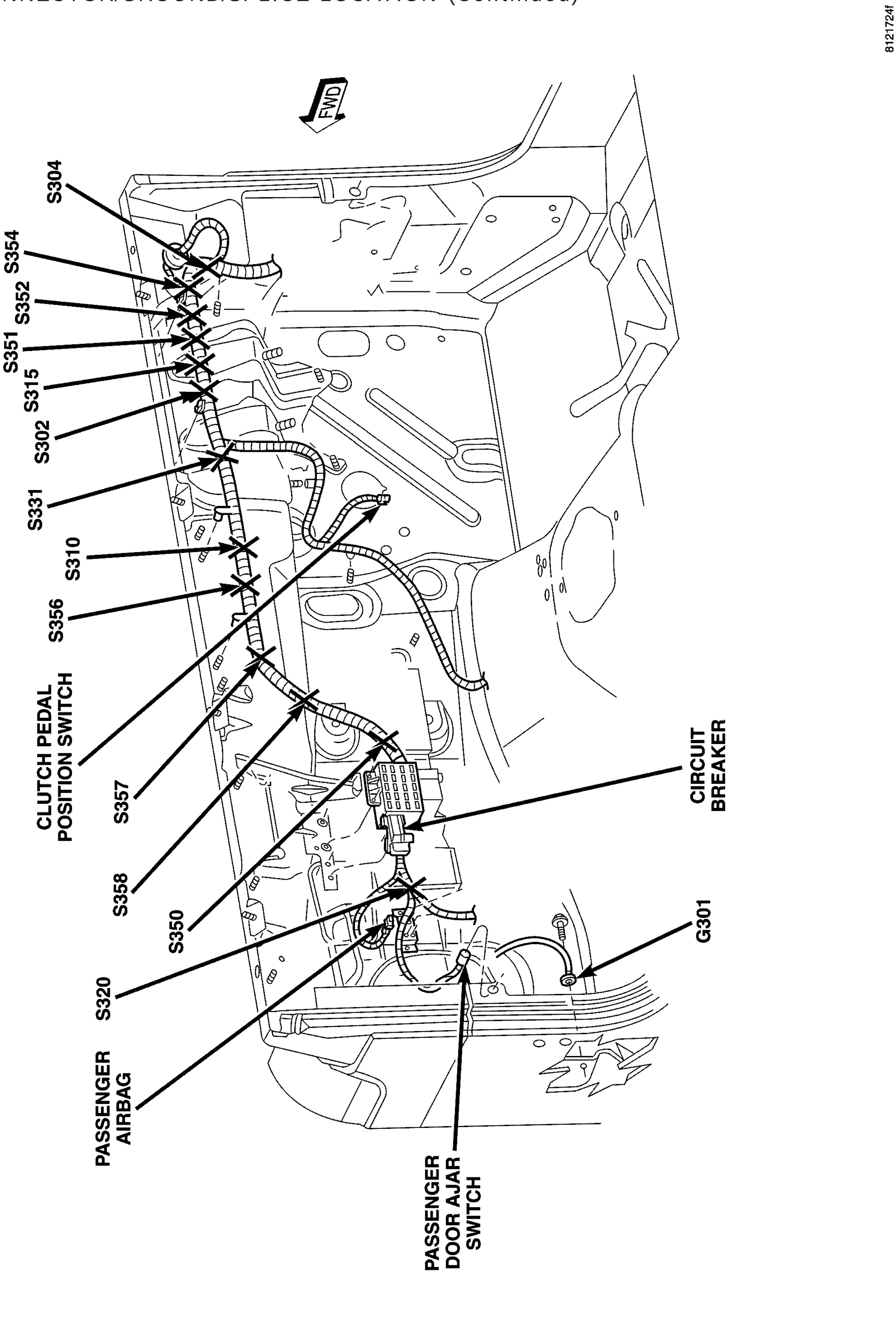

Fig. 19 DASH PANEL RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

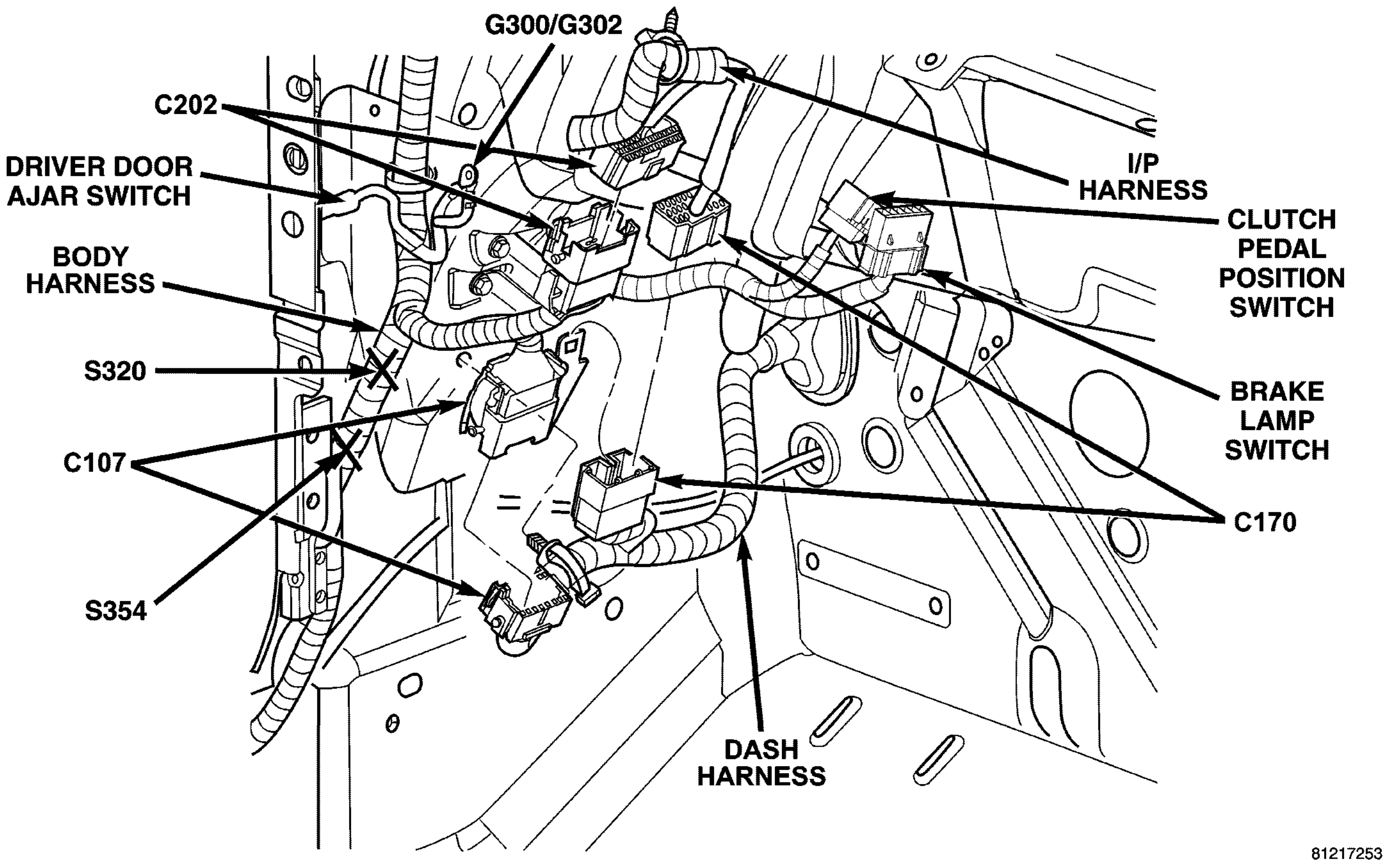

Fig. 20 LEFT COWL PANEL LHD

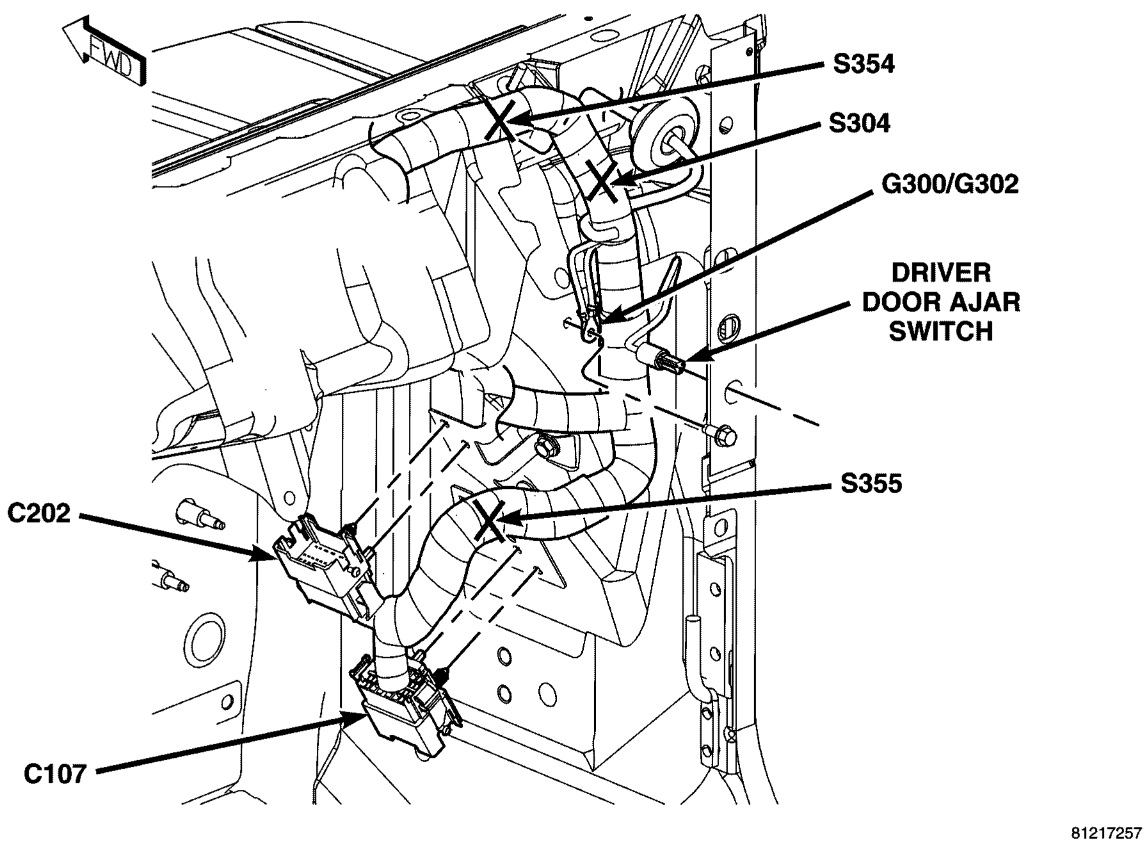

Fig. 21 RIGHT COWL PANEL RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

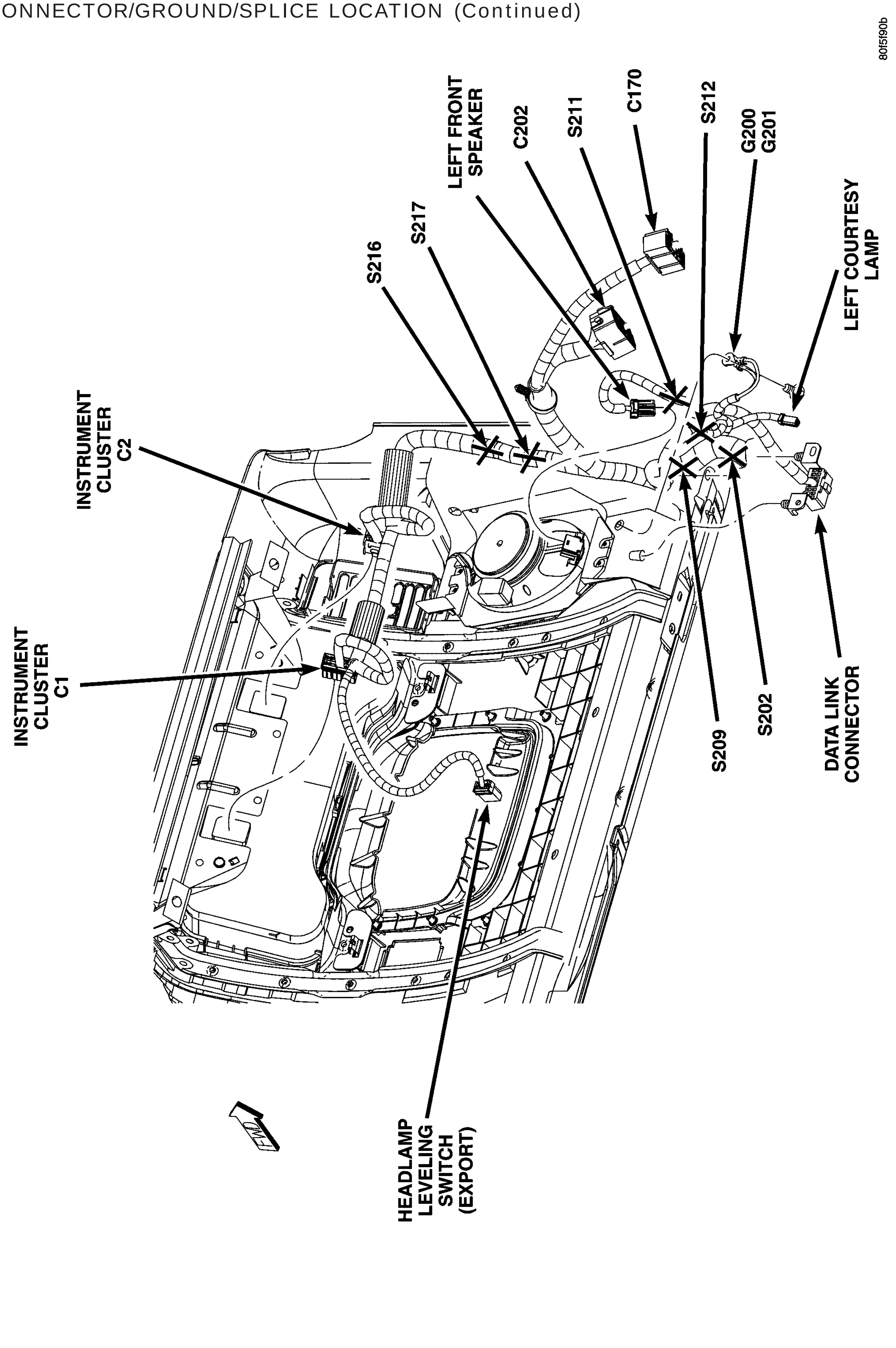

Fig. 22 LEFT SIDE INSTRUMENT PANEL LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

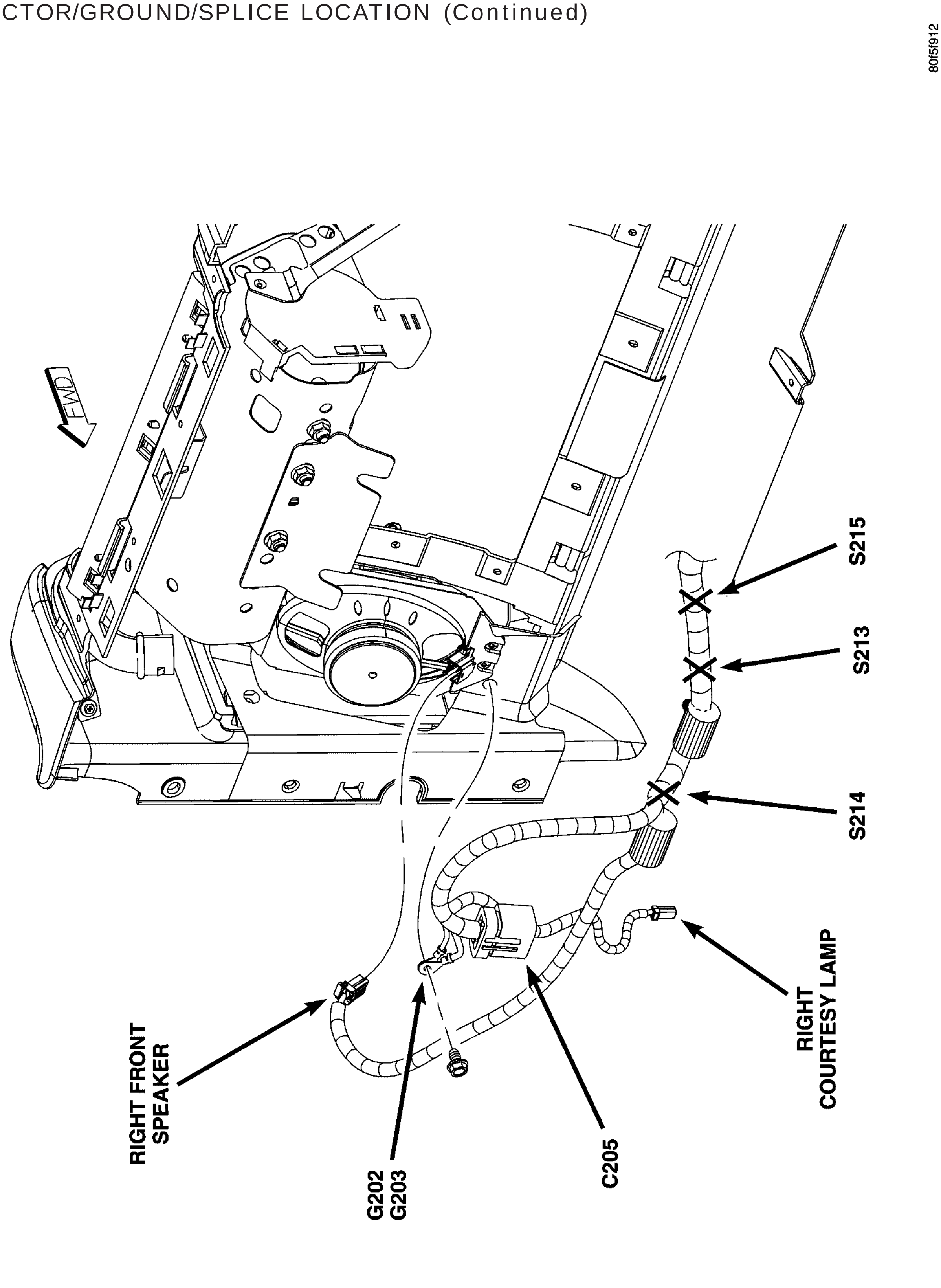

Fig. 23 RIGHT SIDE INSTRUMENT PANEL LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

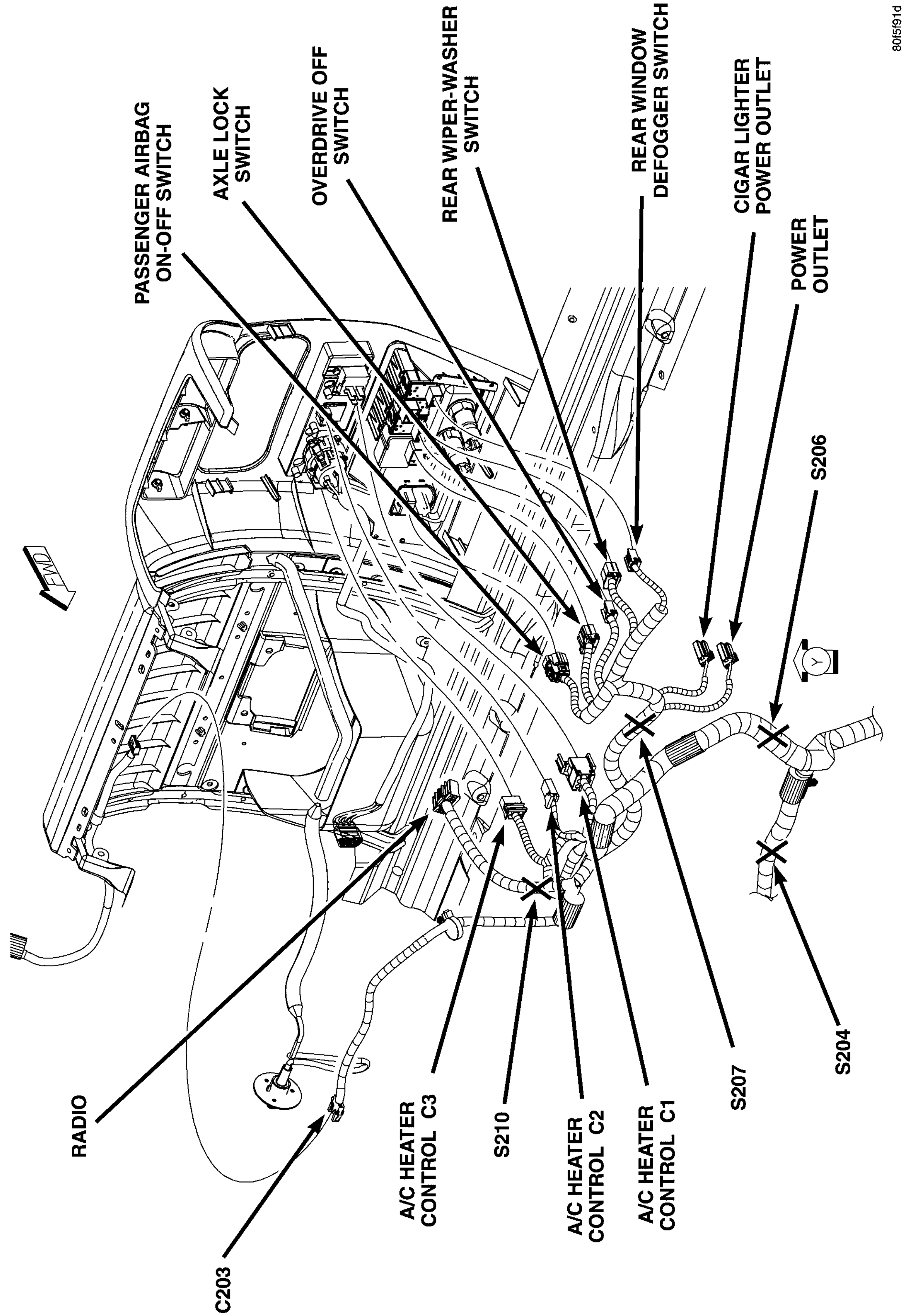

Fig. 24 CENTER INSTRUMENT PANEL LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

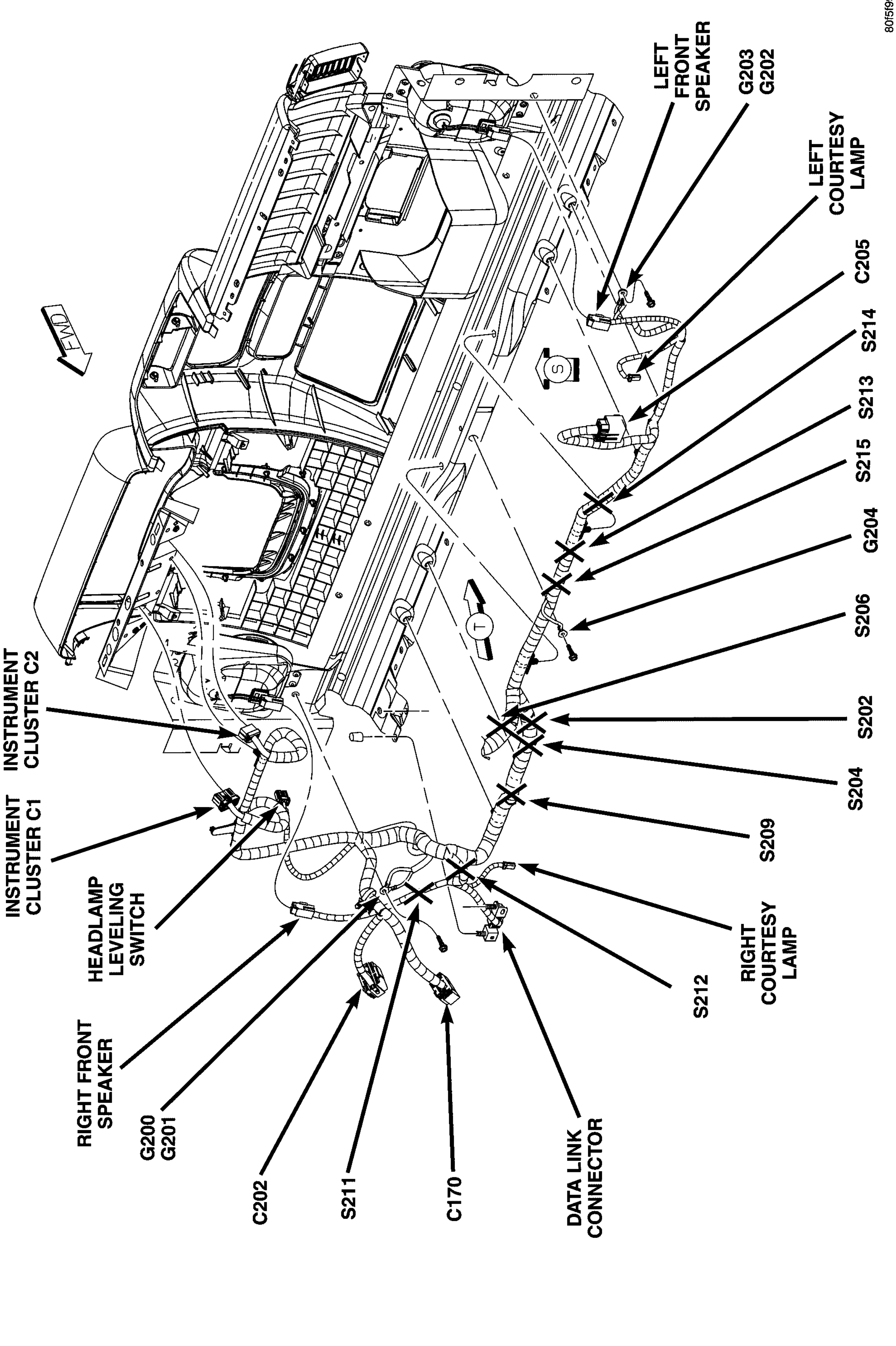

Fig. 25 INSTRUMENT PANEL RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

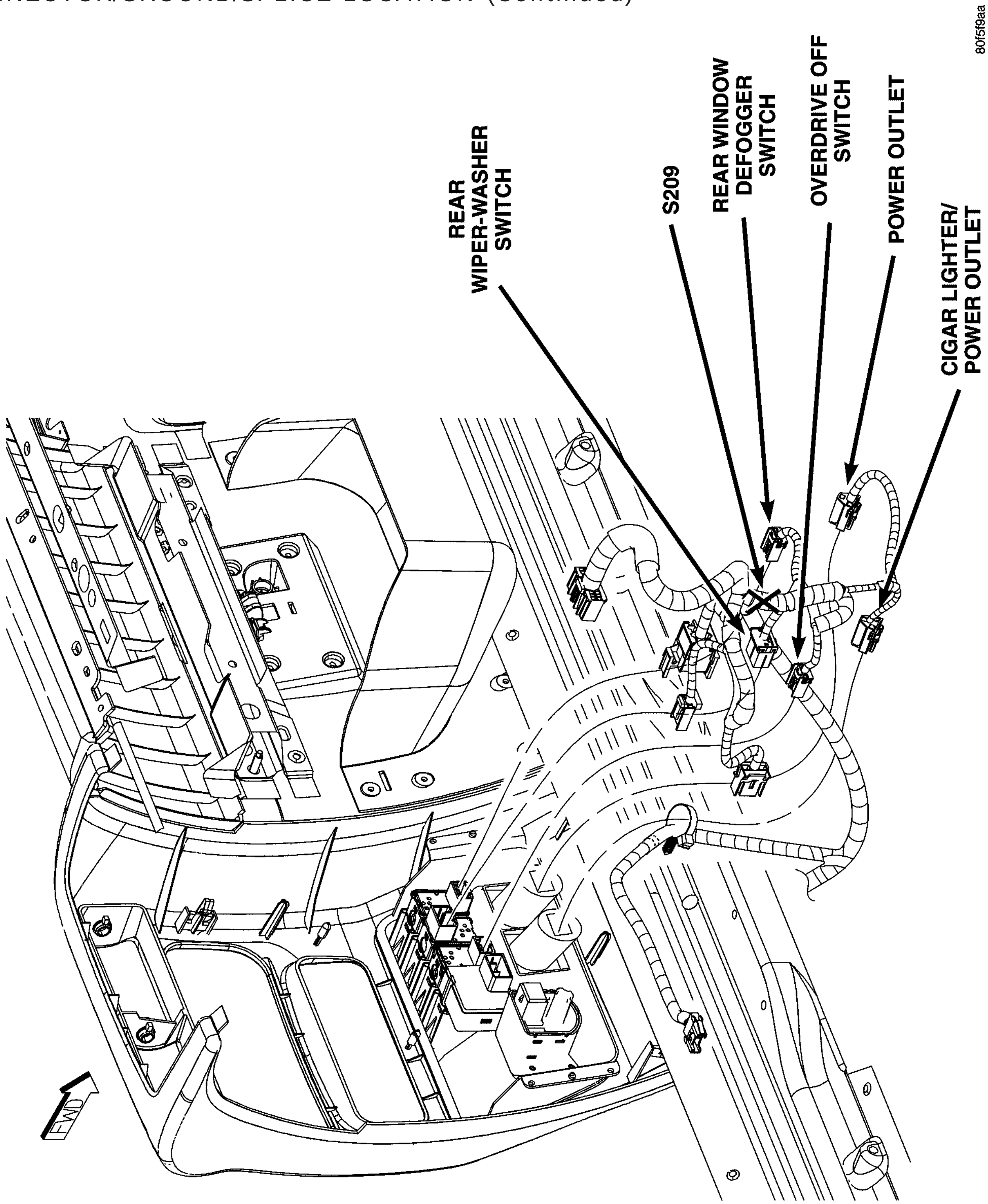

Fig. 26 CENTER INSTRUMENT PANEL RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

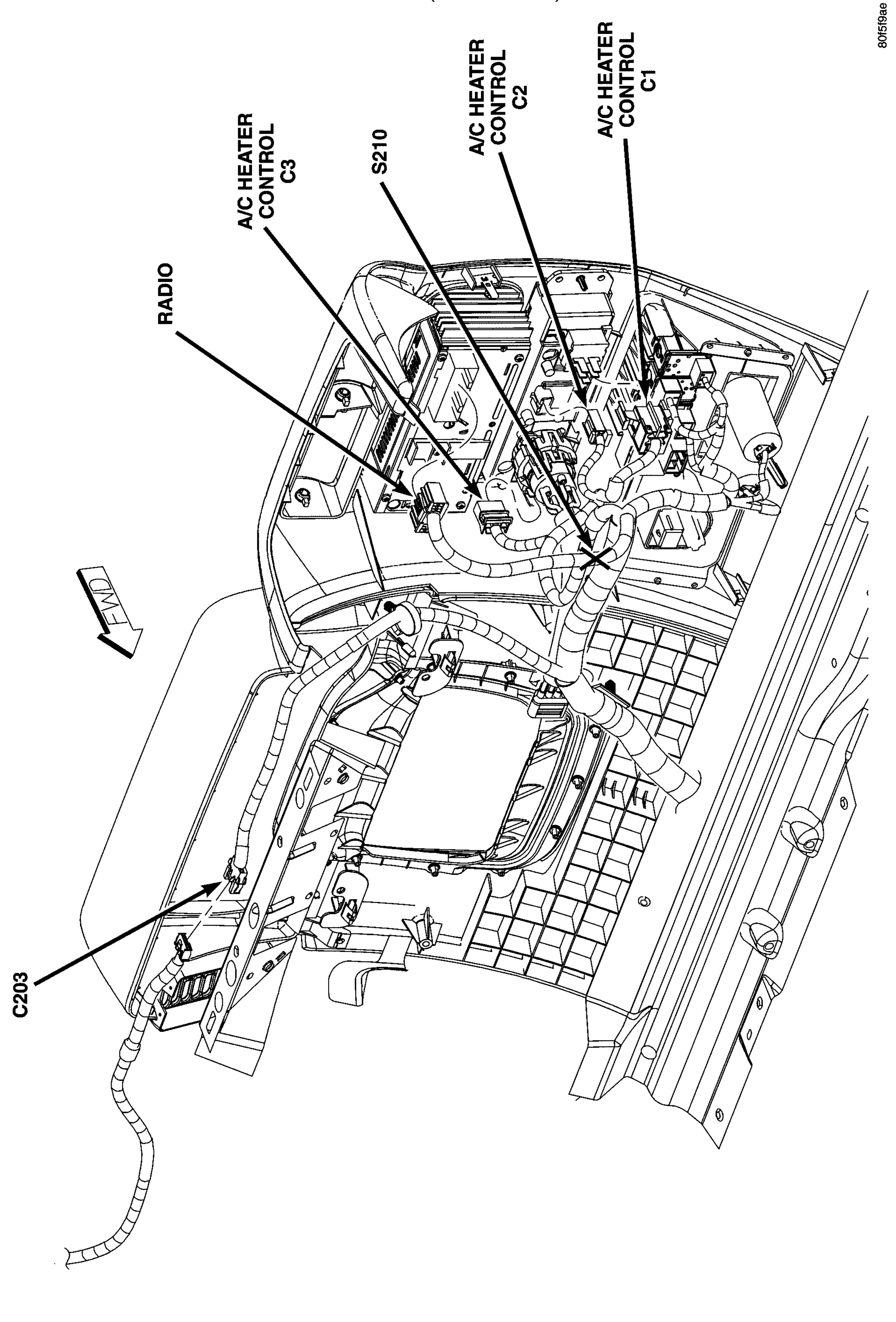

Fig. 27 RIGHT AND CENTER INSTRUMENT PANEL RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

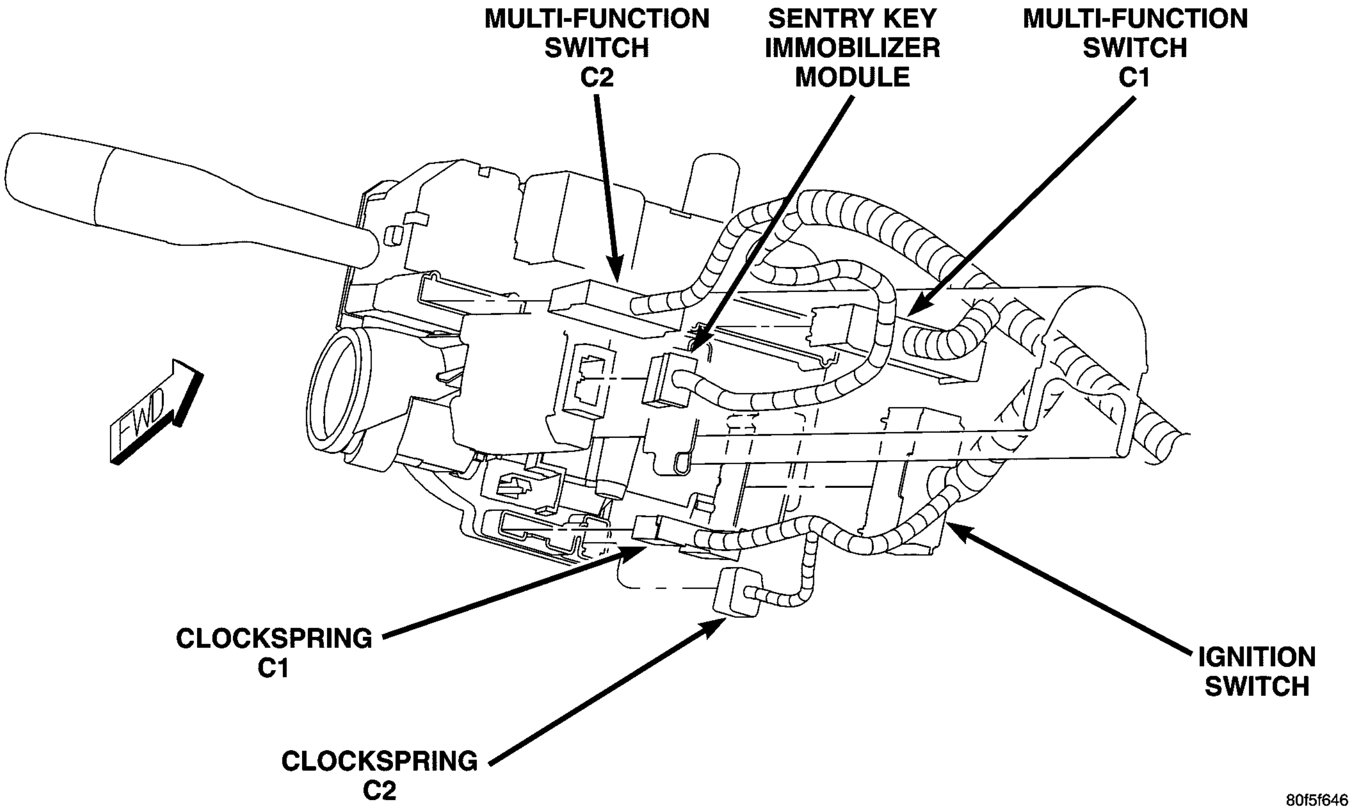

Fig. 28 STEERING COLUMN CONNECTIONS

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

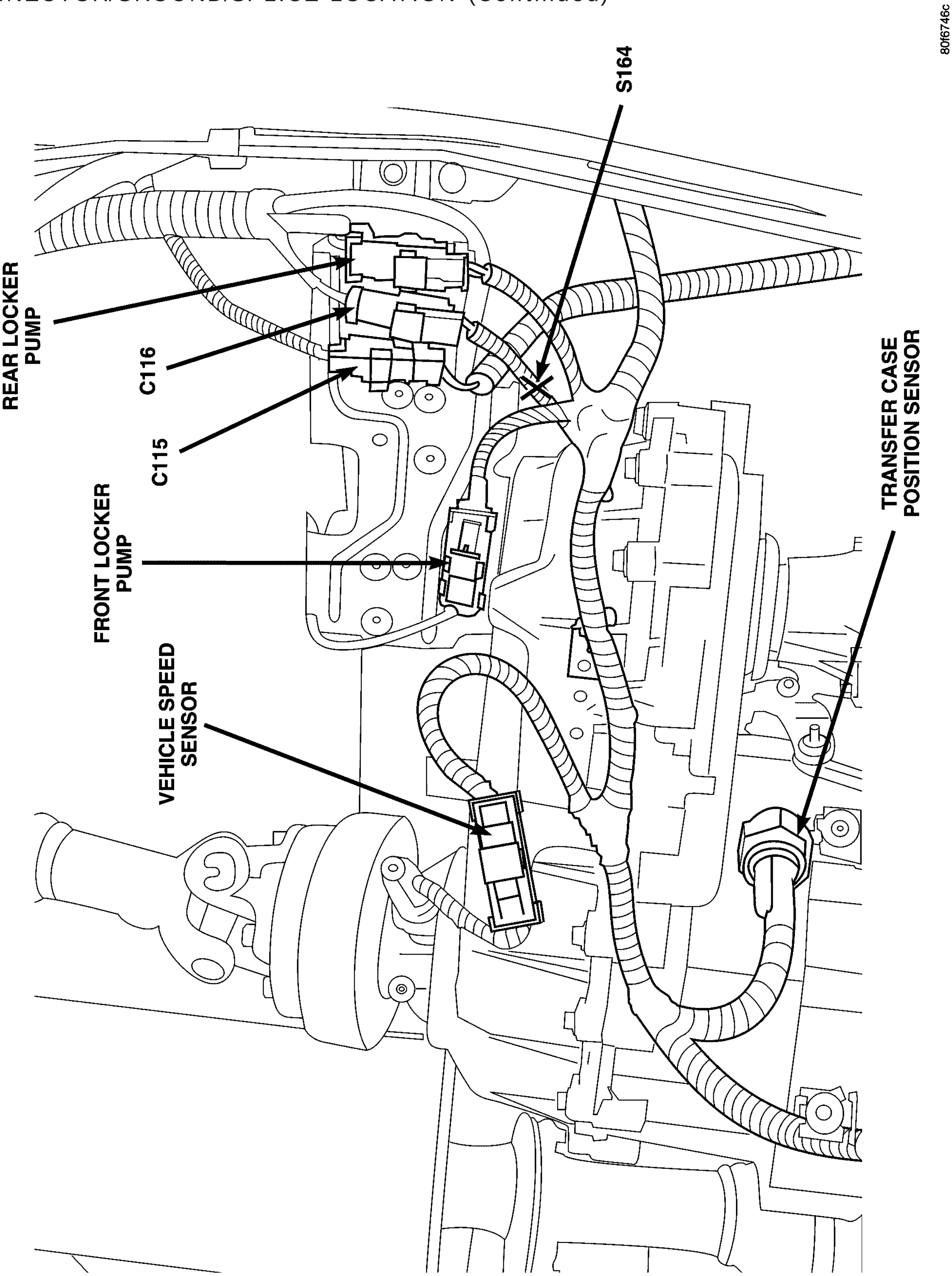

Fig. 29 TRANSFER CASE

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

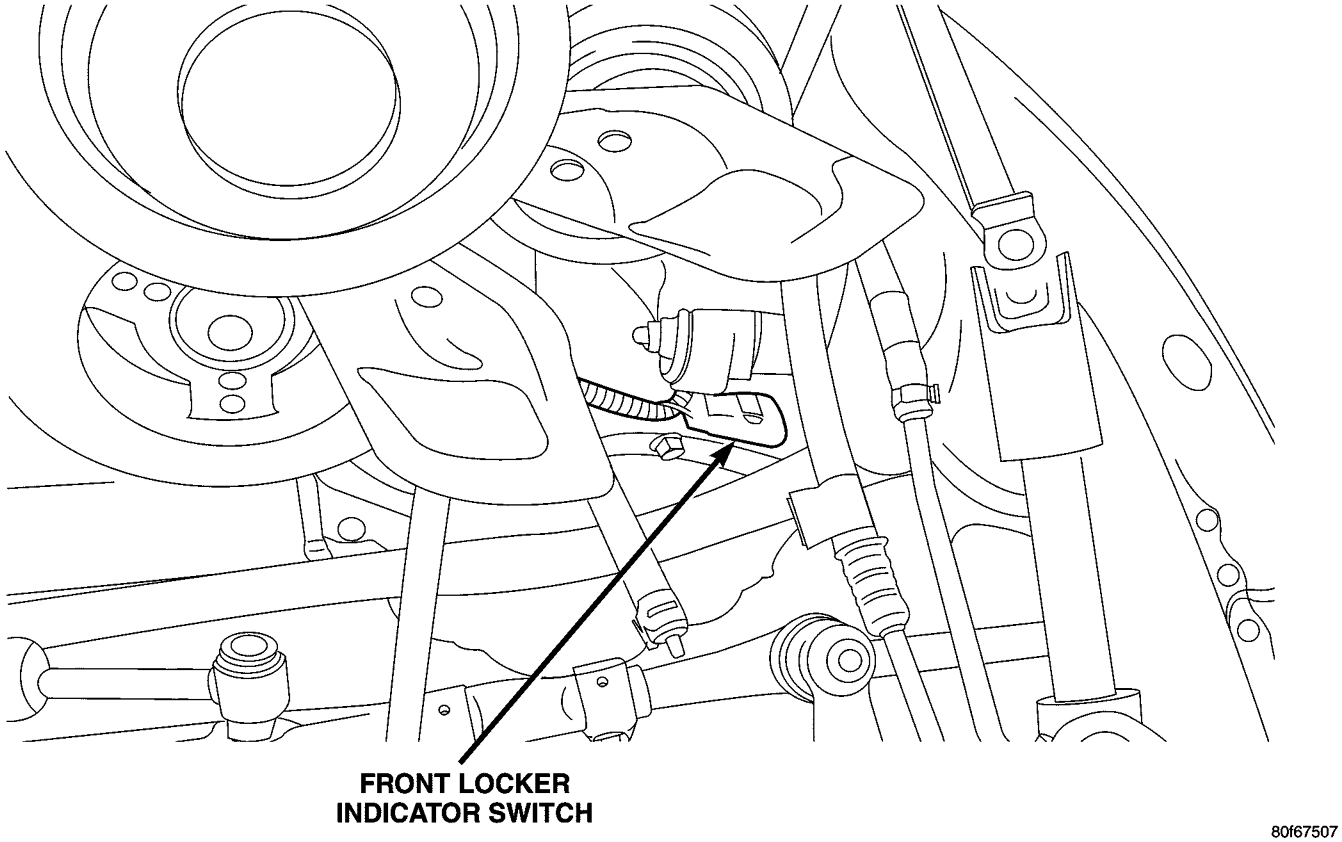

Fig. 30 FRONT LOCKER INDICATOR SWITCH

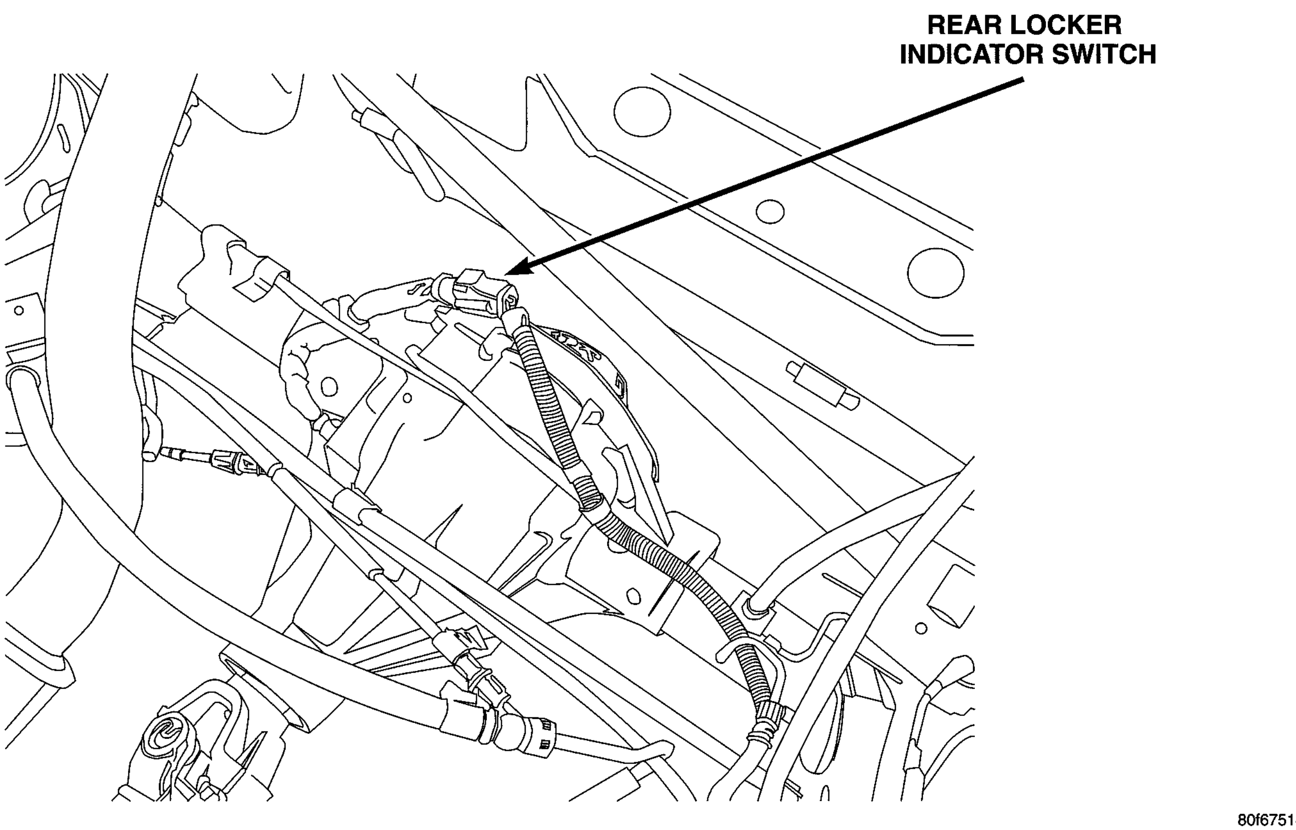

Fig. 31 REAR LOCKER INDICATOR SWITCH

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

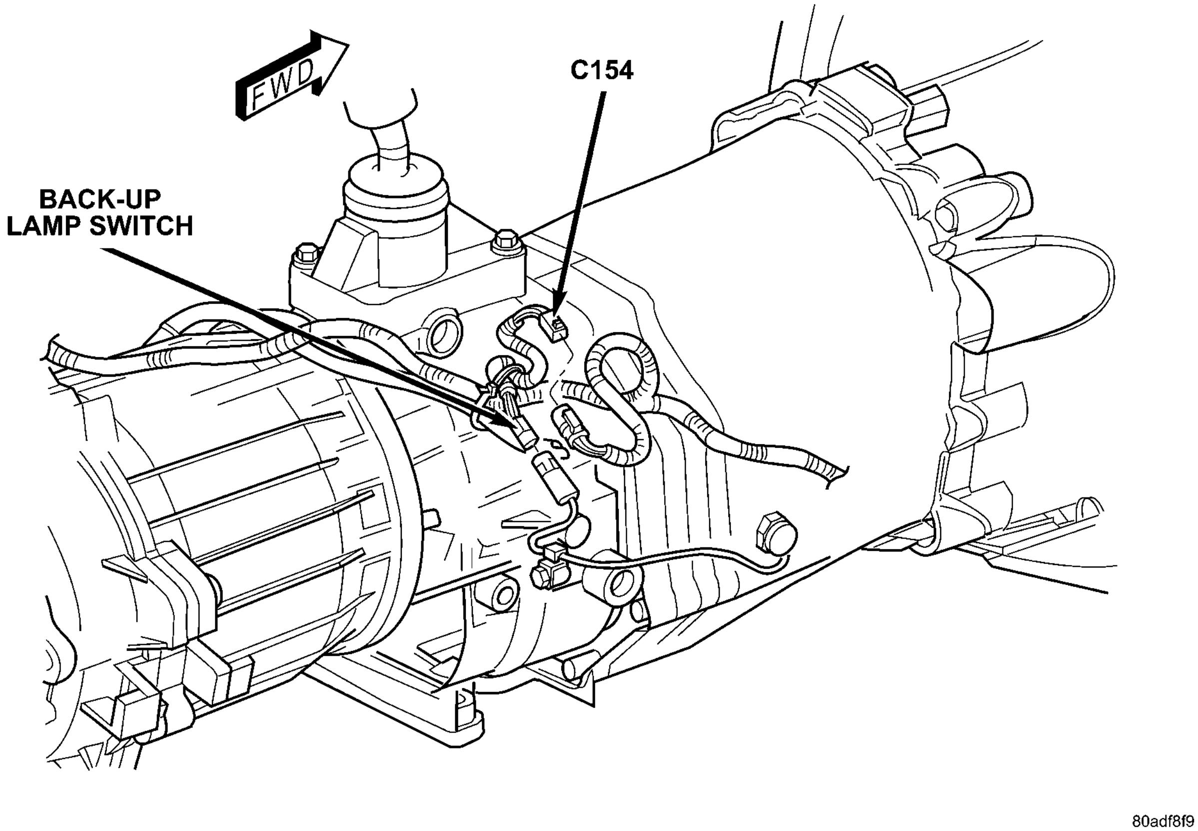

Fig. 32 MANUAL TRANSMISSION BUX

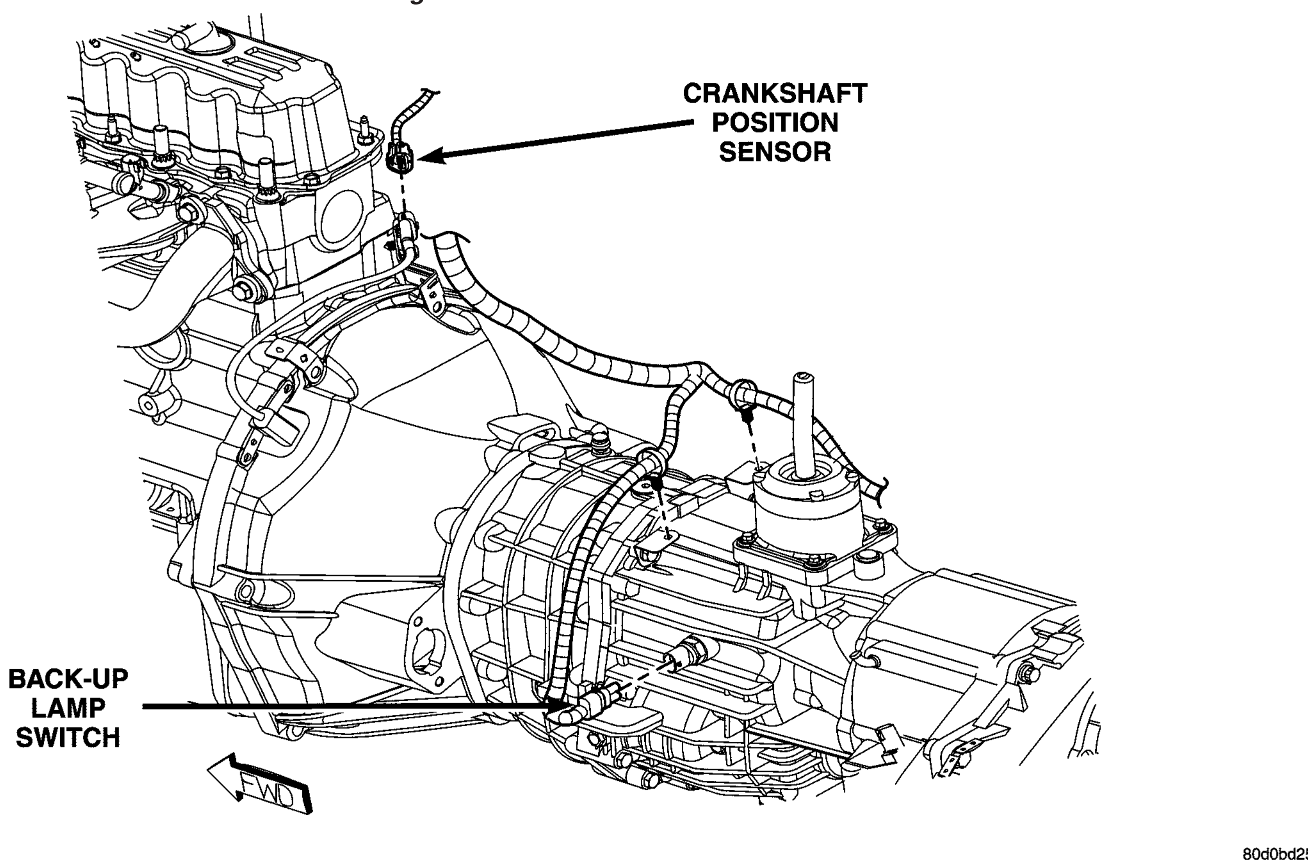

Fig. 33 MANUAL TRANSMISSION

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

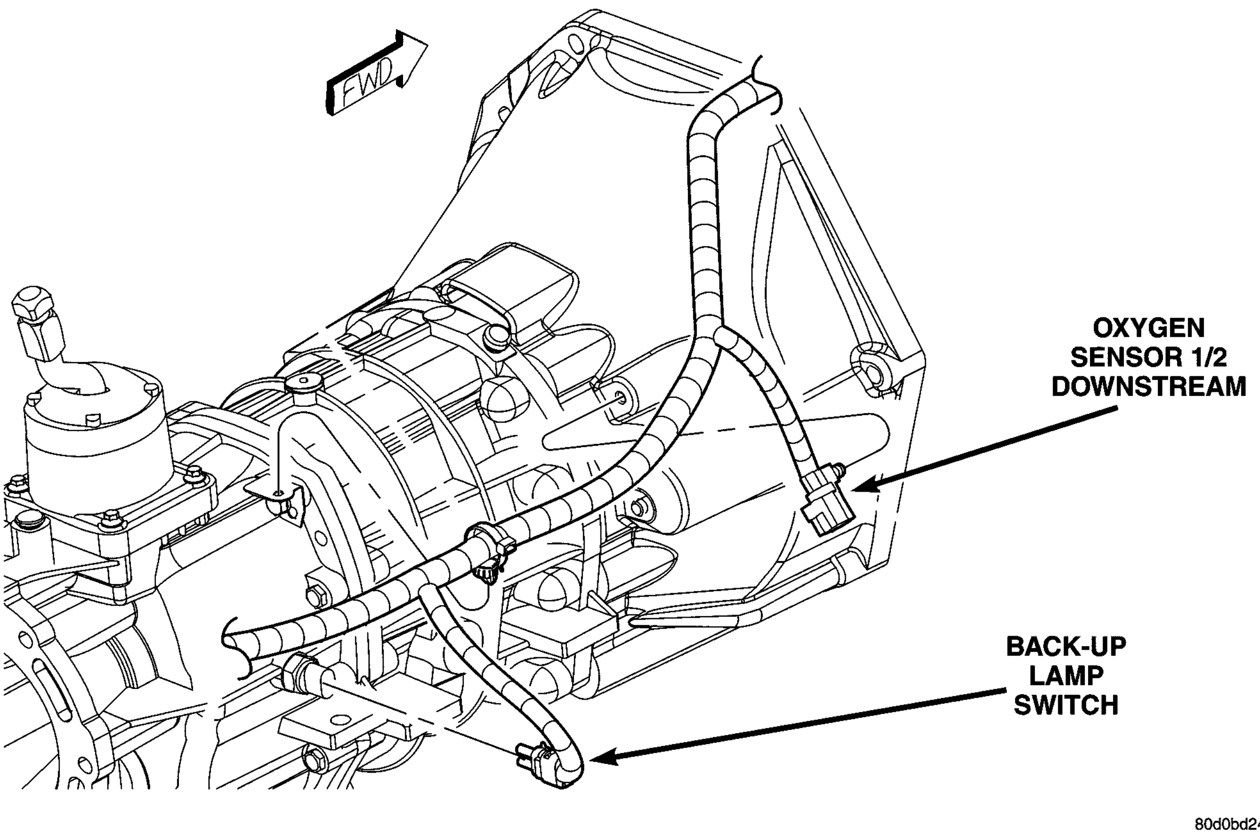

Fig. 34 MANUAL TRANS 2.4L

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

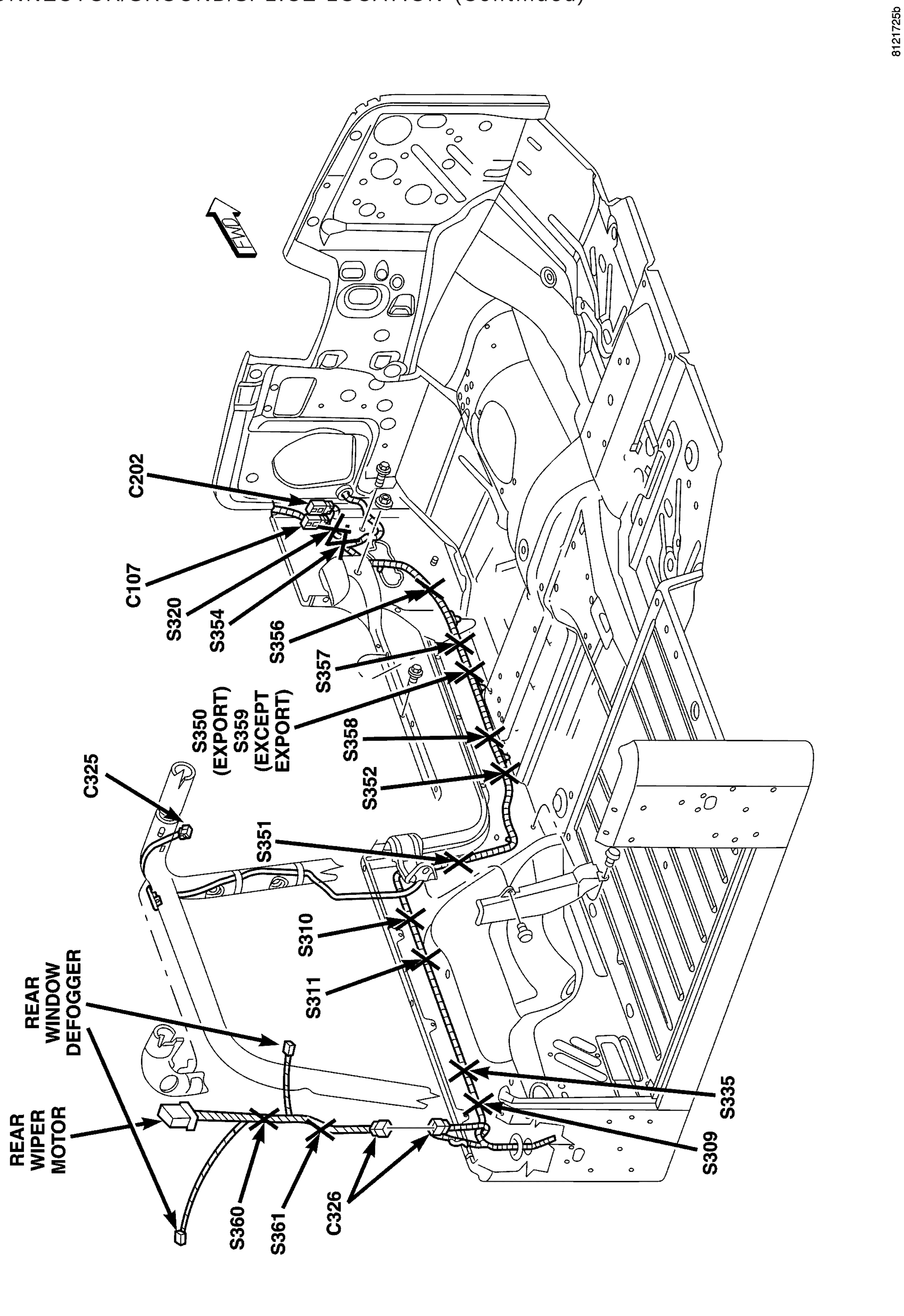

Fig. 35 BODY CONNECTORS LHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

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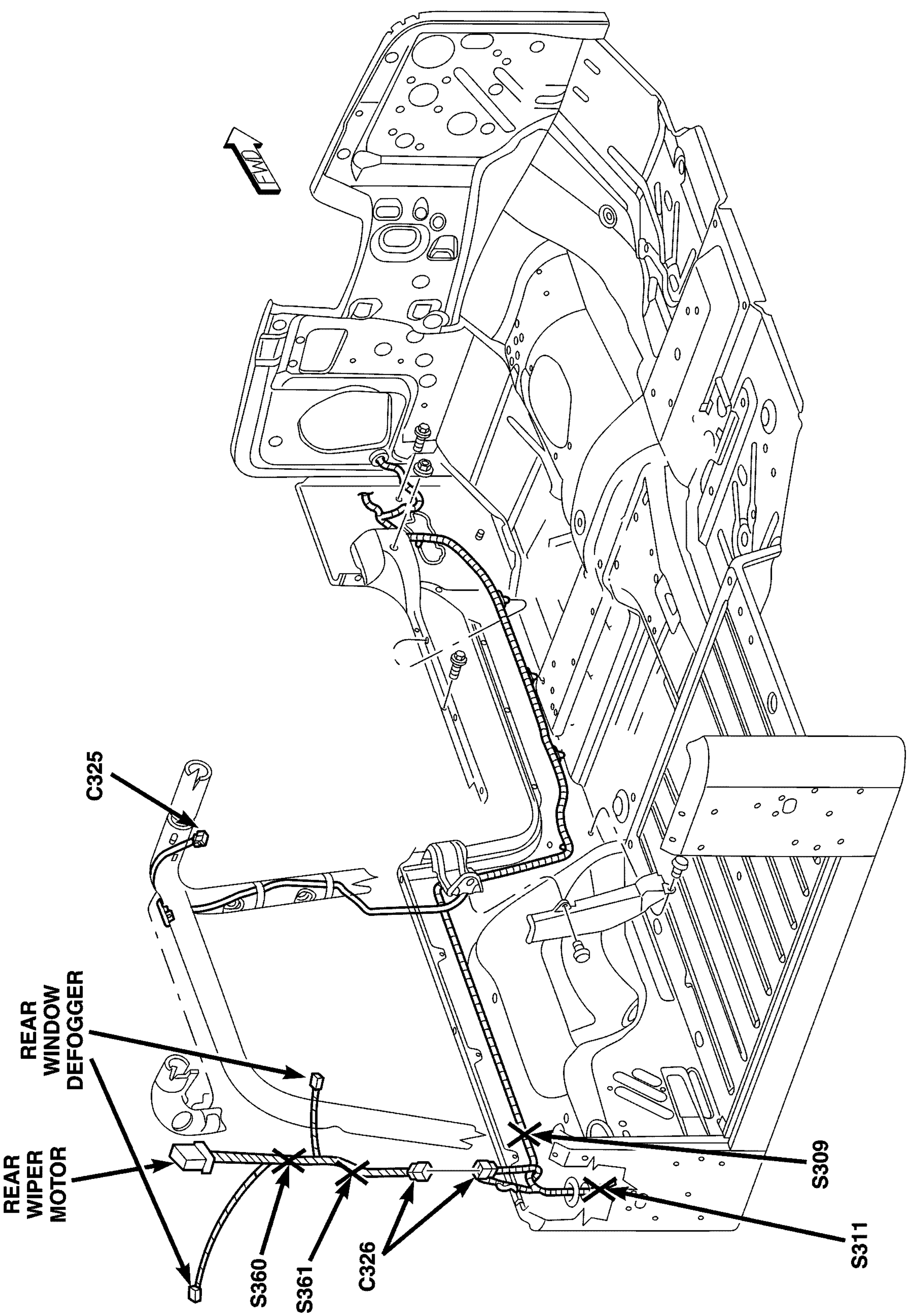


Fig. 36 BODY CONNECTORS RHD

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

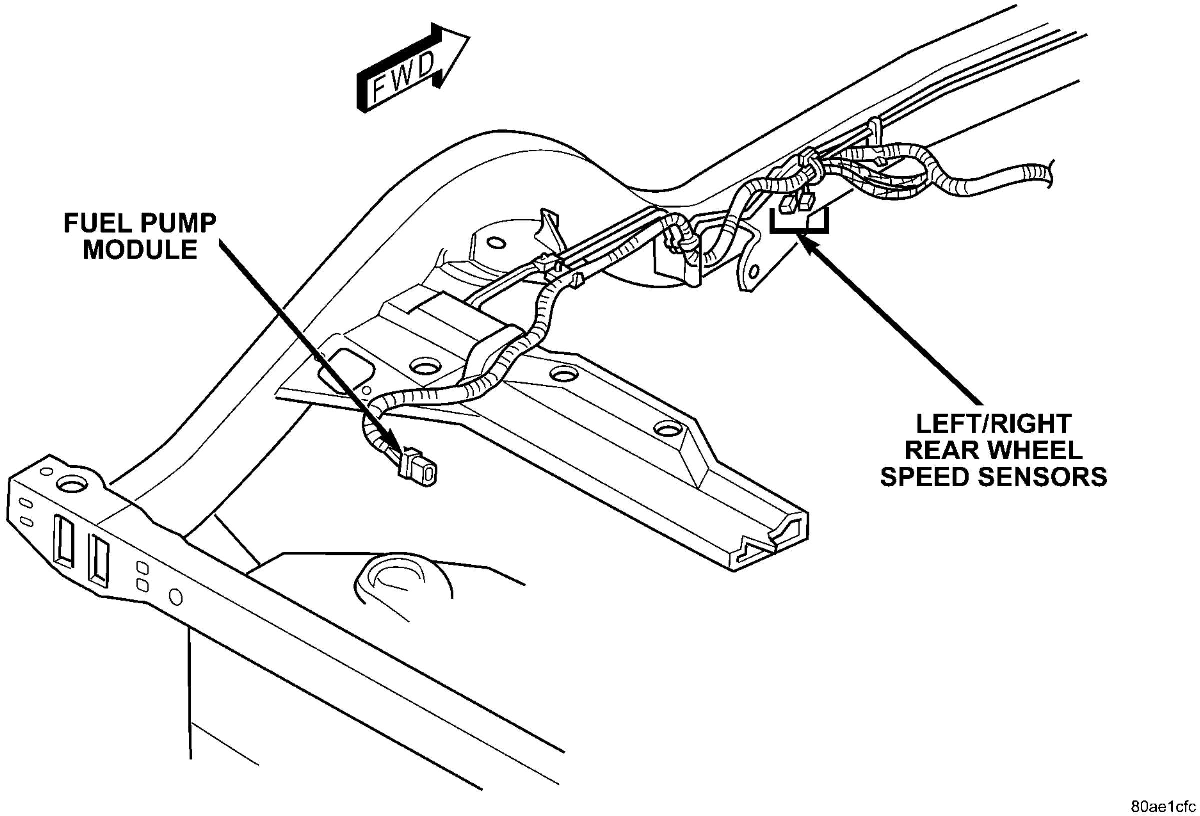


Fig. 37 FUEL PUMP

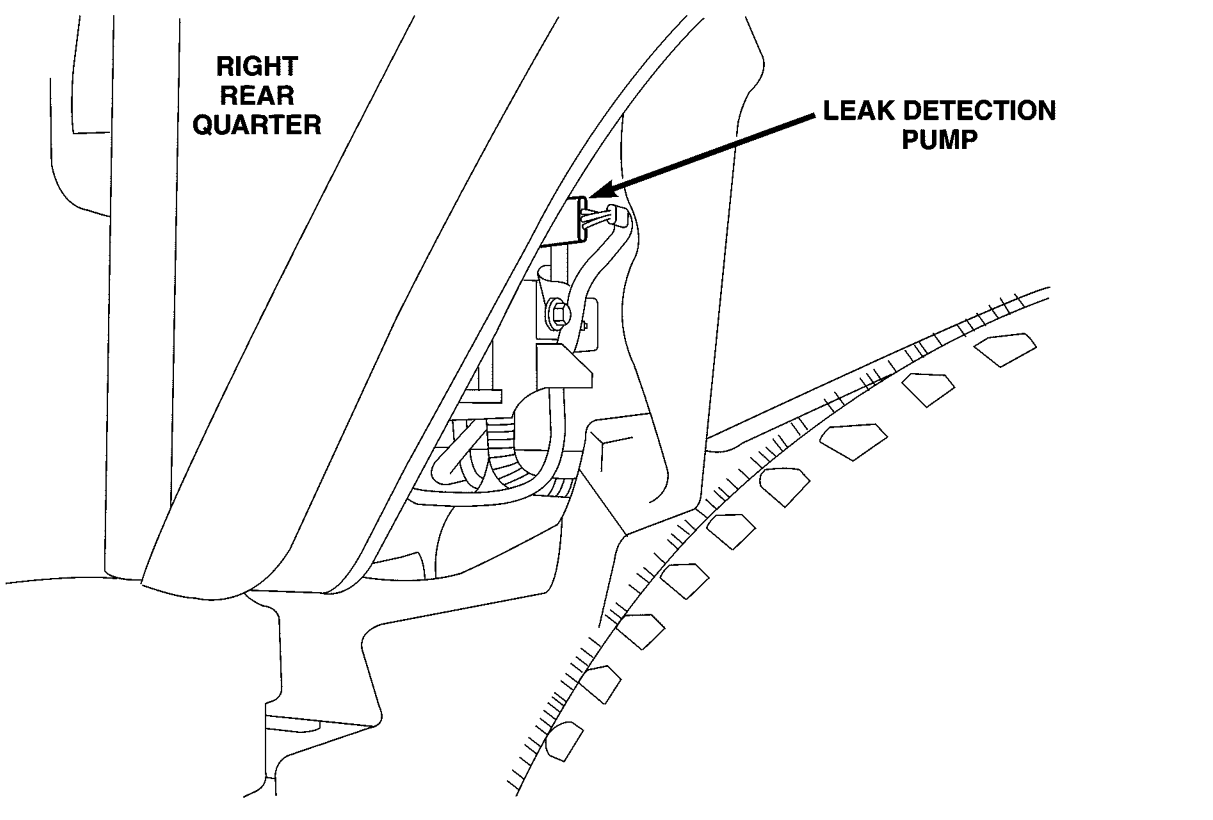


Fig. 38 LEAK DETECTION PUMP

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

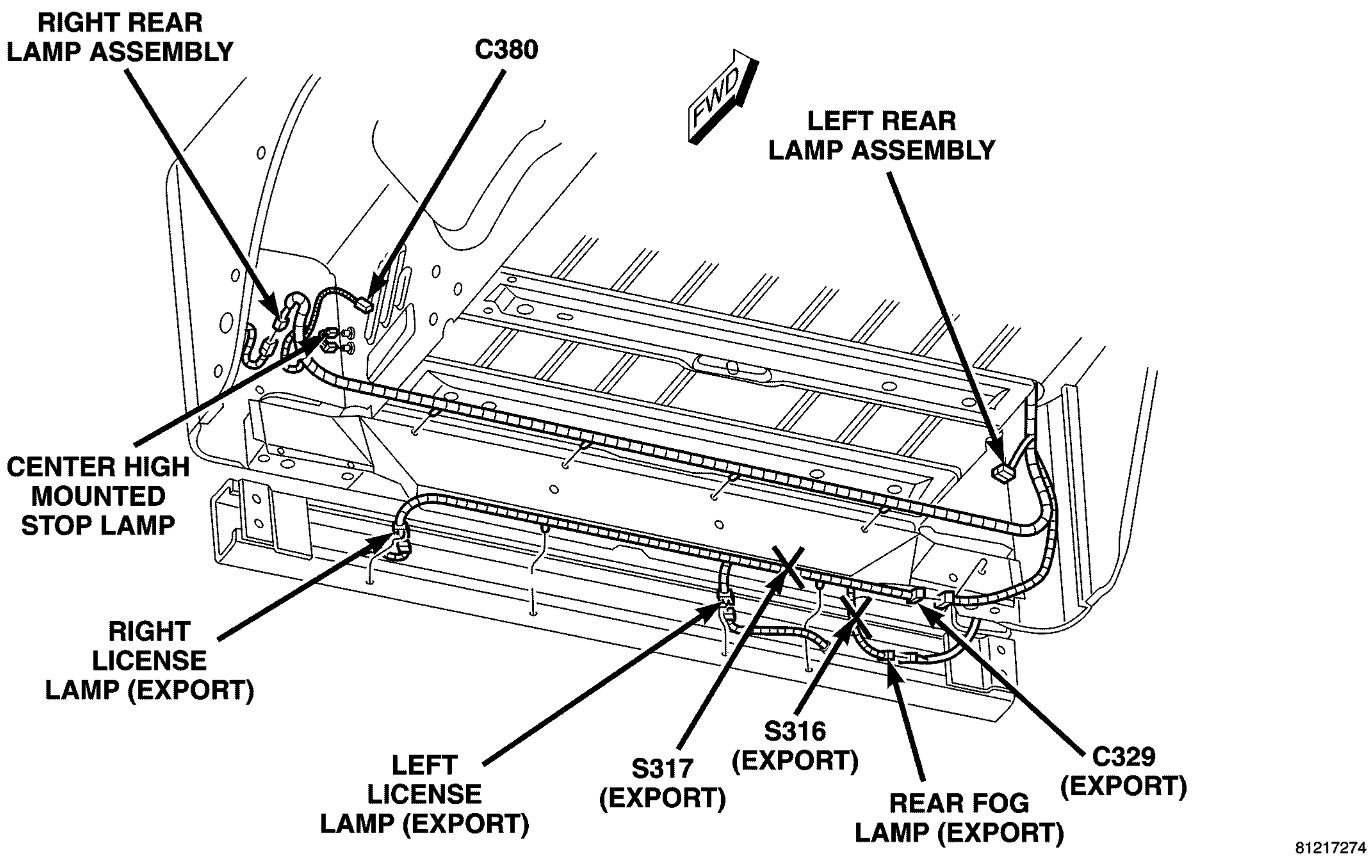


Fig. 39 REAR LAMPS LHD

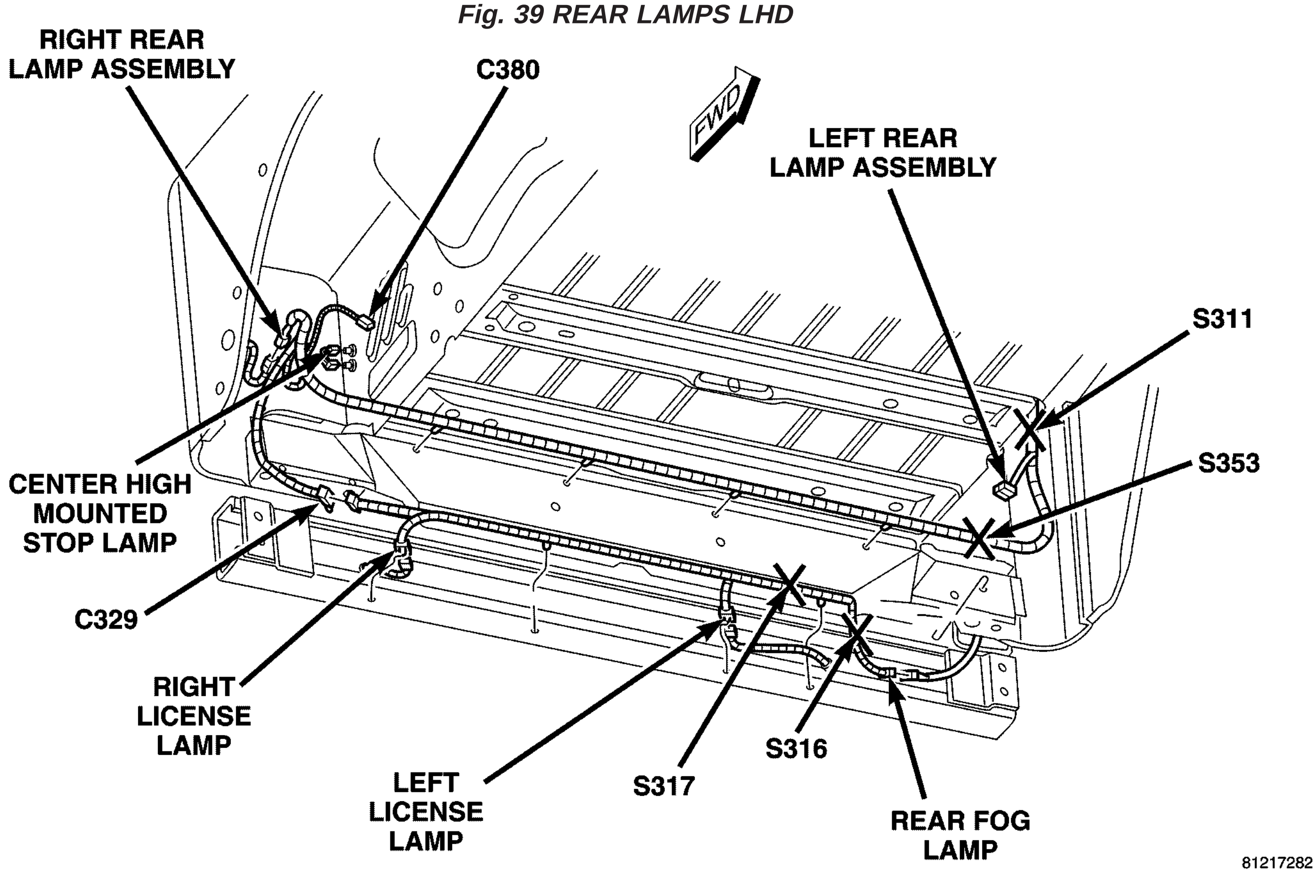


Fig. 40 REAR LAMPS RHD

8W-97 POWER DISTRIBUTION

TABLE OF CONTENTS

POWER DISTRIBUTION

DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Fuseblock
- Cigar Lighter Outlet
- Power Outlet

The power distribution system also incorporates various types of circuit control and protection features, including:

- Blade-type fuses
- Cartridge fuses
- Relays

Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features and use of all of the power distribution system components. Refer to the index in this service manual for the location of complete circuit diagrams for the various power distribution system components.

OPERATION

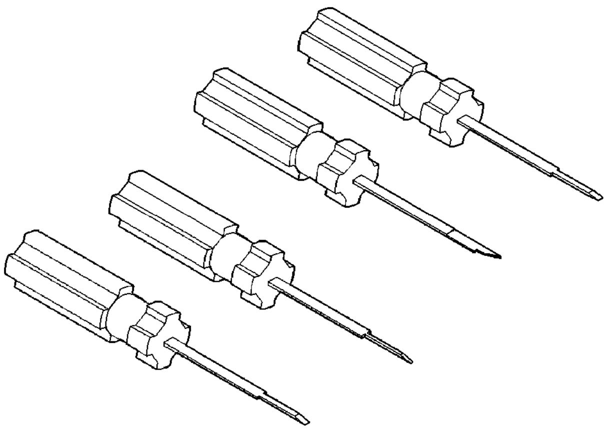
The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the sourcing of additional elec-

POWER DISTRIBUTION (Continued)

trical circuits that may be required to provide the electrical current needed to operate many accessories that the vehicle owner may choose to have installed in the aftermarket.

SPECIAL TOOLS

POWER DISTRIBUTION SYSTEMS



Terminal Pick Kit 6680

CIGAR LIGHTER OUTLET

DESCRIPTION

An instrument panel cigar lighter outlet is standard factory-installed equipment on some models. Models equipped with the optional smoker's package will include a cigar lighter knob and heating element. Models without the smoker's package are equipped with a snap fit plastic cap and the outlet is treated as an extra accessory power outlet. The outlet is installed in the instrument panel accessory switch bezel, which is located near the bottom of the instrument panel center bezel area, below the heater and air conditioner controls.

The cigar lighter outlet is serviced only as a part of the accessory switch bezel unit. If the base is faulty or damaged, the accessory switch bezel unit must be replaced. The cigar lighter knob and heating element unit is available for service. This component cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The cigar lighter base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse (f13) in the Power Distribution Center (PDC) through the ignition switch, only when in the Accessory or On position and through a fuse (f19) in the fuseblock.′

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the receptacle shell, the heating element resistor coil is grounded through its housing to the receptacle shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the receptacle shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the receptacle shell. These clips engage and hold the heating element of the cigar lighter against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the receptacle shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET

For complete circuit diagrams, refer to **Wiring Diagrams**.

WARNING: REFER TO THE RESTRAINTS SECTION OF THE SERVICE MANUAL BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the cigar lighter knob and element from the cigar lighter receptacle shell. Check for continuity between the inside circumference of the cigar lighter receptacle shell and a good ground. there should be continuity. If OK, go to Step 2. If not OK, go to Step 3.

(2) Turn the ignition switch to the On position. Check for battery voltage at the insulated contact located at the back of the cigar lighter receptacle

CIGAR LIGHTER OUTLET (Continued)

shell. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 3.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument panel accessory switch bezel. Check for continuity between the ground circuit cavity #3 of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the Accessory or On positions. Check for battery voltage at cavity #1 of the cigar lighter wire harness connector. If OK, replace the faulty accessory switch bezel unit. If not OK, check for blown fuse in the fuseblock (f19) or in the PDC (f13). If fuse is blown check for short circuit. Repair the circuit as required and replace blown fuse.

FUSE BLOCK

DESCRIPTION

An electrical fuseblock module is mounted on the dash panel in the passenger compartment of the vehicle (Fig. 1). The fuseblock module serves to distribute electrical current to many of the accessory systems in the vehicle. The fuseblock module houses up to twenty blade-type mini fuses.

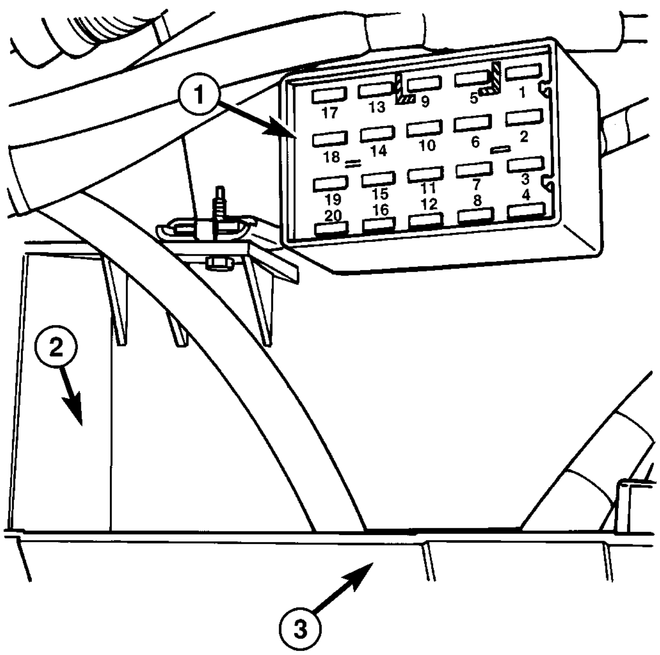


Fig. 1 Fuseblock Module Location

1 - FUSE BLOCK
2 - HEATER CASE
3 - GLOVE BOX OPENING

The molded plastic fuseblock module housing has an integral mounting bracket that is secured with two screws to a bracket welded on the dash panel just above the heater and air conditioner housing. The glove box is rolled down from the instrument panel for service access of the fuseblock module fuses. An adhesive-backed fuse layout map (Fig. 2)is located on the outside of the glove box bin (Fig. 3) to ensure proper fuse identification.

FRT WIPE (25A) 17	TURN SIG (10A) 13	AIRBAG (10A) 9	AIRBAG (10A) 5	PARK LPS SKIM (20A) 1
CIGAR LIGHTER (20A) 18	RADIO (10A) 14	CLUSTER (10A) 10	REAR WIPE (20A) 6	STOP LPS (20A) 2
SPARE FUSE (20A) 19	HBL SW (10A) 15	SOLENOIDS DRL (10A) 11	BACK-UP LP ABS (10A) 7	SUB-WOOFER SYSTEM (20A) 3
TRANS SEE OWNERS MANUAL (20A) 20	HEADLAMP AIM SW (10A) 16	PDC RELAYS SKIM (10A) 12	HEVAC (BLOWER FAN) (10A) 8	DOOR SW DEFEAT (10A) 4
56009391AL				

80d9ff50

Fig. 2 Fuseblock Label

The fuseblock module is integral to the body wire harness. If any internal circuit or the fuseblock module housing is faulty or damaged, the entire fuseblock module and body harness unit must be replaced.

OPERATION

All of the circuits entering and leaving the fuseblock module do so through the body wire harness. Internal connection of all of the fuseblock module circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Wiring Diagrams** for the location of complete fuseblock module circuit diagrams.

REMOVAL

The fuseblock module is serviced as a unit with the body wire harness. If any internal circuit of the fuseblock module or if the fuseblock module housing is faulty or damaged, the entire fuseblock module and the body wire harness unit must be replaced.

(1) Disconnect and isolate the battery negative cable.

FUSE BLOCK (Continued)

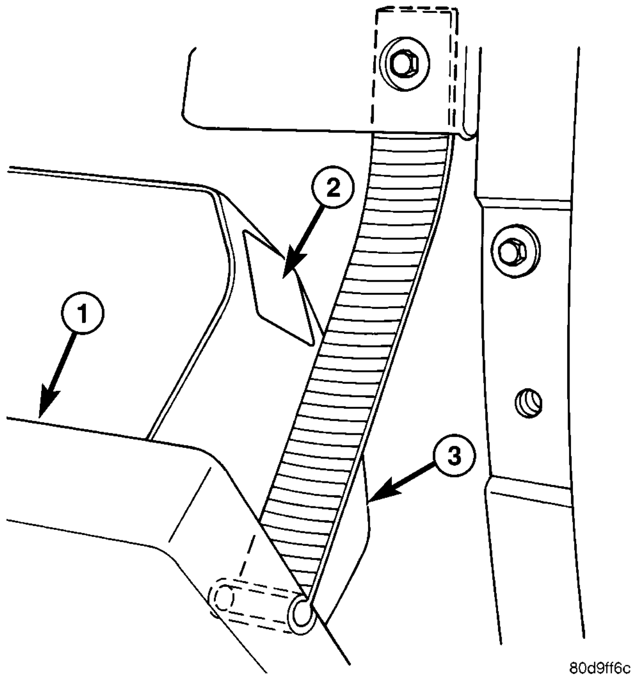


Fig. 3 Fuseblock Label Location

1 - GLOVE BOX DOOR
2 - FUSEBLOCK LABEL
3 - GLOVE BOX BIN

(2) Remove the instrument panel assembly from the dash panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(3) Disconnect each of the body wire harness connectors. Refer to **Connector Locations** in Wiring for the location of the body wire harness connector locations.

(4) Remove all of the fasteners that secure each of the body wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring for the location of the body wire harness ground locations.

(5) Disengage each of the retainers that secure the body wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring for the location of the body wire harness retainer locations.

(6) Remove the two screws that secure the fuseblock module to the bracket on the dash panel (Fig. 4).

(7) Remove the fuseblock module and the body wire harness from the dash panel as a unit.

INSTALLATION

The fuseblock module is serviced as a unit with the body wire harness. If any internal circuit of the fuseblock module or if the fuseblock module housing is faulty or damaged, the entire fuseblock module and the body wire harness unit must be replaced.

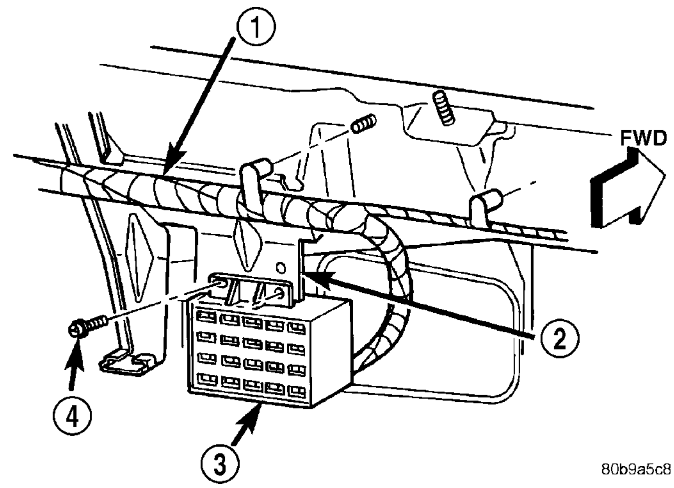


Fig. 4 Fuseblock Module Remove/Install

1 - BODY WIRE HARNESS
2 - BRACKET
3 - FUSEBLOCK MODULE
4 - SCREWS (2)

NOTE: If the fuseblock module is being replaced with a new unit, be certain to transfer each of the fuses from the faulty fuseblock module to the proper cavities of the replacement fuseblock module. Refer to Fuse/Fuse Block in the index of this service manual for the location of complete fuseblock module circuit diagrams and cavity assignments.

(1) Position the fuseblock module and the body wire harness onto the dash panel as a unit.

(2) Install and tighten the two screws that secure the fuseblock module to the bracket on the dash panel. Tighten the screws to 3.3 N·m (30 in. lbs.).

(3) Engage each of the retainers that secure the body wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring for the location of the body wire harness retainer locations.

(4) Install all of the fasteners that secure each of the body wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in Wiring for the location of the body wire harness ground eyelet locations.

(5) Reconnect each of the body wire harness connectors. Refer to **Connector Locations** in Wiring for the location of the body wire harness connector locations.

(6) Install the instrument panel assembly onto the dash panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

(7) Reconnect the battery negative cable.

IOD FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse (Fig. 5) that is removed from its cavity in the Power Distribution Center (PDC) when the vehicle is shipped from the factory. Dealer personnel are to remove the IOD fuse from the storage location and install it into PDC fuse cavity 15 as part of the preparation procedures performed just prior to new vehicle delivery.

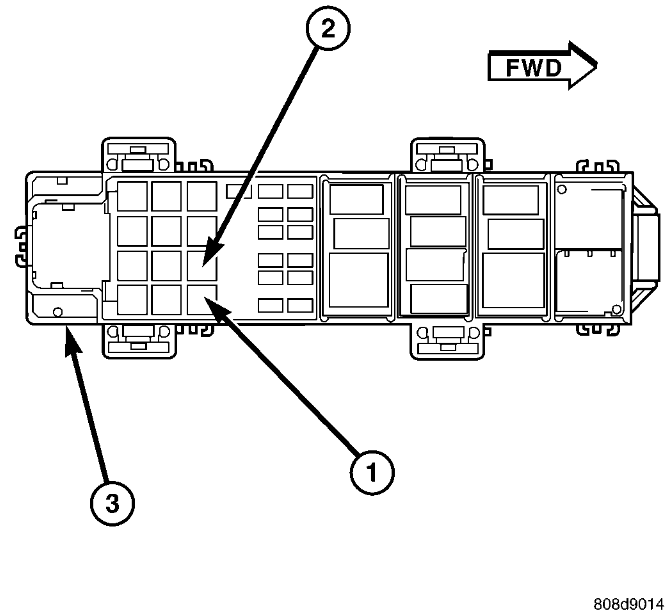


Fig. 5 Ignition-Off Draw Fuse

1 - IGNITION-OFF DRAW FUSE
2 - IGNITION-OFF DRAW FUSE STORAGE LOCATION
3 - POWER DISTRIBUTION CENTER

The PDC has a molded plastic cover that can be unlatched and opened to provide service access to all of the fuses and relays in the PDC. An integral latch and hinge tabs are molded into the PDC cover for easy removal. A fuse layout map is integral to the underside of the PDC cover to ensure proper fuse and relay identification. The IOD fuse is a 50 ampere cartridge-type fuse and, when removed, it is stored in the empty fuse cavity 11 of the PDC.

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for many of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position, including the clock. The only reason the IOD fuse is removed is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is removed from PDC fuse cavity #15 when the vehicle is shipped from the assembly plant. Dealer personnel must install the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse. The IOD fuse serves no useful purpose to the dealer technician in the service or diagnosis of any vehicle system or condition, other than the same purpose as that of any other standard circuit protection device.

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that removing the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged.

REMOVAL

The Ignition-Off Draw (IOD) fuse is removed from Power Distribution Center (PDC) fuse cavity #15 when the vehicle is shipped from the assembly plant. Dealer personnel must install the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation.

(1) Turn the ignition switch to the Off position.

(2) Unlatch and open the cover from the PDC.

(3) Remove the IOD fuse from fuse cavity #15 of the PDC.

(4) Store the removed IOD fuse by inserting the terminal blades of the fuse into the empty fuse cavity #11 of the PDC.

(5) Close and latch the cover onto the PDC.

INSTALLATION

The Ignition-Off Draw (IOD) fuse is removed from Power Distribution Center (PDC) fuse cavity #15 when the vehicle is shipped from the assembly plant. Dealer personnel must install the IOD fuse when the

IOD FUSE (Continued)

vehicle is being prepared for delivery in order to restore full electrical system operation.

(1) Turn the ignition switch to the Off position.

(2) Unlatch and open the cover from the PDC.

(3) Remove the stored IOD fuse from fuse cavity #11 of the PDC.

(4) Align the terminal blades of the IOD fuse with the terminal receptacles in fuse cavity #15 of the PDC.

(5) Use a thumb to press the IOD fuse firmly down into PDC fuse cavity #15.

(6) Close and latch the cover onto the PDC.

MICRO-RELAY

DESCRIPTION

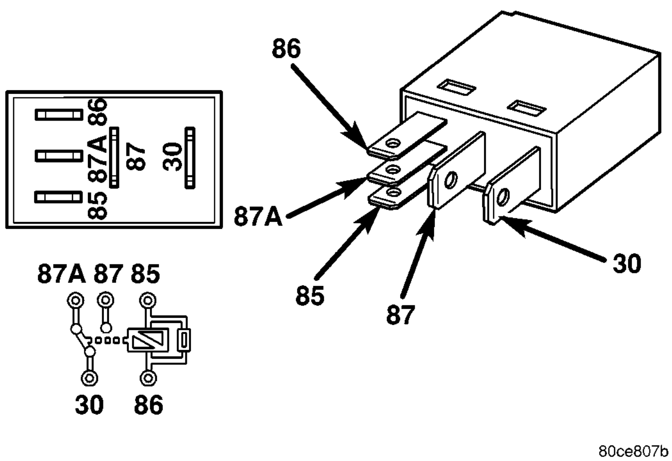


Fig. 6 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

A micro-relay is a conventional International Standards Organization (ISO) micro relay (Fig. 6). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

Relays cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

A micro-relay is an electromechanical switch that uses a low current input from one source to control a high current output to another device. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

DIAGNOSIS AND TESTING - MICRO-RELAY

(1) Remove the relay from its mounting location.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30 (Fig. 6). If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 67.5 - 82.5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the relay by grasping it firmly and pulling it straight out from its receptacle. A slight back and fourth rocking motion may help the removal process.

INSTALLATION

(1) Align the micro-relay terminals with the terminal cavities in the receptacle.

(2) Push firmly and evenly on the top of the relay until the terminals are fully seated in the terminal cavities in the receptacle.

(3) Connect the battery negative cable.

POWER DISTRIBUTION CENTER

DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC) (Fig. 7). The molded plastic PDC housing is located on the right side of the engine compartment, forward of the battery on the top of the right front inner fender shield. The PDC houses up to fifteen maxi-type cartridge fuses, which replace all in-line fusible links. The PDC also houses up to thirteen blade-type mini fuses, and up to twelve International Standards Organization (ISO) relays (four standard-type and eight micro-type).

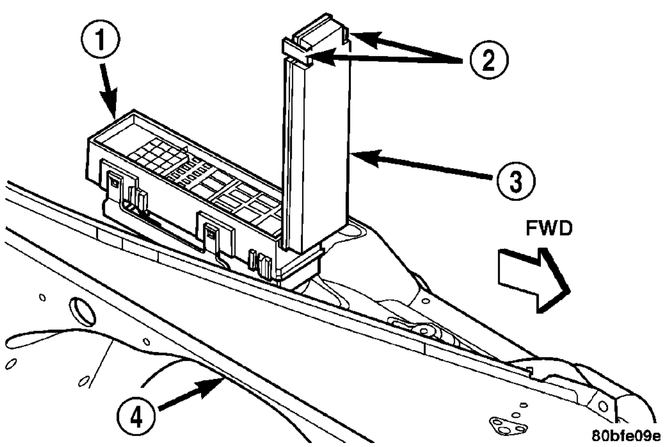


Fig. 7 Power Distribution Center Location

1 - POWER DISTRIBUTION CENTER (PDC)
2 - LATCHES
3 - COVER
4 - RIGHT FRONT FENDER

The PDC housing is secured in the engine compartment at four points. Integral mounts on both sides of the PDC housing engage and latch to stanchions that are integral to the stamped steel PDC bracket. The PDC bracket is secured to the top of the right front inner fender shield with three screws, two at the front of the bracket and one at the rear. The PDC is integral to the dash wire harness, which exits from the bottom of the PDC housing. The PDC housing has a molded plastic cover that includes two integral latches at the rear and pivot hooks at the front that snap over a hinge pin on the front of the PDC housing. The PDC cover is easily opened or removed for service access and has a convenient fuse and relay layout map integral to the inside surface of the cover to ensure proper component identification.

The PDC cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC main housing unit, the fuse wedges and the bus bars cannot be repaired and are only serviced as a unit with the dash wire harness. If the PDC main housing unit, fuse wedges or the bus bars are faulty or damaged, the dash wire harness unit must be replaced.

OPERATION

All of the current from the battery and the generator output enters the PDC through two cables and a single two-holed eyelet that is secured with nuts to the two PDC B(+) terminal studs near the back of the PDC housing. The molded plastic PDC cover is unlatched and opened to access the battery and generator output connection B(+) terminal studs. Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to the**Wiring** section of this service manual for wiring diagrams.

REMOVAL

The Power Distribution Center (PDC) main housing unit, the PDC fuse wedges and the PDC bus bars cannot be repaired and are only serviced as a unit with the dash wire harness. If the PDC main housing unit, the fuse wedges or the bus bars are faulty or damaged, the entire PDC and dash wire harness unit must be replaced.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect each of the dash wire harness connectors. Refer to **Connector Locations** in the Wiring section of this service manual for the location of the dash wire harness connector locations.

(3) Remove all of the fasteners that secure each of the dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the Wiring section of this service manual for the location of the ground eyelet locations.

(4) Disengage each of the retainers that secure the dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the Wiring section of this service manual for the location of the dash wire harness retainer locations.

POWER DISTRIBUTION CENTER (Continued)

(5) Unlatch and open the PDC cover (Fig. 8).

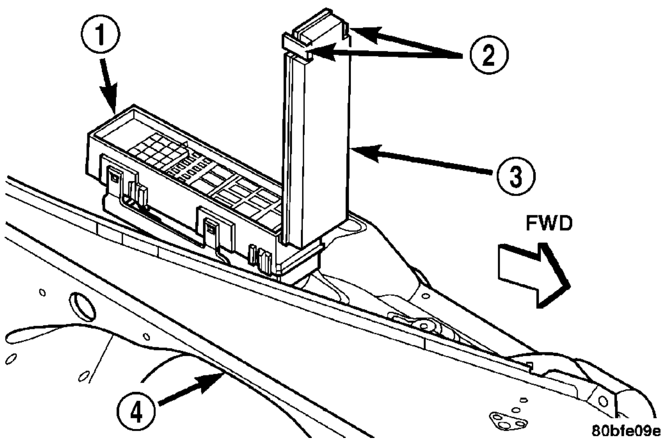


Fig. 8 Power Distribution Center

1 - POWER DISTRIBUTION CENTER (PDC)
2 - LATCHES
3 - COVER
4 - RIGHT FRONT FENDER

(6) Remove the two nuts that secure the eyelet terminal of the battery positive cable take out and the engine wire harness generator output take out to the PDC B(+) terminal studs.

(7) Remove the battery positive cable take out and the engine wire harness generator output take out eyelet terminal from the B(+) terminal studs.

(8) Disengage the latches on the PDC housing mounts from the tabs on the PDC bracket stanchions, and pull the PDC housing upward to disengage the mounts from the stanchions of the bracket.

(9) Remove the PDC and the dash wire harness from the engine compartment as a unit.

DISASSEMBLY

POWER DISTRIBUTION CENTER DISASSEMBLY

The Power Distribution Center (PDC) cover, the PDC housing lower cover, the PDC relay wedges, the PDC relay cassettes and the PDC B(+) terminal stud module are available for service replacement. The PDC cover can be simply unlatched and removed from the PDC housing without the PDC being removed or disassembled. Service of the remaining PDC components requires that the PDC be removed from its mounting and disassembled. Refer to **Wiring Repair** in the index of this service manual for the location of the proper wiring repair procedures.

PDC HOUSING LOWER COVER REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and remove the cover from the PDC.

(3) Unlatch and remove the B(+) terminal stud cover from the PDC.

(4) Remove the two nuts that secure the eyelet terminal to the two B(+) terminal studs of the PDC.

(5) Remove the eyelet terminal from the PDC B(+) terminal studs.

(6) Disengage the latches on the PDC mounts from the tabs on the PDC bracket stanchions, and pull the PDC housing upward to disengage the mounts from the stanchions of the bracket.

(7) Using a trim stick or another suitable wide flat-bladed tool, gently pry the latches on each side and one end of the PDC housing that secure the housing lower cover to the PDC and remove the housing lower cover (Fig. 9).

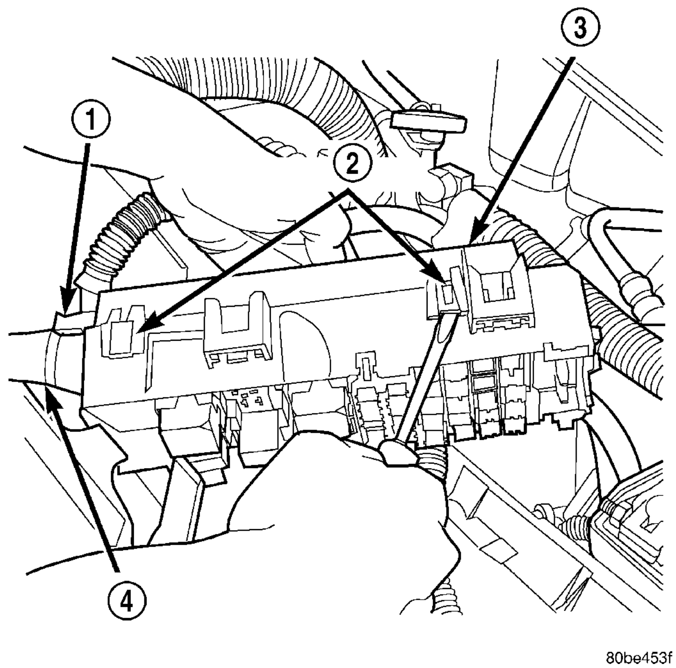


Fig. 9 PDC Housing Lower Cover Remove/Install - Typical

1 - THROUGH FORMATION
2 - LATCHES (5)
3 - PDC HOUSING LOWER COVER
4 - WIRE HARNESS

POWER DISTRIBUTION CENTER (Continued)

PDC B(+) TERMINAL MODULE REMOVAL

(1) Remove the PDC housing lower cover.

(2) From the top of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches that secure the B(+) terminal module in the PDC (Fig. 10).

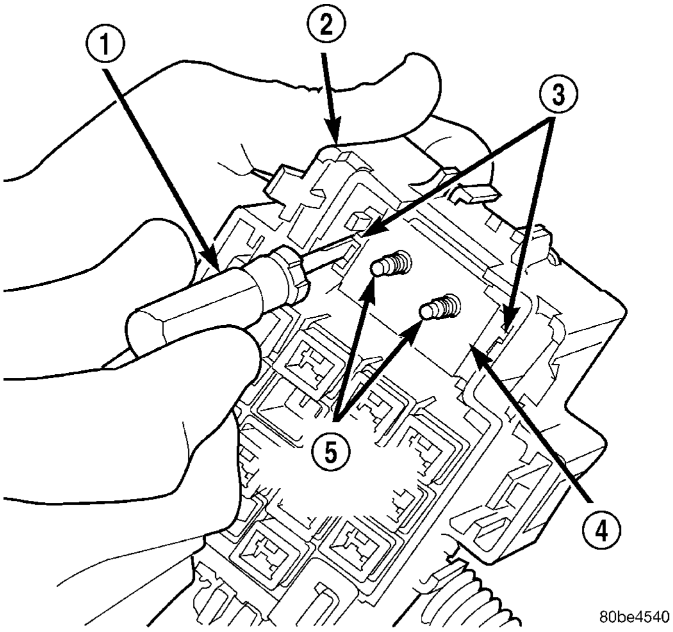


Fig. 10 PDC B(+) Terminal Module Latches

1 - FROM SPECIAL TOOL KIT 6680
2 - PDC HOUSING
3 - LATCHES
4 - BUS BAR
5 - B+ TERMINAL STUDS

(3) Gently and evenly press the two B(+) terminal studs down through the bus bar in the PDC.

(4) From the bottom of the PDC housing, remove the B(+) terminal module from the PDC (Fig. 11).

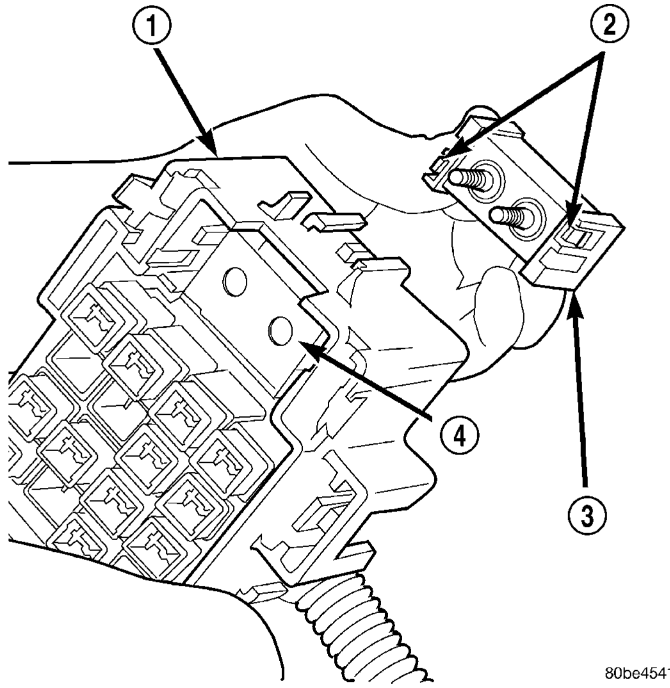


Fig. 11 PDC B(+) Terminal Module Remove/Install

1 - PDC HOUSING
2 - LATCHES
3 - B+ TERMINAL MODULE
4 - BUS BAR

PDC RELAY WEDGE REMOVAL

(1) Remove the PDC housing lower cover.

(2) Remove each of the relays from the PDC relay wedge to be removed.

(3) From the bottom of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches (yellow) that secure the relay wedge to the PDC relay cassette.

(4) From the top of the PDC housing, remove the relay wedge from the PDC relay cassette (Fig. 12).

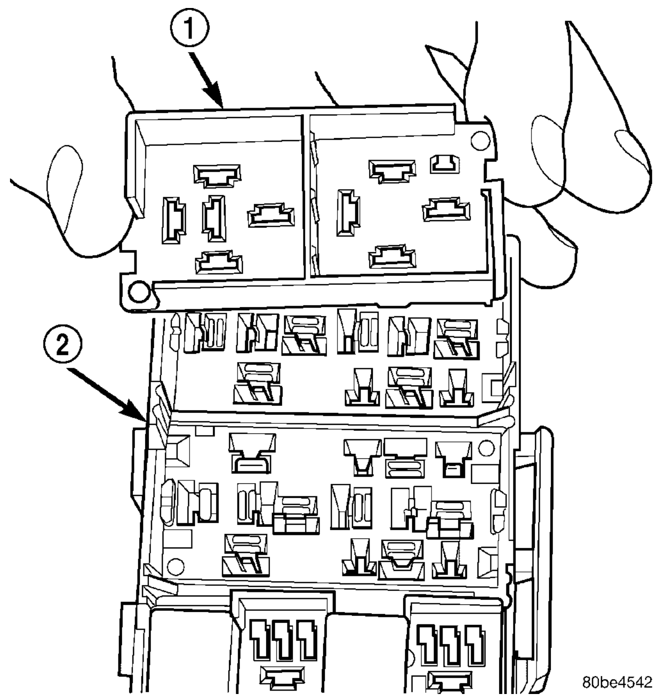


Fig. 12 PDC Relay Wedge Remove/Install - Typical

1 - RELAY WEDGE
2 - PDC HOUSING

PDC RELAY CASSETTE REMOVAL

(1) Remove the relay wedge from the PDC relay cassette to be removed.

NOTE: It may be necessary to remove relay cassettes that are not being serviced from the PDC housing in order to obtain sufficient clearance to service the faulty relay cassette. The same service procedure is repeated as necessary to remove each of the interfering relay wedges and relay cassettes from the PDC housing.

POWER DISTRIBUTION CENTER (Continued)

(2) From the top of the PDC housing, use a small screwdriver or a terminal pick tool (Special Tool Kit 6680) to release the two latches that secure the relay cassette in the PDC (Fig. 13).

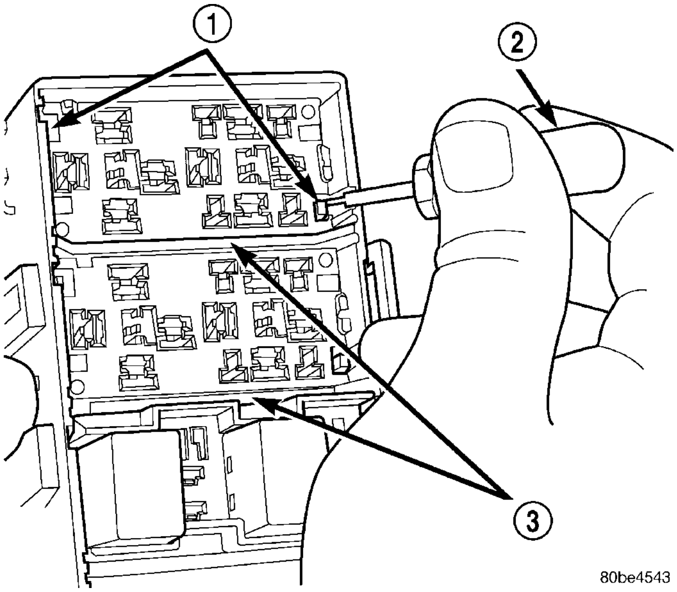


Fig. 13 PDC Relay Cassette Latches - Typical

1 - LATCHES
2 - FROM SPECIAL TOOL KIT 6680
3 - PDC RELAY CASSETTES

(3) Gently and evenly press the relay cassette down through the PDC housing.

(4) From the bottom of the PDC housing, remove the relay cassette from the PDC (Fig. 14).

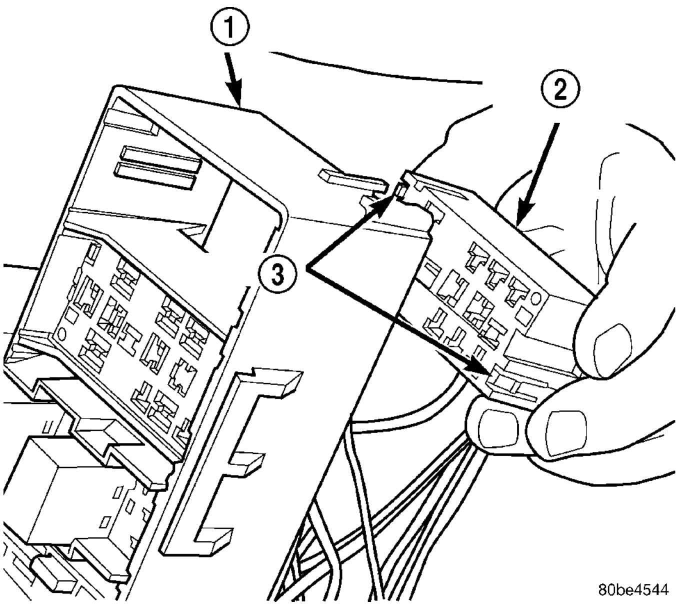


Fig. 14 PDC Relay Cassette Remove/Install - Typical

1 - PDC HOUSING
2 - PDC RELAY CASSETTE
3 - LATCHES

CAUTION: Do not remove the wiring and terminals from the terminal cavities of the faulty PDC relay cassette at this time. Refer to the Assembly procedure that follows for the proper procedures for transferring the wiring and terminals to the replacement PDC relay cassette.

ASSEMBLY

POWER DISTRIBUTION CENTER ASSEMBLY

PDC HOUSING LOWER COVER INSTALLATION

(1) Align the PDC housing lower cover to the bottom of the PDC.

(2) Press the PDC housing lower cover gently and evenly onto the PDC until each of the latches that secure the cover to the PDC is fully engaged.

(3) Engage the mounts on the PDC housing with the stanchions of the PDC bracket and push the unit downward until the mount latches fully engage the mounting tabs on the PDC bracket.

(4) Install the eyelet terminal over the two PDC B(+) terminal studs.

(5) Install and tighten the two nuts that secure the eyelet terminal to the B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(6) Install the B(+) terminal stud cover onto the PDC.

(7) Install the cover onto the PDC.

(8) Reconnect the battery negative cable.

PDC B+ TERMINAL MODULE INSTALLATION

(1) From the bottom of the PDC housing, align and insert the B(+) terminal module into the PDC.

(2) From the bottom of the PDC housing, align and insert the two studs of the PDC B(+) terminal module through the bus bar in the PDC.

(3) From the bottom of the PDC housing, press the B(+) terminal module gently and evenly into the PDC until both of the latches are fully engaged.

(4) Install the PDC housing lower cover.

PDC RELAY WEDGE INSTALLATION

(1) From the top of the PDC housing, align and insert the PDC relay wedge latch arms into the correct cavities in the relay cassette.

(2) Gently and evenly press the PDC relay wedge down into the relay cassette until both of the latches are fully engaged.

(3) Install each of the removed relays into the proper cavities of the PDC relay wedge.

(4) Install the PDC housing lower cover.

POWER DISTRIBUTION CENTER (Continued)

PDC RELAY CASSETTE INSTALLATION

(1) Move the faulty PDC relay cassette with its wiring away from the bottom of the PDC housing far enough to allow the replacement relay cassette to be installed into the PDC.

(2) Using the faulty relay cassette as a guide, be certain that the replacement relay cassette is correctly oriented before installing it into the PDC housing.

(3) From the bottom of the PDC housing, align and insert the replacement relay cassette into the PDC. Press the relay cassette up into the PDC until both of the latches are fully engaged.

CAUTION: Proper care must be taken to be certain that the wiring and terminals from the faulty PDC relay cassette are installed in the correct terminal cavities of the replacement relay cassette. To prevent mistakes it is recommended that the wiring and terminals be removed from the faulty relay cassette one cavity at a time, repaired or spliced as necessary, then installed securely into the correct cavity of the replacement relay cassette. If you are not absolutely certain into which cavity a terminal should be installed, refer to Power Distribution in the index of this service manual for the location of complete PDC wiring diagrams.

(4) While pulling gently on the wire from the bottom of the faulty PDC relay cassette, use a terminal pick tool (Special Tool Kit 6680) from the top of the relay cassette to release the latch that secures the terminal in the relay cassette terminal cavity (Fig. 15).

(5) From the bottom of the faulty PDC relay cassette, remove the wire and terminal from the relay cassette terminal cavity.

(6) Make all necessary repairs and splices to the wire for the removed terminal. Refer to **Wiring Repair** in the index of this service manual for the location of the proper wiring repair procedures.

(7) From the bottom of the PDC housing, align and insert the removed wire and terminal into the correct terminal cavity of the replacement relay cassette. Push the wire and terminal up into the relay cassette terminal cavity until it is fully engaged by the latch.

(8) Repeat Step 4, Step 5, Step 6 and Step 7 one wire and terminal at a time until each of the wires and terminals have been transferred from the faulty PDC relay cassette into the replacement relay cassette.

(9) Install the PDC relay wedge into the replacement PDC relay cassette.

INSTALLATION

The Power Distribution Center (PDC) main housing unit, the PDC fuse wedges and the PDC bus bars cannot be repaired and are only serviced as a unit with the dash wire harness. If the PDC main housing unit, the fuse wedges or the bus bars are faulty or damaged, the entire PDC and dash wire harness unit must be replaced.

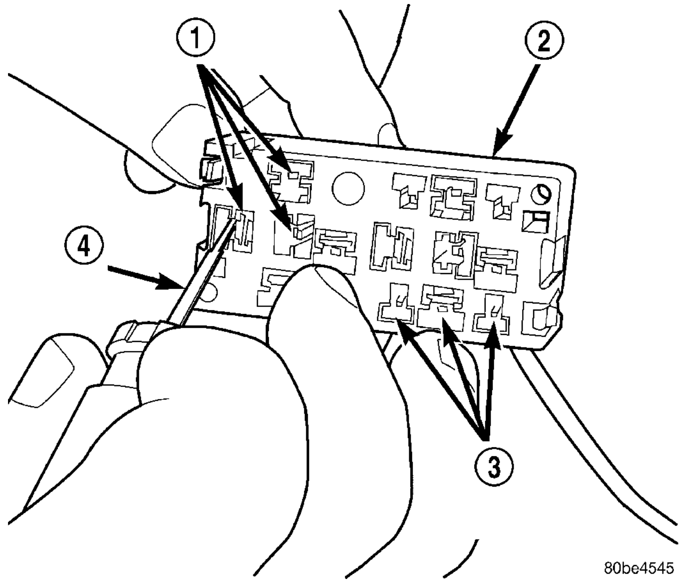


Fig. 15 PDC Relay Cassette Terminal Remove/Install

1 - TERMINAL CAVITIES
2 - PDC RELAY CASSETTE
3 - TERMINAL LATCHES
4 - FROM SPECIAL TOOL KIT 6680

NOTE: If the PDC is being replaced with a new unit, be certain to transfer each of the fuses and relays that have not been included with the replacement PDC from the faulty PDC to the proper cavities of the replacement unit. Refer to Power Distribution in the index of this service manual for the location of complete PDC wiring diagrams and cavity assignments.

(1) Position the PDC and the dash wire harness unit in the engine compartment.

(2) Engage the mounts on the PDC housing with the stanchions of the PDC bracket and push the unit downward until the mount latches engage the mounting tabs on the PDC bracket.

(3) Install the eyelet terminal of the battery positive cable take out and the engine wire harness generator output take out onto the PDC B(+) terminal studs.

(4) Install and tighten the two nuts that secure the eyelet terminal of the battery positive cable take out and the engine wire harness generator output take out to the B(+) terminal studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(5) Engage the tabs on the lower edge of the B(+) terminal stud cover in the slots on the back of the PDC housing, then engage the latch on the top of the cover with the latch receptacle on the PDC housing.

POWER DISTRIBUTION CENTER (Continued)

(6) Engage each of the retainers that secure the dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the dash wire harness retainer locations.

(7) Install all of the fasteners that secure each of the dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the ground eyelet locations.

(8) Reconnect each of the dash wire harness connectors. Refer to **Connector Locations** in the index of this service manual for the location of more information on the dash wire harness connector locations.

(9) Reconnect the battery negative cable.

POWER DISTRIBUTION CENTER SUPPORT BRACKET

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the Power Distribution Center (PDC) from the PDC bracket (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/POWER DISTRIBUTION CENTER - REMOVAL).

(3) Remove the three screws that secure the PDC bracket to the right front inner fender (Fig. 16).

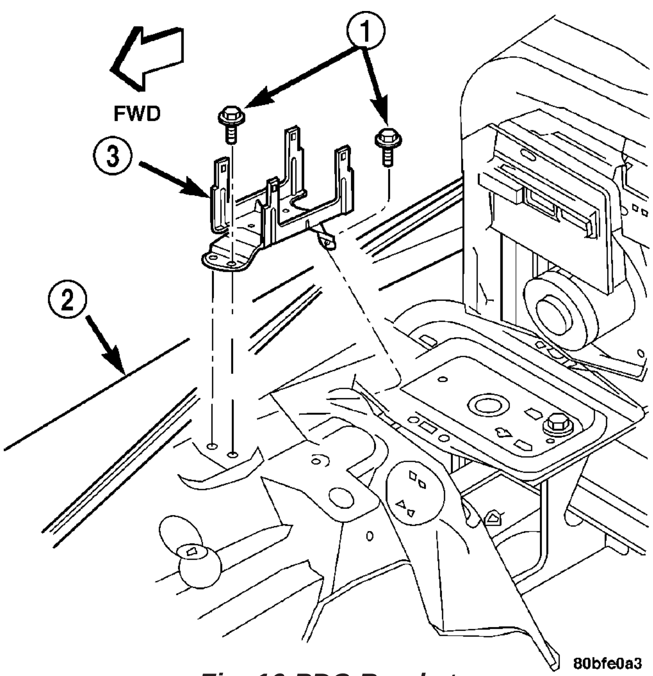


Fig. 16 PDC Bracket

1 - SCREWS (3)
2 - RIGHT FRONT FENDER
3 - PDC BRACKET

(4) Remove the PDC bracket from the right front inner fender.

INSTALLATION

(1) Position the PDC bracket onto the right front inner fender.

(2) Install and tighten the three screws that secure the PDC mounting bracket to the right front inner fender. Tighten the screws to 3.9 N·m (35 in. lbs.).

(3) Install the PDC onto the PDC bracket (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/POWER DISTRIBUTION CENTER - INSTALLATION).

(4) Reconnect the battery negative cable.

POWER OUTLET

DESCRIPTION

An instrument panel power outlet is standard factory installed equipment on this model. The power outlet is installed in the instrument panel accessory switch bezel, which is located near the bottom of the center bezel area below the heater and air conditioning controls. The power outlet base is secured by a snap fit within the instrument panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Power Distribution Center at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING - POWER OUTLET

For complete circuit diagrams, refer to **Power Outlet** in Wiring Diagrams.

(1) Check the fused B(+) fuse in the Power Distribution Center. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the Power Distribution Center. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.

(3) Remove the plastic protective cap from the power outlet receptacle. Check for continuity between

POWER OUTLET (Continued)

the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the power outlet receptacle from the instrument panel. Disconnect the wire harness connector from the power outlet receptacle. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the Power Distribution Center fuse as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the cigar lighter knob and element out of the cigar lighter receptacle base, or unsnap the protective cap from the power outlet receptacle base.

(3) Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the instrument panel (Fig. 17).

(4) Insert a pair of external snap ring pliers into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(5) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(6) Pull the receptacle base away from the instrument panel far enough to access the instrument panel wire harness connector.

(7) Disconnect the instrument panel wire harness connector from the cigar lighter or power outlet receptacle base connector receptacle.

(8) Remove the cigar lighter or power outlet mount from the instrument panel.

INSTALLATION

(1) Reconnect the instrument panel wire harness connector to the cigar lighter or power outlet receptacle base connector receptacle.

(2) Install the cigar lighter or power outlet mount into the instrument panel.

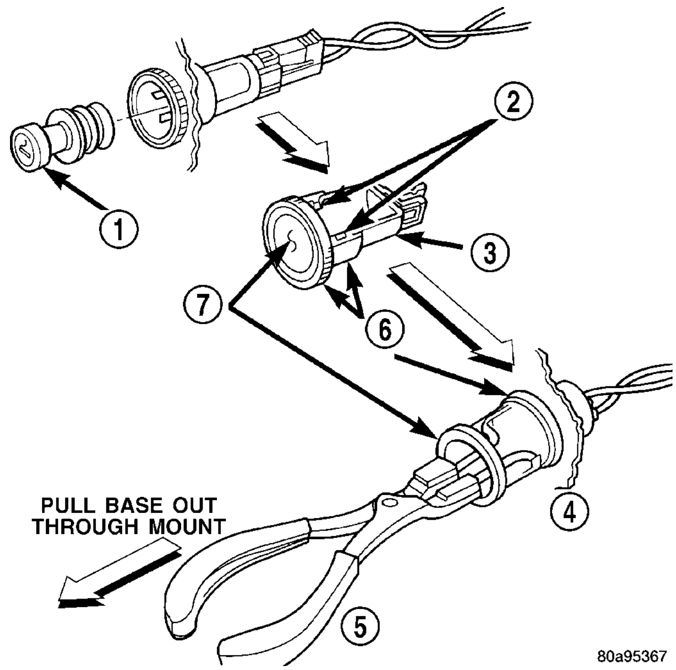


Fig. 17 Cigar Lighter and Power Outlet Remove/Install

1 - KNOB AND ELEMENT
2 - RETAINING BOSSES-ENGAGE PLIERS HERE
3 - BASE
4 - PARTIALLY REMOVED
5 - EXTERNAL SNAP-RING PLIERS
6 - MOUNT
7 - BASE

(3) Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

(4) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(5) Install the cigar lighter knob and element into the cigar lighter receptacle base, or the protective cap into the power outlet receptacle base.

(6) Reconnect the battery negative cable.

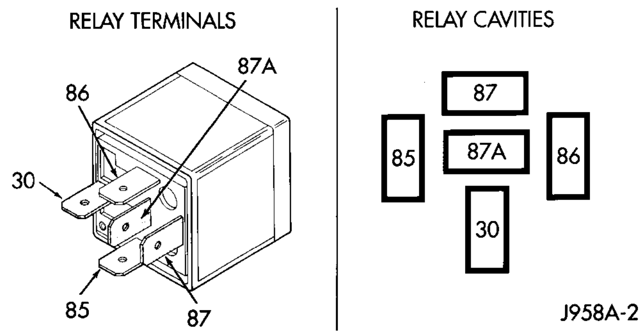
RELAY

DESCRIPTION

A relay is an electromechanical device that switches fused battery current to a electrical component when the ignition switch is turned to the Accessory or Run positions, or when controlled by a electronic module. The relays are located in the junction block or power distribution center (Fig. 18).

The relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

RELAY (Continued)



30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

Fig. 18 ISO Relay

A relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING - RELAY

The relays are located in the junction block or power distribution center. For complete circuit diagrams, refer to **Wiring Diagrams**.

(1) Remove the relay from its mounting location.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 60.7 - 80.3 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

DIAGNOSIS & TESTING - RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) of the junction block or power distribution center is connected to battery voltage and should be hot at all times. Check for battery voltage at the fused B(+) circuit cavity in the junction block receptacle for the relay. If OK, go to Step 2. If not OK, repair the fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the fused B(+) fuse in the junction block that feeds the accessory when the relay is energized by the ignition switch. There should be continuity between the junction block cavity for relay terminal 87 and the fused B(+) fuse in the junction block at all times. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(4) The coil ground terminal (85) is connected to the electromagnet in the relay. It receives battery feed to energize the relay when the ignition switch is in the Accessory or Run positions. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity for relay terminal 85 in the junction block receptacle for the relay. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) The coil battery terminal (86) is connected to the electromagnet in the relay. The junction block cavity for this terminal should have continuity to ground at all times. If not OK, repair the open ground circuit to ground as required.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the relay by grasping it firmly and pulling it straight out from its receptacle. A slight back and fourth rocking motion may help the removal process.

INSTALLATION

(1) Position the relay to the proper receptacle.

(2) Align the relay terminals with the terminal cavities in the receptacle.

(3) Push firmly and evenly on the top of the relay until the terminals are fully seated in the terminal cavities in the receptacle.

(4) Connect the negative battery cable.

ENGINE

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ENGINE 2.4L

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ENGINE 2.4L

DESCRIPTION

The 2.4 Liter (148 cu. in.) in-line four cylinder engine is a double over head camshaft with hydraulic lifters and four valve per cylinder design. The engine is free-wheeling; meaning it has provisions for piston-to-valve clearance. However valve-to-valve interference can occur, if camshafts are rotated independently.

The cylinders are numbered from front of the engine to the rear. The firing order is 1–3–4–2.

The engine identification number is located on the rear of the cylinder block (Fig. 1).

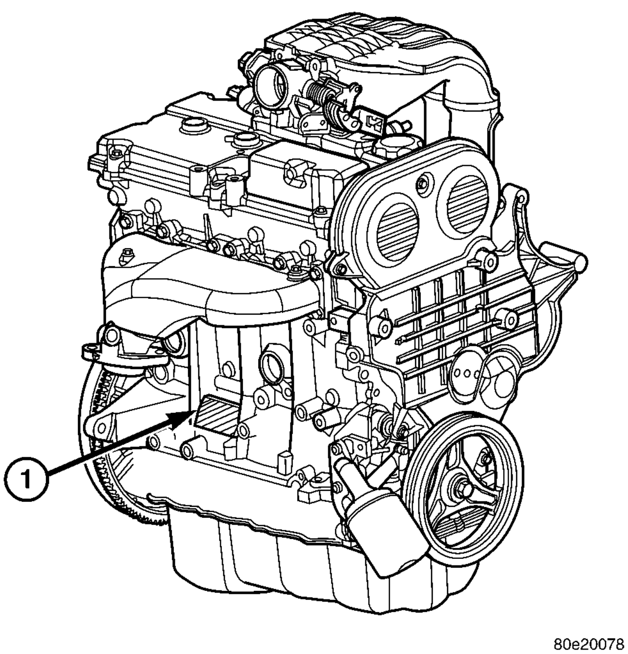


Fig. 1 ENGINE IDENTIFICATION

1 - ENGINE IDENTIFICATION

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the pressure cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

ENGINE 2.4L (Continued)

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

(4) Remove the Auto Shutdown (ASD) relay from the PDC.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0–500 psi (Blue) pressure transducer with cable adaptors to the DRBIII®.

(7) Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(8) Repeat the previous step for all remaining cylinders.

(9) Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.

(10) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(11) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

DIAGNOSIS AND TESTING - ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

(5) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:

- Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the nipple on the cover.
- Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.
- Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
- If the leakage occurs at the crankshaft rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

NOTE: If oil leakage is observed at the dipstick tube to block location; remove the tube, clean and reseal using Mopar® Stud & Bearing Mount (press fit tube applications only), and for O-ring style tubes, remove tube and replace the O-ring seal.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The

ENGINE 2.4L (Continued)

following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurize the crankcase as previously described.

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

DIAGNOSIS AND TESTING - ENGINE

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Engine Mechanical and the Engine Performance diagnostic charts, for possible causes and corrections of malfunctions (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - MECHANICAL) (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - PERFORMANCE).

For fuel system diagnosis, (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING).

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Lash Adjuster (Tappet) Noise Diagnosis
- Engine Oil Leak Inspection

ENGINE 2.4L (Continued)

DIAGNOSIS AND TESTING - ENGINE MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check and correct engine oil level.
	2. Thin or diluted oil.	2. Change oil to correct viscosity.
	3. Thick oil	3. (a) Change engine oil and filter.
		(b) Run engine to operating temperature.
		(c) Change engine oil and filter again.
	4. Low oil pressure.	4. Check and correct engine oil level.
	5. Dirt in tappets/lash adjusters.	5. Replace rocker arm/hydraulic lash adjuster assembly.
	6. Worn rocker arms.	6. Inspect oil supply to rocker arms.
	7. Worn tappets/lash adjusters.	7. Install new rocker arm/hydraulic lash adjuster assembly.
	8. Worn valve guides.	8. Replace cylinder head assembly.
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.
	10. Missing adjuster pivot.	10. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Thick oil	4. (a) Change engine oil and filter.
		(b) Run engine to operating temperature.
		(c) Change engine oil and filter again.
	5. Excessive bearing clearance.	5. Measure bearings for correct clearance. Repair as necessary.
	6. Connecting rod journal out-of-round.	6. Replace crankshaft or grind surface.
	7. Misaligned connecting rods.	7. Replace bent connecting rods.

ENGINE 2.4L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thin or diluted oil.	3. Change oil to correct viscosity.
	4. Thick oil	4. (a) Change engine oil and filter.
		(b) Run engine to operating temperature.
		(c) Change engine oil and filter again.
	5. Excessive bearing clearance.	5. Measure bearings for correct clearance. Repair as necessary.
	6. Excessive end play.	6. Check thrust bearing for wear on flanges.
	7. Crankshaft journal out-of-round or worn.	7. Replace crankshaft or grind journals.
	8. Loose flywheel or torque converter.	8. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check engine oil level.
	2. Faulty oil pressure sending unit.	2. Install new sending unit.
	3. Low oil pressure.	3. Check sending unit and main bearing oil clearance.
	4. Clogged oil filter.	4. Install new oil filter.
	5. Worn parts in oil pump.	5. Replace worn parts or pump.
	6. Thin or diluted oil.	6. Change oil to correct viscosity.
	7. Oil pump relief valve stuck.	7. Replace oil pump.
	8. Oil pump suction tube loose.	8. Remove oil pan and install new tube or clean, if necessary.
	9. Oil pump cover warped or cracked.	9. Install new oil pump.
	10. Excessive bearing clearance.	10. Measure bearings for correct clearance.
OIL AKS	1. Misaligned or deteriorated gaskets.	1. Replace gasket(s).
	2. Loose fastener, broken or porous metal part.	2. Tighten, repair or replace the part.
	3. Misaligned or deteriorated cup or threaded plug.	3. Replace as necessary.

ENGINE 2.4L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction.	1. Check system and repair as necessary. (Refer to 25 - EMISSIONS CONTROL/ EVAPORATIVE EMISSIONS/PCV VALVE - DIAGNOSIS AND TESTING)
	2. Worn, scuffed or broken rings.	2. Hone cylinder bores. Install new rings.
	3. Carbon in oil ring slots.	3. Install new rings.
	4. Rings fitted too tightly in grooves.	4. Remove rings and check grooves. If groove is not proper width, replace piston.
	5. Worn valve guide(s).	5. Replace cylinder head assembly.
	6. Valve stem seal(s) worn or damaged.	6. Replace seal(s).

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - DIAGNOSIS AND TESTING)
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.
	3. Faulty starter.	3. Test starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING)
	4. Faulty coil(s) or control unit.	4. Test and replace as needed. (Refer to Appropriate Diagnostic Information)
	5. Incorrect spark plug gap.	5. Set gap. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS)
	6. Contamination in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump.	7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information)
	8. Incorrect engine timing.	8. Check for a skipped timing belt/chain.

ENGINE 2.4L (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low.	1. Test minimum air flow. (Refer to Appropriate Diagnostic Information)
	2. Incorrect fuel mixture.	2. (Refer to Appropriate Diagnostic Information)
	3. Intake manifold leakage.	3. Inspect intake manifold, manifold gasket, and vacuum hoses.
	4. Faulty ignition coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs.	1. Clean plugs and set gap.
	2. Contamination in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Incorrect valve timing.	4. Correct valve timing.
	5. Leaking cylinder head gasket.	5. Replace cylinder head gasket.
	6. Low compression.	6. Test compression of each cylinder.
	7. Burned, warped, or pitted valves.	7. Replace valves.
	8. Plugged or restricted exhaust system.	8. Perform exhaust restriction test. (Refer to 11 - EXHAUST SYSTEM - DIAGNOSIS AND TESTING) Install new parts, as necessary.
	9. Faulty ignition coil(s).	9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs.	1. Clean spark plugs and set gap.
	2. Contamination in Fuel System.	2. Clean fuel system and replace fuel filter.
	3. Burned, warped, or pitted valves.	3. Replace valves.
	4. Faulty ignition coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap.	1. Clean spark plugs and set gap.
	2. Faulty ignition coil(s).	2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	3. Dirty fuel injector(s).	Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Contamination in fuel system.	4. Clean system and replace fuel filter.

ENGINE 2.4L (Continued)

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (excluding spark plug and camshaft bearing cap attaching threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original center line.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 2).

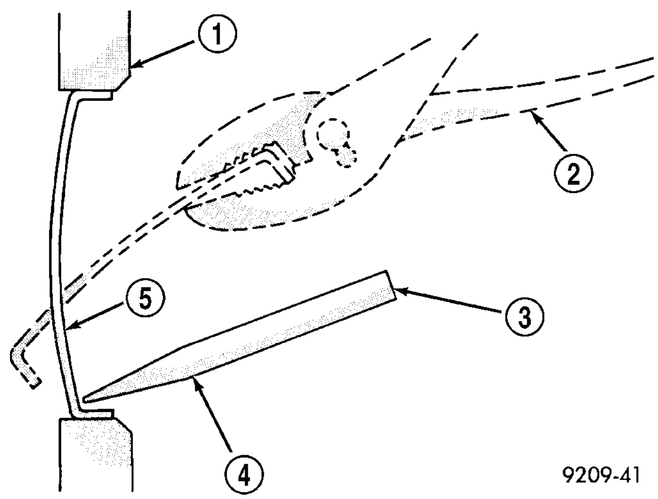


Fig. 2 Core Hole Plug Removal

1 - CYLINDER BLOCK
2 - REMOVE PLUG WITH PLIERS
3 - STRIKE HERE WITH HAMMER
4 - DRIFT PUNCH
5 - CUP PLUG

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (Fig. 3)

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (Fig. 3)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 3)

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

STANDARD PROCEDURE - MEASURING BEARING CLEARANCE USING PLASTIGAGE

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

(1) Remove oil film from surface to be checked. Plastigage is soluble in oil.

(2) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (Fig. 4). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.

(3) Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band clos-

ENGINE 2.4L (Continued)

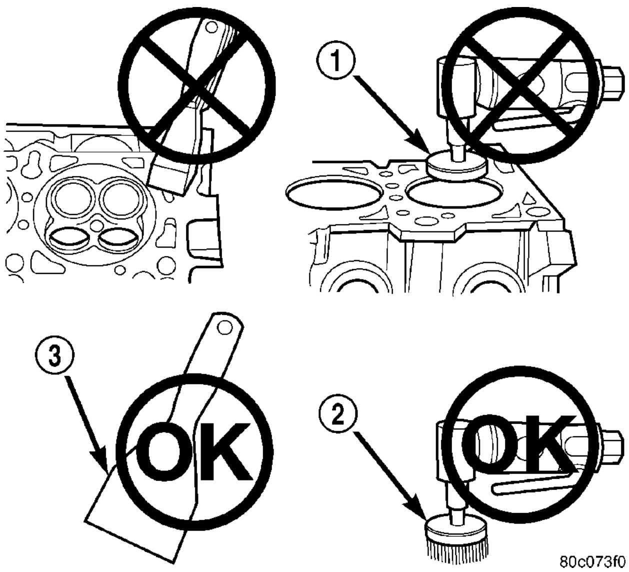


Fig. 3 Proper Tool Usage For Surface Preparation

1 - ABRASIVE PAD
2 - 3M ROLOC™ BRISTLE DISC
3 - PLASTIC/WOOD SCRAPER

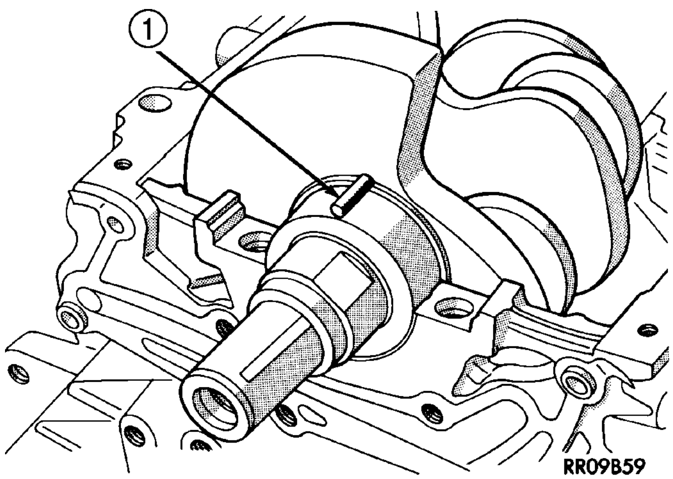


Fig. 4 Plastigage Placed in Lower Shell - Typical

1 - PLASTIGAGE

est to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Compare clearance measurements to specs found in engine specifications (Refer to 9 - ENGINE - SPECIFICATIONS). **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

(4) Install the proper crankshaft bearings to achieve the specified bearing clearances. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE) (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE)

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® BED PLATE SEALANT is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

ENGINE 2.4L (Continued)

MOPAR® GASKET SEALANT is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

SEALER APPLICATION

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.

(1) Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.

(2) Remove negative battery cable.

(3) Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.

(4) With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.

(5) Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).

(6) Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)

(7) Repair engine or components as necessary to prevent this problem from re-occurring.

CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

(8) Install new spark plugs.

(9) Drain engine oil and remove oil filter.

(10) Install a new oil filter.

(11) Fill engine with specified amount of approved oil.

(12) Connect negative battery cable.

(13) Start engine and check for any leaks.

REMOVAL - ENGINE ASSEMBLY

(1) Disconnect the battery negative cable.

(2) Remove hood. Mark hood hinge location for reinstallation.

(3) Remove air cleaner assembly.

(4) Remove radiator core support bracket.

(5) Remove fan shroud with electric fan assembly.

(6) Remove drive belt.

NOTE: It is NOT necessary to discharge the A/C system to remove the engine.

(7) Remove A/C compressor and secure away from engine with lines attached.

(8) Remove generator and secure away from engine.

NOTE: Do NOT remove the phenolic pulley from the P/S pump. It is not required for P/S pump removal.

(9) Remove power steering pump with lines attached and secure away from engine.

(10) Drain cooling system.

(11) Remove coolant bottle.

(12) Disconnect the heater hoses from the engine.

(13) Disconnect heater hoses from heater core and remove hose assembly.

(14) Disconnect throttle and speed control cables.

(15) Remove upper radiator hose from engine.

(16) Remove lower radiator hose from engine.

(17) Disconnect the engine to body ground straps at the left side of cowl.

(18) Disconnect the engine wiring harness at the following points:

- Intake air temperature (IAT) sensor
- Fuel Injectors
- Throttle Position (TPS) Switch

ENGINE 2.4L (Continued)

- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs
- Crankshaft Position Sensor

(19) Remove coil over plugs.

(20) Release fuel rail pressure.

(21) Remove fuel rail and secure away from engine.

(22) Remove the PCV hose.

(23) Remove the breather hoses.

(24) Remove the vacuum hose for the power brake booster.

(25) Disconnect knock sensors.

(26) Secure the left and right engine wiring harnesses away from engine.

(27) Raise vehicle.

(28) Disconnect oxygen sensor wiring.

(29) Disconnect crankshaft position sensor.

(30) Disconnect the engine block heater power cable, if equipped.

(31) Disconnect the front propshaft at the front differential and secure out of way.

(32) Remove the starter.

(33) Remove the ground straps from the engine

(34) Disconnect the exhaust pipes at the manifold.

(35) Remove the structural cover, if equipped.

(36) Remove torque convertor bolts, and mark location for reassembly.

(37) Remove transmission bellhousing to engine bolts.

(38) Loosen left and right engine mount thru bolts.

NOTE: It is not necessary to completely remove engine mount thru bolts, for engine removal.

(39) Lower the vehicle.

(40) Support the transmission with a suitable jack.

(41) Connect a suitable engine hoist to the engine.

CAUTION: The 2.4L engine with manual transmissions, can be removed without removing the manual transmission. Use caution when attempting this procedure as the clearance is tight.

(42) Remove engine from vehicle.

INSTALLATION - ENGINE ASSEMBLY

(1) Position the engine in the vehicle.

CAUTION: Use caution when installing 2.4L engine into vehicle equipped with manual transmission, as clearance is tight.

(2) Install both left and right side engine mounts into the frame mounts.

(3) Raise the vehicle.

(4) Install the transmission bellhousing to engine mounting bolts. Tighten the bolts to 41 N·m (30 ft. lbs.).

(5) Tighten the engine mount thru bolts.

(6) Install the torque convertor bolts.

(7) Connect the ground straps on the left and right side of the engine.

(8) Install the starter.

(9) Connect the crankshaft position sensor.

(10) Install the engine block heater power cable, if equipped.

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

(11) Install the structural cover.

(12) Install the exhaust pipe.

(13) Connect the oxygen sensors.

(14) Lower vehicle.

(15) Connect the knock sensors.

(16) Connect the engine to body ground straps.

(17) Install the power brake booster vacuum hose.

(18) Install the breather hoses.

(19) Install the PCV hose.

(20) Install the fuel rail.

(21) Install the coil over plugs.

(22) Reconnect the engine wiring harness at the following points:

- Intake air temperature (IAT) sensor
- Fuel Injectors
- Throttle Position (TPS) Switch
- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs
- Crankshaft Position Sensor

(23) Connect lower radiator hose.

(24) Connect upper radiator hose.

(25) Connect throttle and speed control cables.

(26) Install the heater hose assembly.

(27) Install coolant recovery bottle.

(28) Install the power steering pump.

(29) Install the generator.

(30) Install the A/C compressor.

(31) Install the drive belt.

(32) Install the fan shroud with the electric fan assembly.

(33) Install the radiator core support bracket.

(34) Install the air cleaner assembly.

(35) Refill the engine cooling system.

(36) Install the hood.

(37) Check and fill engine oil.

(38) Connect the battery negative cable.

(39) Start the engine and check for leaks.

ENGINE 2.4L (Continued)

SPECIFICATIONS

SPECIFICATIONS - 2.4L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	In-Line OHV, DOHC	
Number of Cylinders	4	
Firing Order	1-3-4-2	
Compression Ratio	9.5:1	
Max. Variation Between Cylinders	25%	
	Metric	Standard
Displacement	2.4 Liters	148 cu. in.
Bore	87.5 mm	3.445 in.
Stroke	101.0 mm	3.976 in.
Compression Pressure	1172-1551 kPa	170-225 psi

CYLINDER BLOCK

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Cylinder Bore Diameter	87.4924 - 87.5076 mm	3.4446 - 3.4452 in.
Out-of-Round (Max.)	0.051 mm	0.002 in.
Taper (Max.)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Diameter	87.463 - 87.481 mm	3.4434 -3.4441 in.
Clearance @ 14 mm (0.551 in.) from bottom of skirt	0.024 - 0.057 mm	0.0009 - 0.0022 in.
Weight	331 - 339 grams	11.67- 11.95 oz.
Land Clearance (Diametrical)	0.614 - 0.664 mm	0.024 - 0.026 in.
Piston Length	66.25 mm	2.608 in.
Piston Ring Groove Depth No. 1	4.640 - 4.784 mm	0.182 - 0.188 in.
Piston Ring Groove Depth No. 2	4.575 - 4.719 mm	(0.180 - 0.185 in.)
Piston Ring Groove Depth No. 3	4.097 - 4.236 mm	0.161 - 0.166 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston	0.005 - 0.018 mm	0.0002 - 0.0008 in.
Clearance in Connecting Rod	Interference	
Diameter	21.998 - 22.003 mm	0.8660 - 0.8662 in.
End Play	None	
Length	72.75 - 73.25 mm	2.864 - 2.883 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.25 - 0.51 mm	0.0098 - 0.020 in.
Wear Limit	0.8 mm	0.031 in.
2nd Compression Ring	0.23 - 0.48 mm	0.009 - 0.018 in.
Wear Limit	0.8 mm	0.031 in.
Oil Control Steel Rails	0.25 - 0.64 mm	0.0098 - 0.025 in.
Wear Limit	1.00 mm	0.039 in.
Compression Rings	0.030 - 0.080 mm	0.0011 - 0.0031 in.
Wear Limit	0.10 mm	0.004 in.
Ring Side Clearance - Oil Ring Pack	0.012 - 0.178 mm	0.0004 - 0.0070 in.
Ring Width - Compression Rings	1.47 - 1.50 mm	0.057 - 0.059 in.
Ring Width - Oil Ring Pack	2.72 - 2.88 mm	0.107 - 0.1133 in.

ENGINE 2.4L (Continued)

CONNECTING ROD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.025 - 0.071 mm	0.0009 - 0.0027 in.
Wear Limit	0.075 mm	0.003 in.
Bore Diameter - Piston Pin	20.96 - 20.98 mm	0.8252 - 0.8260 in.
Bore Diameter - Crankshaft End	53.007 - 52.993 mm	2.0868 - 2.0863 in.
Side Clearance	0.13 - 0.38 mm	0.005 - 0.015 in.
Wear Limit	0.40 mm	0.016 in.
Weight - Total (Less Bearing)	565.8 grams	19.96 oz.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	49.984 - 50.000 mm	1.968 - 1.9685 in.
Main Bearing Journal Diameter	59.992 - 60.008 mm	2.362 - 2.3625 in.
Journal Out-of-Round (Max.)	0.0035 mm	0.0003 in.
Journal Taper (Max.)	0.007 mm	0.0001 in.
End Play	0.09 - 0.24 mm	0.0035 - 0.0094 in.
Wear Limit	0.38 mm	0.015 in.
Main Bearing Diametrical Clearance	0.018 - 0.062 mm	0.0007 - 0.0024 in.

HYDRAULIC LASH ADJUSTER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	15.901 - 15.913 mm	0.626 - 0.6264 in.
Plunger Travel Minimum (Dry)	3.0 mm	0.118 in.

CYLINDER HEAD CAMSHAFT BEARING BORE DIAMETER

DSECRIPTION	SPECIFICATION	
	Metric	Standard
Journals No.1 - 6	26.020 - 26.041 mm	1.024 - 1.025 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter No. 1 - 6	25.951 - 25.970 mm	1.021 - 1.022 in.
Bearing Clearance - Diametrical	0.069 - 0.071 mm	0.0027 - 0.003 in.
End Play	0.05 - 0.17 mm	0.0019 - 0.0066 in.
Lift (Zero Lash)		
Intake	8.25 mm	0.324 in.
Exhaust	6.60 mm	0.259 in.
Intake Valve Timing*		
Closes (ABDC)	51°	
Opens (BTDC)	1°	
Duration	232°	
Exhaust Valve Timing*		
Closes (ATDC)	7°	
Opens (BBDC)	47°	
Duration	234°	
Valve Overlap	8°	
* All reading in degrees. Timing points @4° from top of ramp.		

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Material	Cast Aluminum	
Gasket Thickness (Compressed)	0.71 mm	0.028 in.

ENGINE 2.4L (Continued)

VALVE SEAT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Angle	44.5 - 45°	
Seat Diameter - Intake	34.37 - 34.63 mm	1.353 - 1.363 in.
Seat Diameter - Exhaust	27.06 - 27.32 mm	1.065 - 1.075 in.
Runout (Max.)	0.05 mm	0.002 in.
Valve Seat Width - Intake and Exhaust	0.9 - 1.3 mm	0.035 - 0.051 in.
Service Limit - Intake	2.0 mm	0.079 in.
Service Limit - Exhaust	2.5 mm	0.098 in.

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter I.D.	5.975 - 6.000 mm	0.235 - 0.236 in.
Guide Bore Diameter	11.0 - 11.02 mm	0.4330 - 0.4338 in.
Guide Height (spring seat to guide tip)	13.25 - 13.75 mm	0.521 - 0.541 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle - Intake and Exhaust	44.5 - 45°	
Head Diameter - Intake	34.67 - 34.93 mm	1.364 - 1.375 in.
Head Diameter - Exhaust	28.32 - 28.52 mm	1.114 - 1.122 in.
Valve Length (Overall)		
Intake	112.76 - 113.32 mm	4.439 - 4.461 in.
Exhaust	110.89 - 111.69 mm	4.365 - 4.397 in.
Valve Stem Diameter		
Intake	5.934 - 5.952 mm	0.2337 - 0.2344 in.
Exhaust	5.906 - 5.924 mm	0.2326 - 0.2333 in.

VALVE MARGIN

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	1.2 - 1.7 mm	0.047 - 0.066 in.
Service Limit	0.95 mm	.0037 in.
Exhaust	0.985 - 1.315 mm	0.038 - 0.051 in.
Service Limit	1.05 mm	.039 in.

VALVE STEM TIP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	48.04 mm	1.891 in.
Exhaust	47.99 mm	1.889 in.

VALVE STEM TO GUIDE CLEARANCE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	0.048 - 0.066 mm	0.0018 - 0.0025 in.
Max. Allowable	0.076 mm	0.003 in.
Service Limit	0.25 mm	0.010 in.
Exhaust	0.0736 - 0.094 mm	0.0029 - 0.0037 in.
Max. Allowable	0.101 mm	0.004 in.
Service Limit	0.25 mm	0.010 in.

ENGINE 2.4L (Continued)

VALVE SPRINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length (Approx.)	48.4 mm	1.905 in.
Nominal Force (Valve Closed)	338 N @ 38.0 mm	75.98 lbs. @ 1.496 in.
Nominal Force (Valve Open)	607 N @ 29.75 mm	136 lbs. @ 1.172 in.
Installed Height	38.00 mm	1.496 in.
Number of Coils	7.82	
Wire Diameter	3.86 mm	1.496 in

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors (Max.)	0.10 mm	0.004 in.
Cover Out-of-Flat (Max.)	0.025 mm	0.001 in.
Inner Rotor Thickness (Min.)	9.40 mm	0.370 in.
Outer Rotor Thickness (Min.)	9.40 mm	0.370 in.
Outer Rotor Clearance (Max.)	0.039 mm	0.015 in.
Outer Rotor Diameter (Min.)	79.95 mm	3.148 in.
Tip Clearance Between Rotors (Max.)	0.20 mm	0.008 in.

OIL PRESSURE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed*	25 kPa	4 psi
At 3000 rpm	170 - 550 kPa	25 - 80 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.		

SPECIFICATIONS - TORQUE

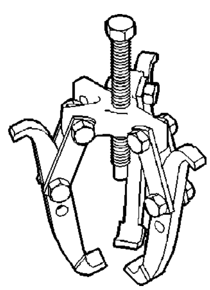
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolts, Balance Shaft Carrier to Block	54	40	-
Fastener - Double Ended, Balance Shaft Gear Cover	12	-	105
Bolt, Balance Shaft Sprocket	28	-	250
Bolts, Balance Shaft Chain Tensioner	12	-	105
Bolts, Balance Shaft Carrier Cover	12	-	105
Bolt, Camshaft Sprocket	115	85	-
Bolts, Connecting Rod Cap	27 +¼ turn	20 +¼ turn	-
Bolts, Crankshaft Main Bearing Cap/Bedplate			
M8 Bolts	28	-	250
M11 Bolts	75	55	-
Crankshaft Damper	136	100	-
Bolts, Cylinder Head	(Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION)		
Bolts, Cylinder Head Cover	12	-	105
Flex Plate to Crankshaft	95	70	-
Flywheel Mounting Bolts	81	60	-
Bolts, Engine Mount Bracket Right	61	45	-
Bolts, Engine Mounting	(Refer to 9 ENGINE/ ENGINE MOUNTING)		
Bolts, Exhaust Manifold to Cylinder Head	23	-	200
Bolts, Exhaust Manifold Heat Shield	12	-	105
Bolts, Intake Manifold - Lower	28	-	250
Oil Filter	20	15	-
Bolts, Oil Pan	12	-	105
Plug, Oil Pan Drain	27	20	-
Bolts, Oil Pump to Block	28	-	250
Bolts, Oil Pump Cover Plate	12	-	105

ENGINE 2.4L (Continued)

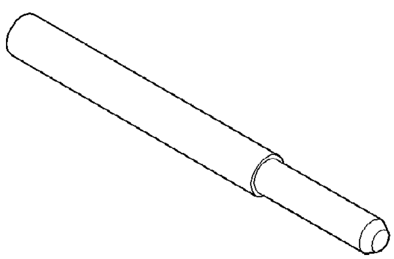
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, Oil Pump Pick-up Tube	28	20	-
Cap - Oil Pump Relief Valve	41	30	-
Spark Plugs	28	20.6	-
Bolts, Timing Belt Covers			
- Front Covers to Rear Covers	12	-	105
- Rear Cover	12	-	105
Bolts, Timing Belt Tensioner Assembly	61	45	-

SPECIAL TOOLS

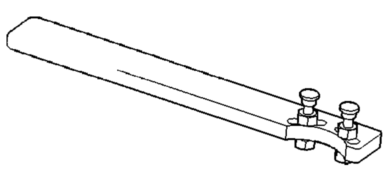
2.4L ENGINE



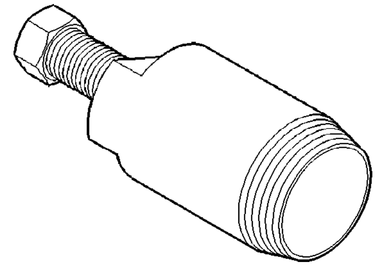
Puller 1026



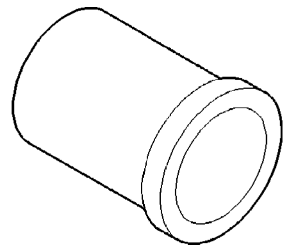
Crankshaft Damper Removal Insert 6827-A



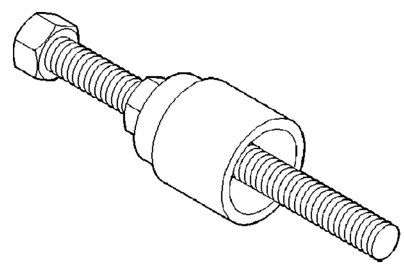
Camshaft Sprocket Holder 6847



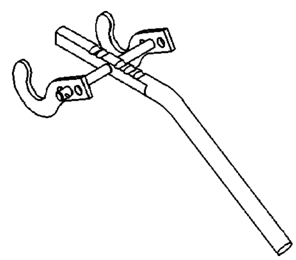
Camshaft Seal Remover C-4679-A



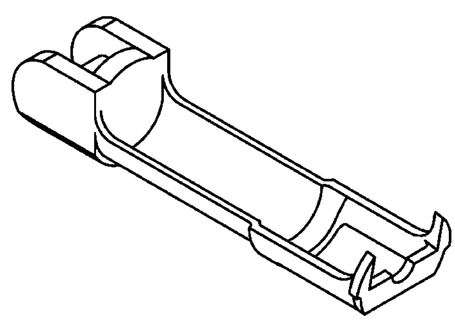
Camshaft Seal Installer MD-998306



Crankshaft Damper Installer 6792

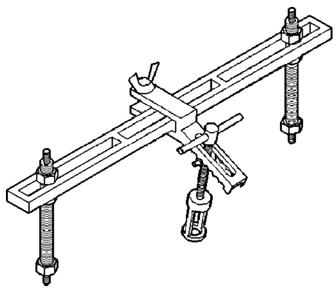


Valve Spring Compressor 8215

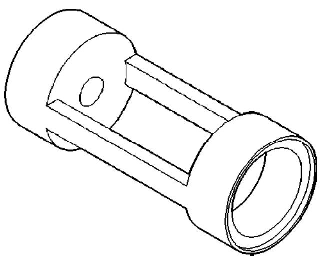


Adaptor 8436

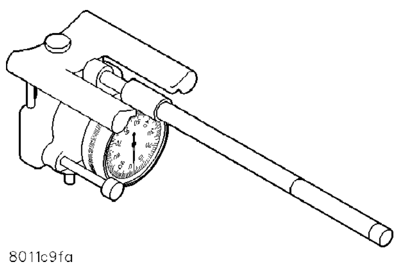
ENGINE 2.4L (Continued)



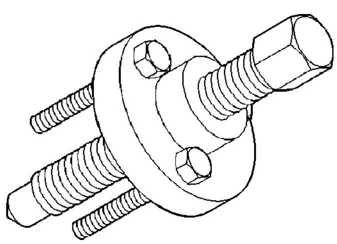
Valve Spring Compressor MD998772A



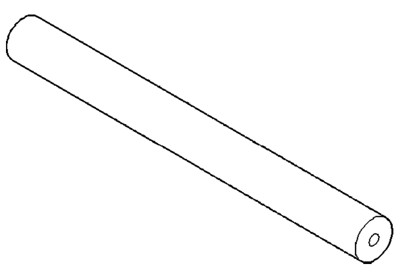
Valve Spring Compressor Adapter 6779



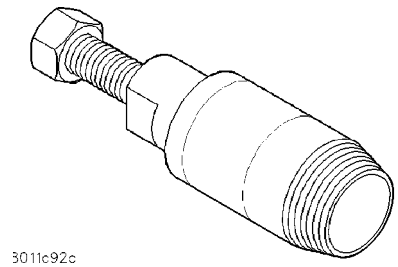
Cylinder Bore Gage C-119



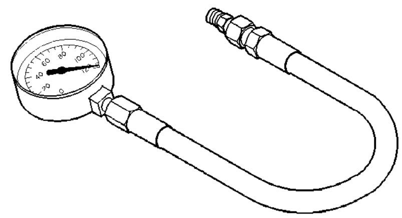
Crankshaft Sprocket Remover 6793



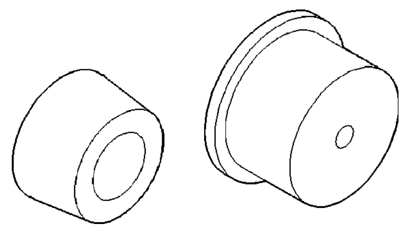
Crankshaft Sprocket Remover Insert C-4685-C2



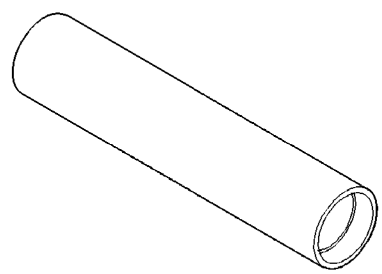
Crankshaft Seal Remover 6771



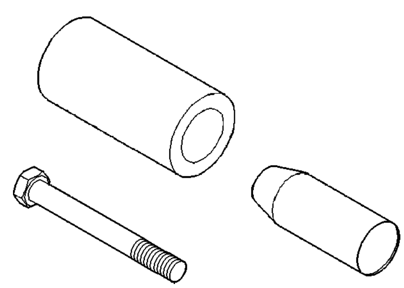
Oil Pressure Gauge C-3292



Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2

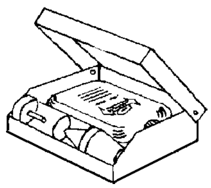


Balance Shaft Sprocket Installer 6052

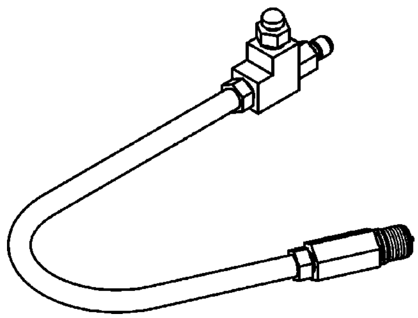


Front Crankshaft Oil Seal Installer 6780

ENGINE 2.4L (Continued)



Combustion Leak Tester C-3685-A



Cylinder Compression Pressure Adaptor 8116

AIR CLEANER ELEMENT - 2.4L

REMOVAL - 2.4L

Housing removal is not necessary for element (filter) replacement.

(1) Disconnect air intake duct at front of element cover.

(2) Pry up spring clips (Fig. 5) from housing cover (spring clips retain cover to housing).

(3) Release housing cover from locating tabs located on housing, and remove cover.

(4) Remove air cleaner element (filter) from housing.

(5) Clean inside of housing before replacing element.

INSTALLATION - 2.4L

(1) Install element into housing.

(2) Position housing cover into housing locating tabs.

(3) Pry up spring clips and lock cover to housing.

(4) Connect air intake duct.

If any air filter, air resonator, air intake tubes or air filter housing clamps had been loosened or removed, tighten them to 5 N·m (40 in. lbs.) torque.

AIR CLEANER HOUSING

REMOVAL

(1)

(2) Disconnect air intake duct at front of element cover.

(3) Pry up spring clips from housing cover (spring clips retain cover to housing).

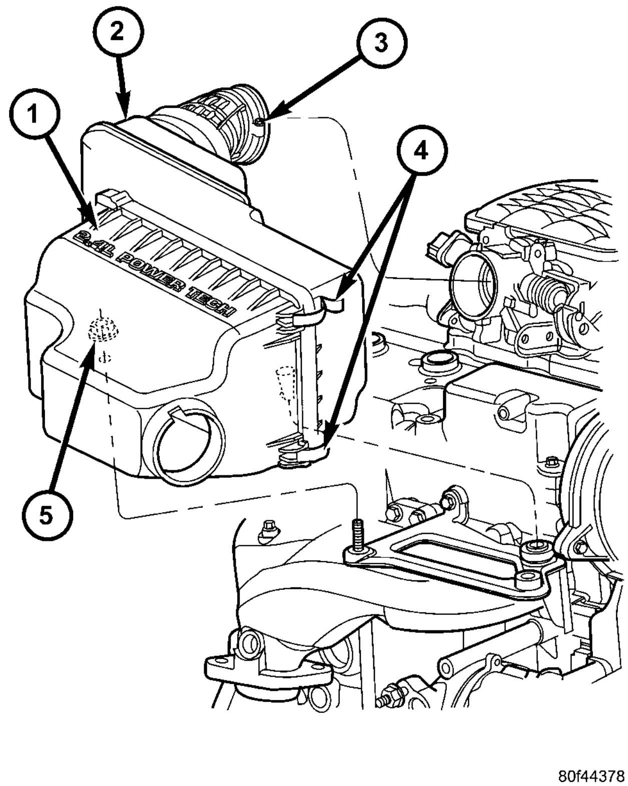


Fig. 5 AIR CLEANER ELEMENT - 2.4L

1 - COVER
2 - HOUSING
3 - CLAMP
4 - SPRING CLIPS
5 - HOUSING MOUNTING NUT

(4) Release housing cover from locating tabs located on housing, and remove cover. (Fig. 6)

(5) Remove air cleaner element (filter) from housing.

(6) Remove vent hose.

(7) Remove the housing mounting nut.

(8) Remove the air cleaner housing.

INSTALLATION

(1) Install the air cleaner housing mounting bracket.

(2) Install the air cleaner housing and mounting nut. Tighten nut to 4.5 N·m (40 in. lbs.).

(3) Install vent hose.

(4) Install air cleaner element into the housing.

(5) Position the housing cover into the locating tabs on the housing and install the cover.

(6) Pry up the spring clips and lock the cover in place.

(7) Install the air intake duct. (Fig. 6)

(8) Install the air outlet duct.

AIR CLEANER HOUSING (Continued)

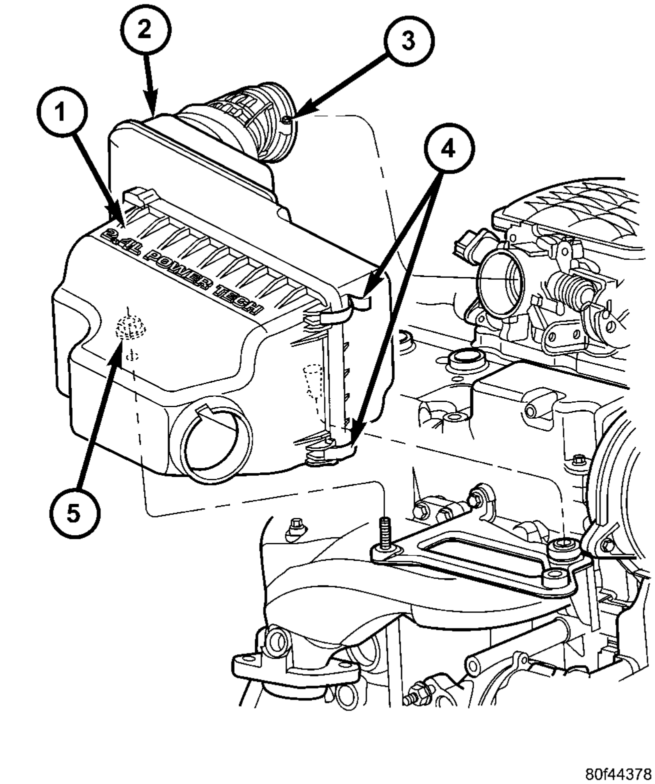


Fig. 6 AIR CLEANER ELEMENT - 2.4L

1 - COVER
2 - HOUSING
3 - CLAMP
4 - SPRING CLIPS
5 - HOUSING MOUNTING NUT

CYLINDER HEAD

DESCRIPTION

The cross flow designed, aluminum cylinder head contains dual over-head camshafts with four valves per cylinder (Fig. 7). The valves are arrange in two in-line banks. The intake valves face toward the left side of the vehicle. The exhaust valves face the right side. The cylinder head incorporates powdered metal valve guides and seats. The cylinder head is sealed to the block using a multi-layer steel head gasket and retaining bolts.

Integral oil galleries providing lubrication passages to the hydraulic lash adjusters, camshafts, and valve mechanisms.

OPERATION

The cylinder head closes the combustion chamber, allowing the pistons to compress the fuel/air mixture for ignition. The valves are actuated by the lobe profiles on the camshaft to open and close at specified duration to either allow clean air in the combustion chamber or the exhaust gases out; depending on the stroke of the engine.

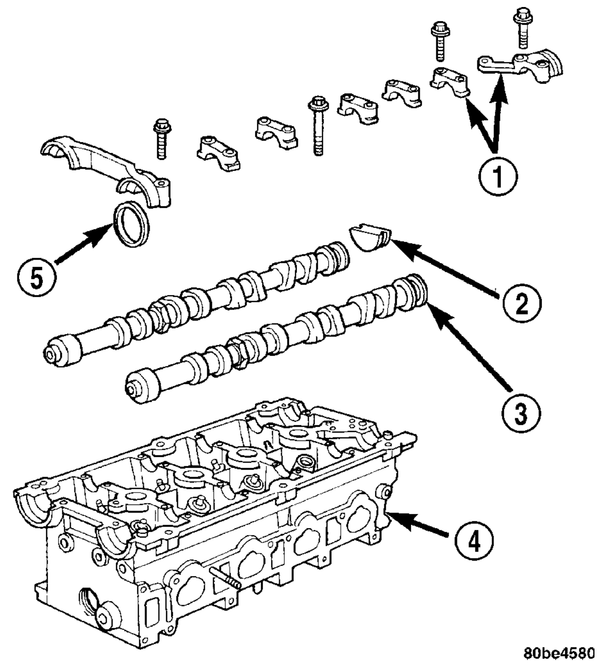


Fig. 7 Cylinder Head and Camshafts

1 - CAMSHAFT BEARING CAPS
2 - PLUG
3 - CAMSHAFT
4 - CYLINDER HEAD
5 - CAMSHAFT OIL SEAL

DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL - CYLINDER HEAD

(1) Perform fuel system pressure release procedure **before attempting any repairs.** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - SPECIFICATIONS)

(2) Disconnect battery negative cable.

(3) Drain cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

(4) Remove air filter housing and inlet tube.

(5) Remove intake manifold.

(6) Remove heater tube support bracket from cylinder head.

(7) Disconnect radiator upper and heater supply hoses from water outlet connections.

(8) Remove accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

(9) Raise vehicle and remove exhaust pipe from manifold.

(10) Remove power steering pump and set aside. Do not disconnect lines.

(11) Remove accessory drive bracket

(12) Remove ignition coil and wires from engine.

(13) Disconnect cam sensor and fuel injector wiring connectors.

(14) Remove timing belt and camshaft sprockets. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(15) Remove timing belt idler pulley and rear timing belt cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(16) Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(17) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

NOTE: Identify rocker arm position to ensure correct re-installation in original position, if reused.

(18) Remove rocker arms. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL).

(19) Remove cylinder head bolts in REVERSE sequence of tightening.

(20) Remove cylinder head from engine block.

(21) Inspect and clean cylinder head. (Refer to 9 - ENGINE/CYLINDER HEAD - INSPECTION) (Refer to 9 - ENGINE/CYLINDER HEAD - CLEANING)

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Remove all gasket material from cylinder head and block (Refer to 9 - ENGINE - STANDARD PROCEDURE). Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION

(1) Cylinder head must be flat within 0.1 mm (0.004 in.) (Fig. 8).

(2) Inspect camshaft bearing journals for scoring.

(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(4) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 9). (Refer to 9 - ENGINE - SPECIFICATIONS) Replace guides if they are not within specification.

CYLINDER HEAD (Continued)

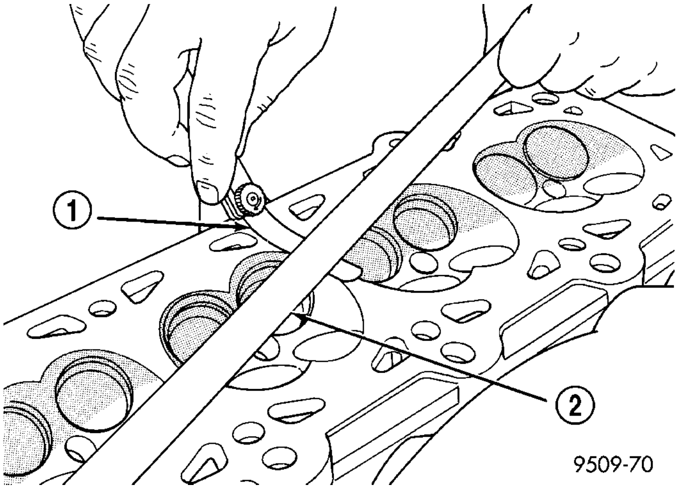


Fig. 8 Checking Cylinder Head Flatness

1 - FEELER GAUGE
2 - STRAIGHT EDGE

(5) Check valve guide height (Fig. 10).

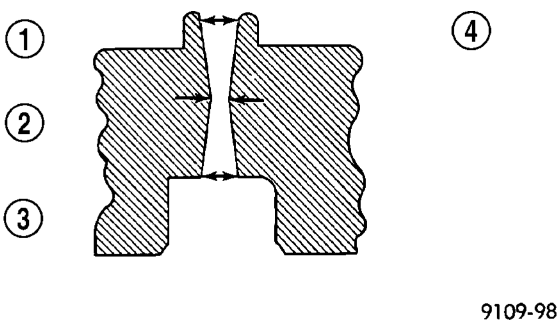


Fig. 9 Checking Wear on Valve Guide - Typical

1 - TOP
2 - MIDDLE
3 - BOTTOM
4 - CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT LOCATIONS

INSTALLATION - CYLINDER HEAD

NOTE: The Cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts must be replaced (Fig. 11).

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.

(1) Before installing the bolts, the threads should be coated with engine oil.

(2) Position cylinder head gasket on engine block (Fig. 12).

(3) Install cylinder head on engine block.

(4) Tighten the cylinder head bolts in the sequence shown in (Fig. 13). Using the 4 step torque turn method, tighten according to the following values:

- First All to 34 N·m (25 ft. lbs.)
- Second All to 68 N·m (50 ft. lbs.)

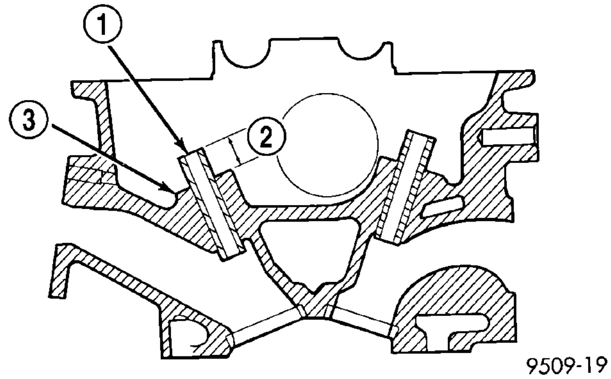


Fig. 10 Valve Guide Height

1 - VALVE GUIDE
2 - 13.25 - 13.75 MM (.521 - .541 IN.)
3 - SPRING SEAT

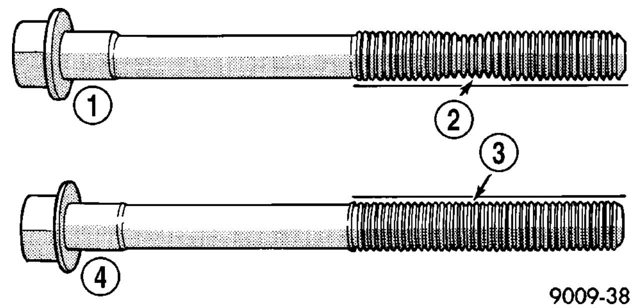


Fig. 11 Checking Bolts for Stretching (Necking)

1 - STRETCHED BOLT
2 - THREADS ARE NOT STRAIGHT ON LINE
3 - THREADS ARE STRAIGHT ON LINE
4 - UNSTRETCHED BOLT

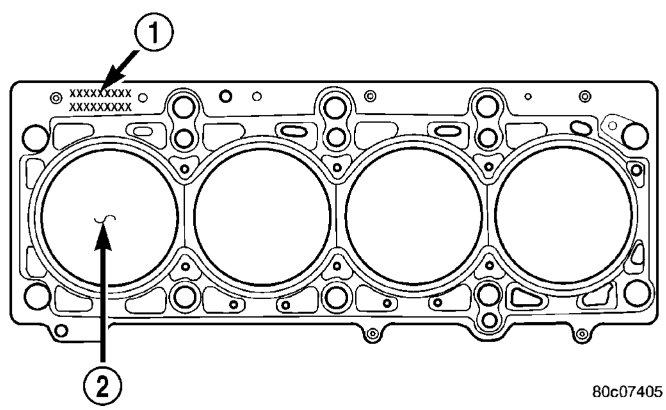


Fig. 12 Cylinder Head Gasket Positioning

1 - PART NUMBER FACES UP
2 - NO. 1 CYLINDER

- Third All to 68 N·m (50 ft. lbs.)

CAUTION: Do not use a torque wrench for the following step.

CYLINDER HEAD (Continued)

- Fourth Turn an additional 1/4 Turn,

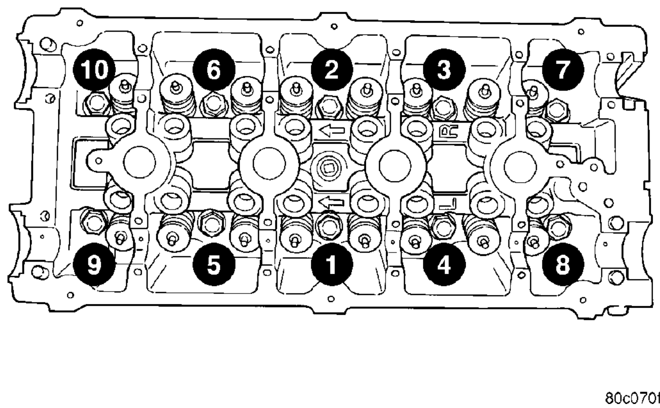


Fig. 13 Cylinder Head Tightening Sequence

(5) Install rocker arms. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION)

(6) Install camshafts. (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

(7) Install cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

(8) Install timing belt rear cover and timing belt idler pulley. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(9) Install timing belt and camshaft sprockets. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(10) Connect cam sensor and fuel injectors wiring connectors.

(11) Install ignition coil and wires. Connect ignition coil wiring connector.

(12) Install accessary drive bracket.

(13) Install power steering pump to cylinder head.

(14) Raise vehicle and install the exhaust pipe to the manifold.

(15) Install accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

(16) Install heater tube support bracket to cylinder head.

(17) Install intake manifold.

(18) Connect all vacuum lines, electrical wiring, ground straps and fuel line.

(19) Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

(20) Connect battery negative cable.

CAMSHAFT OIL SEAL(S)

REMOVAL

(1) Remove timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(2) Hold each camshaft sprocket with Special Tool 6847 while removing center bolt (Fig. 14).

(3) Remove camshaft sprockets.

(4) Remove exhaust camshaft target ring.

(5) Remove exhaust camshaft sensor.

CAUTION: Inspect sensor and target ring for excessive wear. Clean sensor face and install new spacer pad.

(6) Remove rear timing belt cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(7) Remove camshaft seal using Special Tool C-4679-A (Fig. 15).

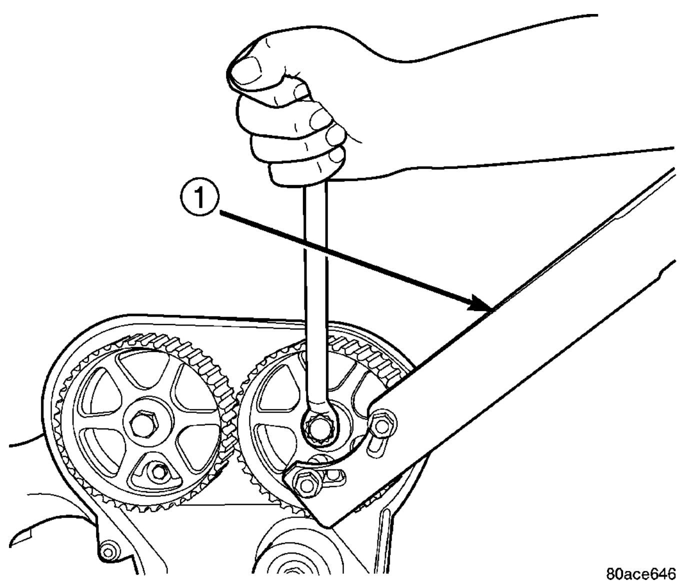


Fig. 14 Camshaft Sprocket - Removal/Installation

1 - SPECIAL TOOL 6847

CAUTION: Do not nick shaft seal surface or seal bore.

INSTALLATION

NOTE: Clean and inspect sensor and target ring for excessive wear. Clean sensor face and always install a new spacer pad.

(1) Shaft seal surface must be free of varnish, dirt or nicks. Polish with 400 grit paper if necessary.

CAMSHAFT OIL SEAL(S) (Continued)

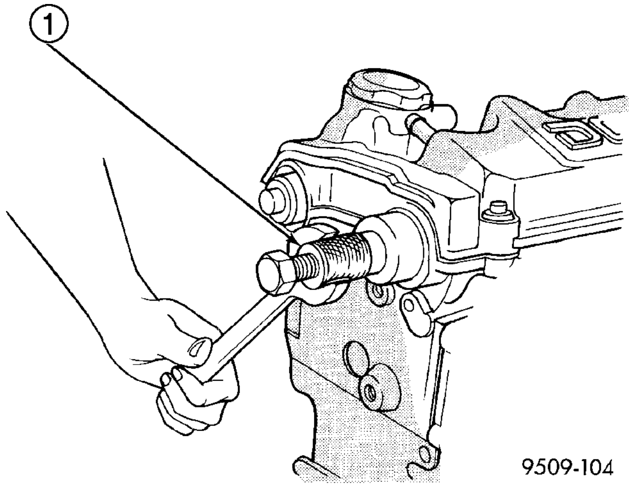


Fig. 15 Camshaft Oil Seal - Removal With C-4679-A

1 - SPECIAL TOOL C-4679

(2) Install camshaft seals into cylinder head using Special Tool MD-998306 until flush with head (Fig. 16).

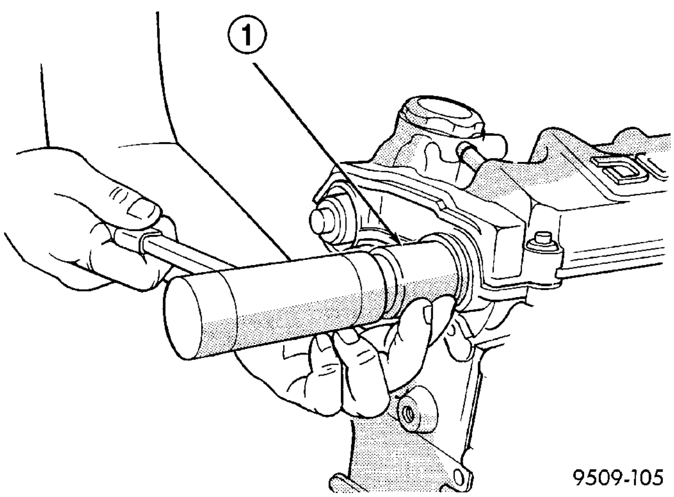


Fig. 16 Camshaft Seal - Installation

1 - SPECIAL TOOL MD 998306

(3) Install timing belt rear cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

NOTE: Target ring tab should provide positive snap-on fit on the camshaft.

(4) Install exhaust camshaft target ring with the word **FRONT** facing forward.

(5) Install exhaust camshaft sensor.

(6) Install camshaft sprockets. Hold each sprocket with Special Tool 6847 and tighten center bolt to 101 N·m (75 ft. lbs.).

(7) Install timing belt and front covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

CAMSHAFT(S)

DESCRIPTION

Both nodular iron camshafts have six bearing journal surfaces and two cam lobes per cylinder (Fig. 17). Flanges at the rear journals control camshaft end play. Provision for a cam position sensor is located on the exhaust camshaft on the front of the cylinder head. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

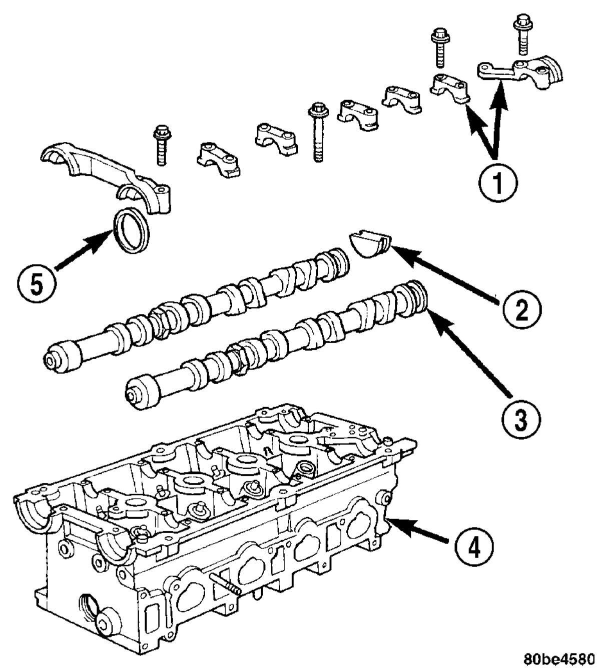


Fig. 17 Camshafts

1 - CAMSHAFT BEARING CAPS
2 - PLUG
3 - CAMSHAFT
4 - CYLINDER HEAD
5 - CAMSHAFT OIL SEAL

OPERATION

The camshaft is driven by the crankshaft via drive sprockets and belt. The camshaft has precisely machined lobes to provide accurate valve timing and duration.

STANDARD PROCEDURE - CAMSHAFT END-PLAY

(1) Oil camshaft journals and install camshaft **WITHOUT** cam follower assemblies. Install rear cam caps and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

CAMSHAFT(S) (Continued)

(3) Zero dial indicator (Fig. 18).

(4) Move camshaft as far forward as it will go.

(5) Record reading on dial indicator. For end play specification, (Refer to 9 - ENGINE - SPECIFICATIONS).

(6) If end play is excessive, check cylinder head and camshaft for wear; replace as necessary.

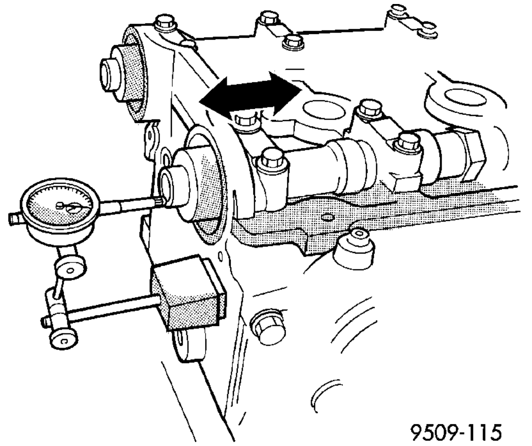


Fig. 18 Camshaft End Play - Typical

REMOVAL

(1) Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Remove camshaft position sensor and camshaft target magnet. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/CAMSHAFT POSITION SENSOR - REMOVAL)

(3) Remove timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(4) Remove camshaft sprockets and timing belt rear cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(5) Bearing caps are identified for location. Remove the outside bearing caps first (Fig. 19).

(6) Loosen the camshaft bearing cap attaching fasteners in sequence shown (Fig. 20) one camshaft at a time.

CAUTION: Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.

(7) Identify the camshafts before removing from the head. The camshafts are not interchangeable.

(8) Remove camshafts from cylinder head.

NOTE: If removing rocker arms, identify for reinstallation in the original position.

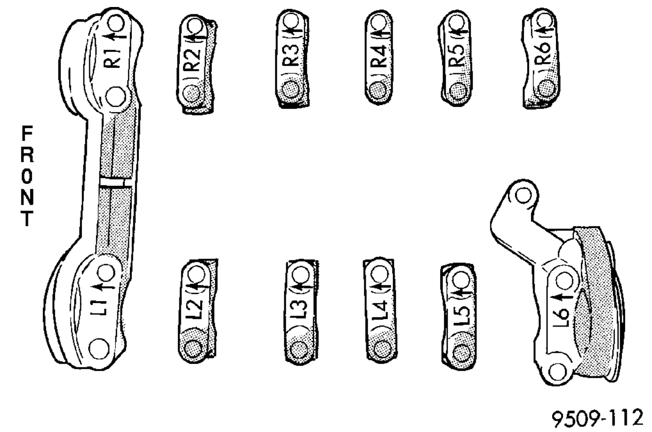


Fig. 19 Camshaft Bearing Cap Identification

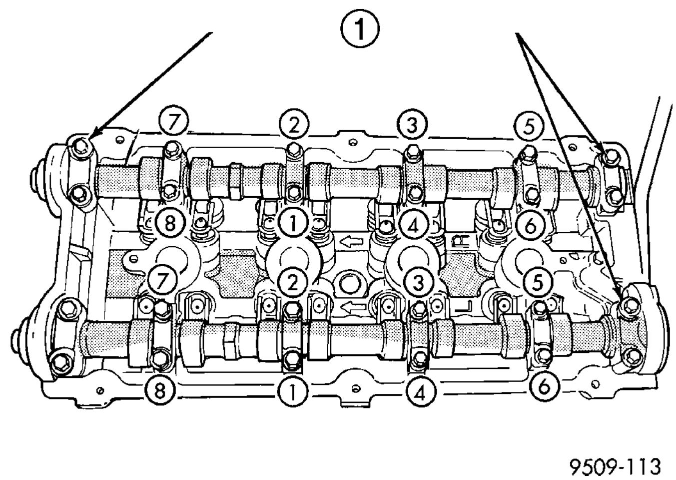


Fig. 20 Camshaft Bearing Cap - Removal

1 - REMOVE OUTSIDE BEARING CAPS FIRST

CLEANING

Clean camshaft with a suitable solvent.

INSPECTION

(1) Inspect camshaft bearing journals for damage and binding (Fig. 21). If journals are binding, check the cylinder head for damage. Also check cylinder head oil holes for clogging.

(2) Check the cam lobe and bearing surfaces for abnormal wear and damage. Replace camshaft if defective.

NOTE: If camshaft is replaced due to lobe wear or damage, always replace the rocker arms.

(3) Measure the lobe actual wear (unworn area - wear zone = actual wear) (Fig. 21) and replace camshaft if out of limit. Standard value is 0.0254 mm (0.001 in.), wear **limit** is 0.254 mm (0.010 in.).

CAMSHAFT(S) (Continued)

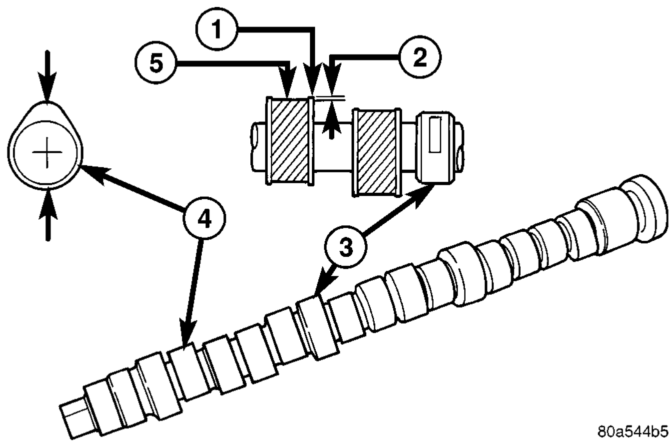


Fig. 21 Checking Camshaft(s) for Wear

1 - UNWORN AREA
2 - ACTUAL WEAR
3 - BEARING JOURNAL
4 - LOBE
5 - WEAR ZONE

INSTALLATION

CAUTION: Ensure that NONE of the pistons are at top dead center when installing the camshafts.

(1) Lubricate all camshaft bearing journals, rocker arms and camshaft lobes.

(2) Install all rocker arms in original positions, if reused.

(3) Position camshafts on cylinder head bearing journals. Install right and left camshaft bearing caps No. 2 – 5 and right No. 6. Tighten M6 fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 22).

(4) Apply Mopar® Gasket Maker to No. 1 and No. 6 bearing caps (Fig. 23). Install bearing caps and tighten M8 fasteners to 28 N·m (250 in. lbs.).

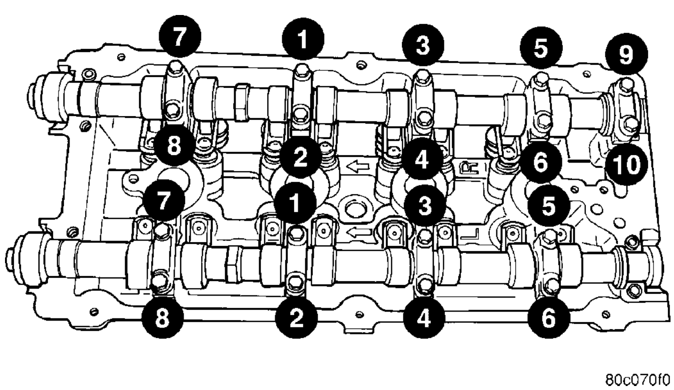


Fig. 22 Camshaft Bearing Cap Tightening Sequence

NOTE: Bearing end caps must be installed before seals can be installed.

(5) Install camshaft oil seals. (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT OIL SEAL(S) - INSTALLATION)

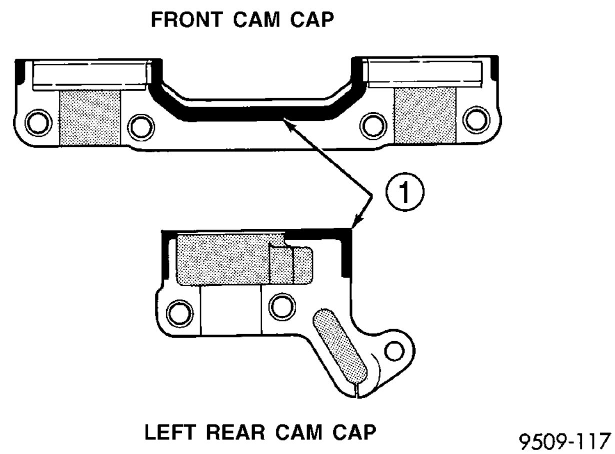


Fig. 23 Camshaft Bearing Cap Sealing

1 - 1.5 mm (.060 in.) DIAMETER BEAD OF MOPAR GASKET MAKER

(6) Install camshaft target magnet and camshaft position sensor.

(7) Install cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

(8) Install timing belt rear cover and camshaft sprocket. (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(9) Install timing belt. (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

CYLINDER HEAD COVER

REMOVAL

(1) Remove intake manifold. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL)

(2) Remove ignition coil and spark plug wires.

(3) Disconnect PCV and make-up air hoses from cylinder head cover.

(4) Remove cylinder head cover bolts.

(5) Remove cylinder head cover from cylinder head.

CLEANING

Clean cylinder head and cover mating surfaces using a suitable solvent.

INSPECTION

Inspect cover rails for flatness.

CYLINDER HEAD COVER (Continued)

INSTALLATION

NOTE: Replace spark plug well seals and bolt assemblies when installing a new cylinder head cover gasket.

(1) Install new cylinder head cover gaskets and spark plug well seals (Fig. 24).

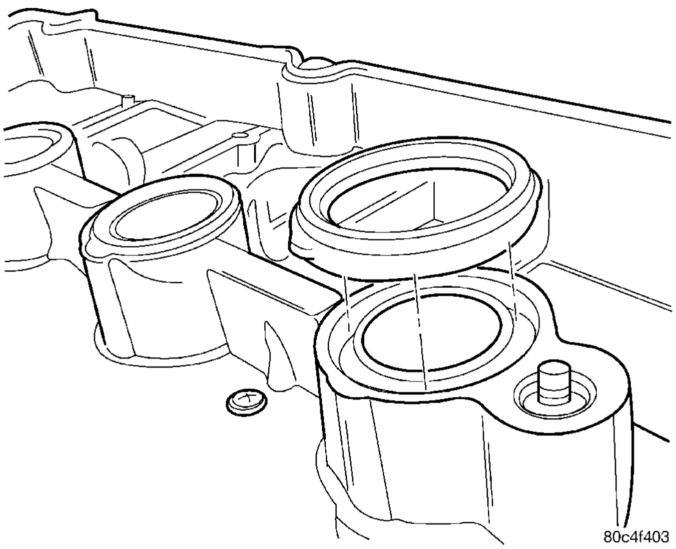


Fig. 24 Spark Plug Well Seals

(2) Replace cylinder head cover bolt assemblies (Fig. 25).

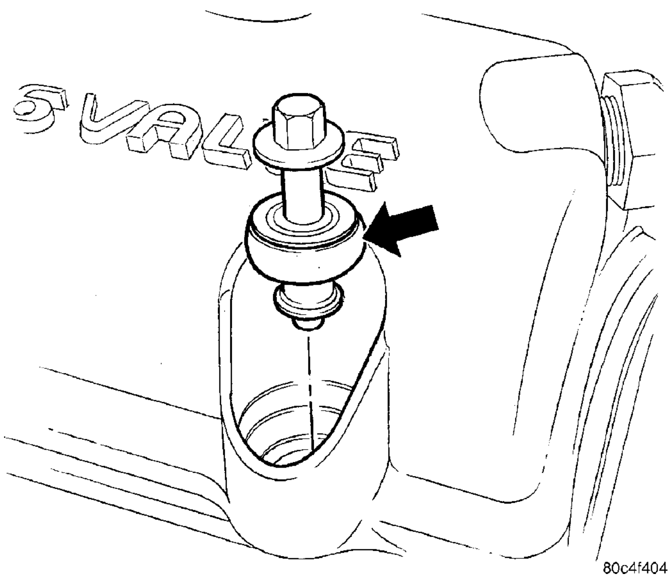


Fig. 25 Cylinder Head Cover Bolt Assembly

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(3) Apply Mopar® Engine RTV GEN II at the camshaft cap corners and at the top edges of the 1/2 round seal (Fig. 26).

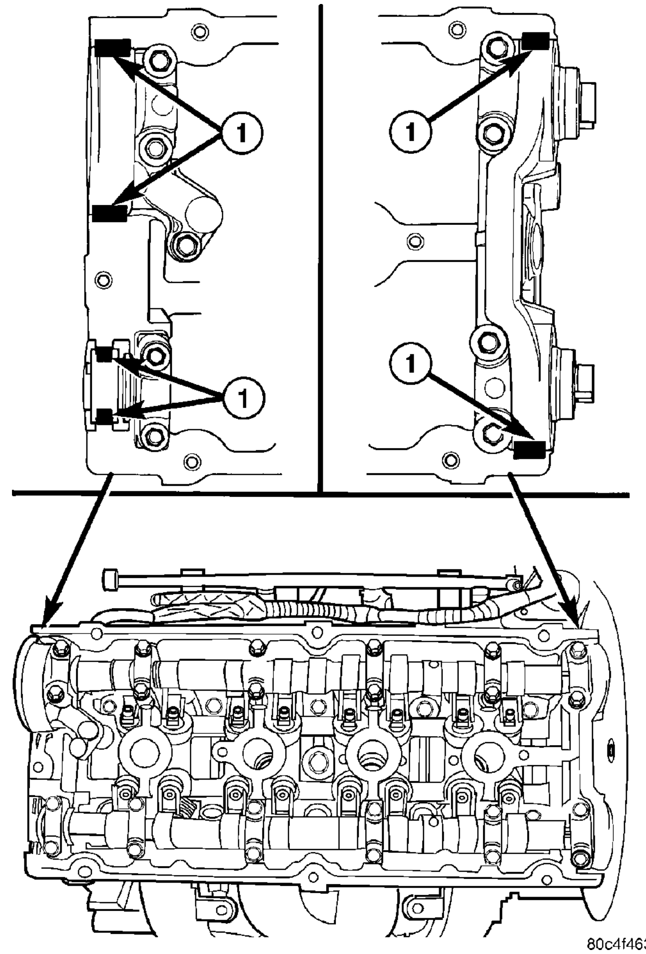


Fig. 26 Sealer Locations - Typical

1 – SEALER LOCATION

(4) Install cylinder head cover assembly to cylinder head. Install all bolts, ensuring the two (2) bolts containing the sealing washer are located in the center locations of cover. Tighten bolts in sequence shown in (Fig. 27). Using a 3 step torque method as follows:

(a) Tighten all bolts to 4.5 N·m (40 in. lbs.).

(b) Tighten all bolts to 9.0 N·m (80 in. lbs.).

(c) Tighten all bolts to 12 N·m (105 in. lbs.).

(5) Install intake manifold.

(6) Install ignition coil and spark plug wires. Tighten fasteners to 12 N·m (105 in. lbs.).

(7) If the PCV valve was removed, apply Mopar® Thread Sealant with Teflon to threads and install valve to cylinder head cover. Tighten PCV valve to 8 N·m (70 in. lbs.).

(8) Connect PCV and make-up air hoses to cylinder head cover.

CYLINDER HEAD COVER (Continued)

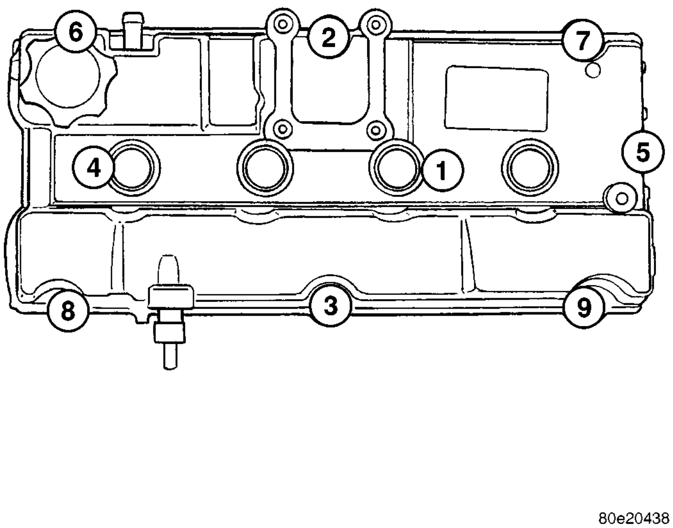


Fig. 27 CYLINDER HEAD TIGHTENING SEQUENCE

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The four valves per cylinder are opened by using roller rocker arms which pivot on hydraulic lash adjusters. The valves have chrome plated valve stems. Viton rubber valve stem seals are integral with the spring seats. They have chrome plated stems to prevent scuffing. Viton rubber valve stem seals are integral with the spring seats. The valves, spring retainers,and locks, are the 3 - bead lock design

CLEANING

(1) Clean all valves thoroughly and discard burned, warped and cracked valves.

VALVE SPRINGS

REMOVAL

REMOVAL - CYLINDER HEAD ON

(1) Remove camshafts.

(2) Rotate crankshaft until piston is at TDC on compression.

(3) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(4) Using Special Tool MD-998772-A with adapter 6779 (Fig. 28), compress valve springs and remove valve locks.

(5) Remove valve spring(s).

(6) Remove valve stem seal(s) by a using valve stem seal tool (Fig. 30).

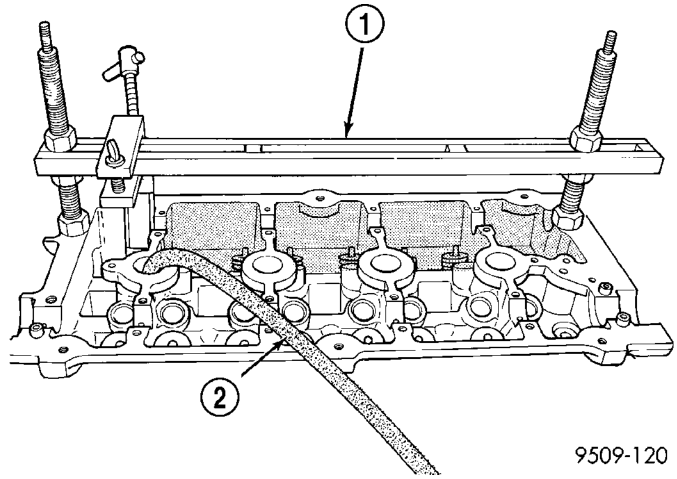


Fig. 28 Valve Spring - Removal/Installation

1 - VALVE SPRING COMPRESSOR MD 998772A
2 - AIR HOSE

REMOVAL - CYLINDER HEAD OFF

(1) With cylinder head removed from cylinder block, compress valve springs using a universal valve spring compressor.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves, locks and retainers to insure installation in original location.

(4) Inspect the valves. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - INSPECTION)

INSPECTION

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested for correct tension. Discard the springs that do not meet specifications. The following specifications apply to both intake and exhaust valves springs:

- Valve Closed Nominal Tension - 76 lbs. @ 38.0 mm (1.50 in.)
- Valve Open Nominal Tension - 136 lbs. @ 29.75 mm (1.17 in.)

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

VALVE SPRINGS (Continued)

INSTALLATION

INSTALLATION - CYLINDER HEAD ON

(1) Install valve seal/valve spring seat assembly (Fig. 29). Push the assembly down to seat it onto the valve guide.

(2) Install valve spring and retainer, use Special Tool MD-998772-A with adapter 6779 to compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems.

(3) Remove air hose and install spark plugs.

(4) Install camshafts and cylinder head cover .

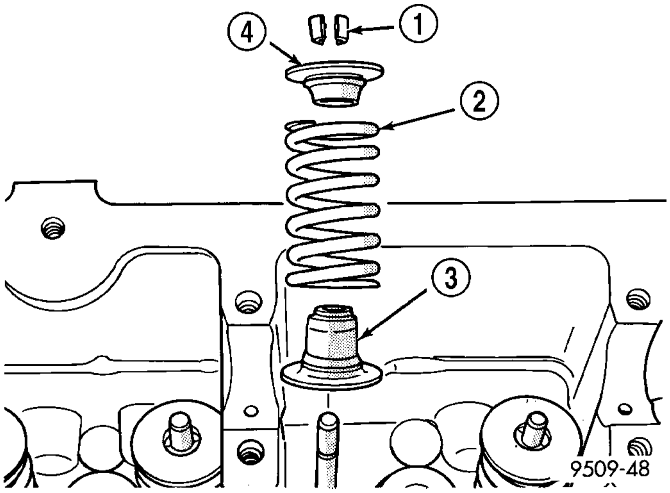


Fig. 29 Valve Stem Seal/Valve Spring Seat - Typical

1 - 3-GROOVE -VALVE RETAINING LOCKS
2 - VALVE SPRING
3 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY
4 - VALVE SPRING RETAINER

INSTALLATION - CYLINDER HEAD OFF

(1) Coat valve stems with clean engine oil and insert in cylinder head.

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 30). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: When oversize valves are used, the corresponding oversize valve seal must also be used. Excessive guide wear may result if oversize seals are not used with oversize valves.

(3) Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Ensure both locks are in the correct location after removing tool.

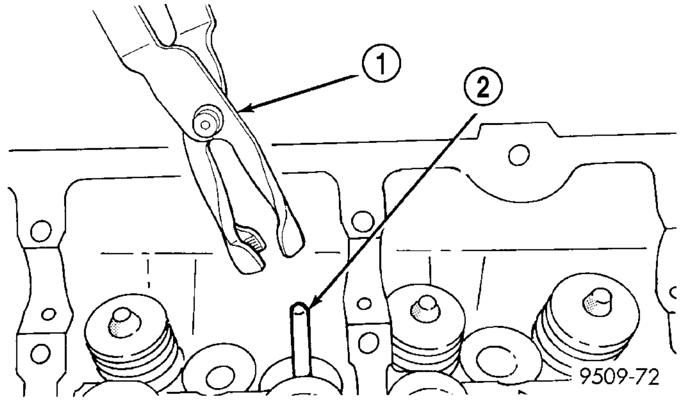


Fig. 30 Valve Stem Oil Seal Tool

1 - VALVE SEAL TOOL
2 - VALVE STEM

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 31). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.525 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

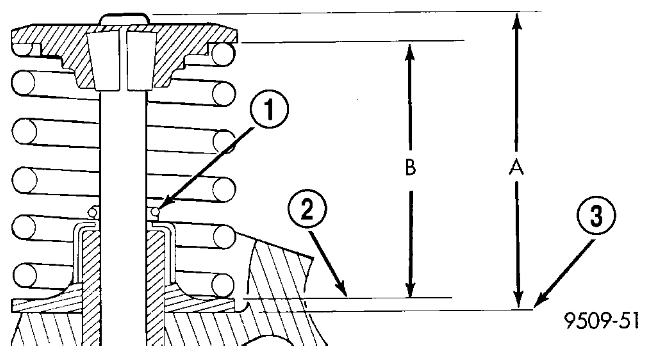


Fig. 31 Checking Spring Installed Height and Valve Tip Height Dimensions

1 - GARTER SPRING
2 - VALVE SPRING SEAT
3 - CYLINDER HEAD SURFACE

HYDRAULIC LIFTERS

DIAGNOSIS AND TESTING - LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

HYDRAULIC LIFTERS (Continued)

(3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor (integral to the head gasket) in the vertical oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace as necessary.

REMOVAL

NOTE: This procedure is for in-vehicle service with camshafts installed.

(1) Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Remove the camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

(3) Remove rocker arm. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL)

(4) Remove hydraulic lifter (Fig. 32).

(5) Repeat removal procedure for each hydraulic lifter.

(6) If reusing, mark each hydraulic lifter for reassembly in original position. Lifters are serviced as an assembly.

INSTALLATION

(1) Install hydraulic lifter (Fig. 32). Ensure the lifters are at least partially full of engine oil. This is indicated by little or no plunger travel when the lifter is depressed.

(2) Install rocker arm. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION)

(3) Repeat installation procedure for each hydraulic lifter.

(4) Install camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

(5) Install cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

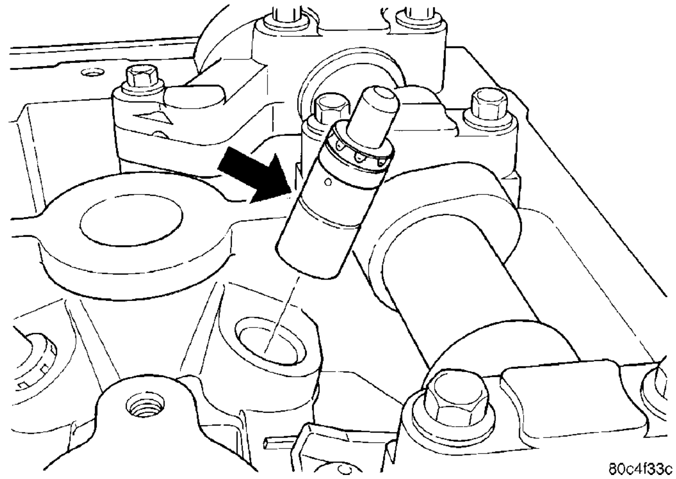


Fig. 32 Hydraulic Lash Adjuster

ROCKER ARMS

REMOVAL

NOTE: This procedure is for in-vehicle service with camshafts installed.

(1) Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Remove fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL)

(3) Remove spark plugs.

(4) Rotate engine until the camshaft lobe, on the follower being removed, is position on its base circle (heel). Also, the piston should be a minimum of 6.3 mm (0.25 in) below TDC position.

CAUTION: If cam follower assemblies are to be reused, always mark position for reassembly in their original positions.

(5) Using Special Tools 8215 and 8436 slowly depress valve assembly until rocker arm can be removed (Fig. 33).

NOTE: It may be necessary to remove additional brackets or components to allow clearance for tool handle movement.

(6) Repeat removal procedure for each rocker arm.

INSPECTION

Inspect the rocker arm for wear or damage (Fig. 34). Replace as necessary.

INSTALLATION

(1) Lubricate rocker arm with clean engine oil.

ROCKER ARMS (Continued)

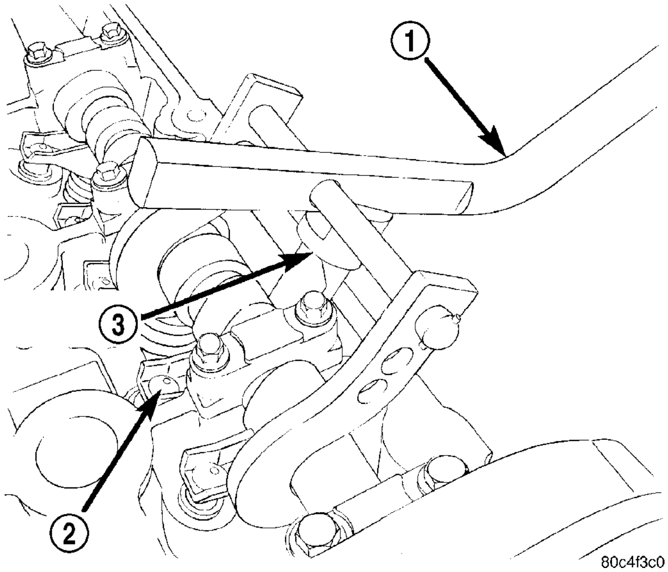


Fig. 33 Rocker Arm - Removal/Installation

1 - SPECIAL TOOL 8215
2 - ROCKER ARM
3 - SPECIAL TOOL 8436

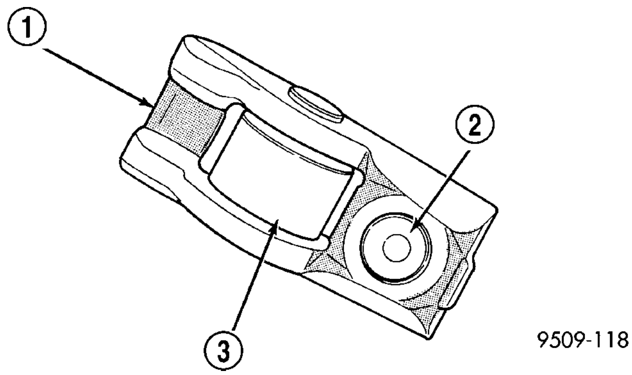


Fig. 34 Rocker Arm - Typical

1 - TIP
2 - LASH ADJUSTER POCKET
3 - ROLLER

(2) Using Special Tools 8215 and 8436 slowly depress valve assembly until rocker arm can be installed on the hydraulic lifter and valve stem.

(3) Repeat installation procedure for each rocker arm.

(4) Install spark plugs.

(5) Install fuel rail. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL RAIL - INSTALLATION)

(6) Install cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

ENGINE BLOCK

DESCRIPTION

The cast iron cylinder block is a two-piece assembly, consisting of the cylinder block and bedplate (Fig. 35). The bedplate incorporates the main bearing caps and bolts to the cylinder block. This design offers a much stronger lower end and increased cylinder block rigidity. The rear oil seal retainer is integral with the block. The bedplate and block are serviced as an assembly.

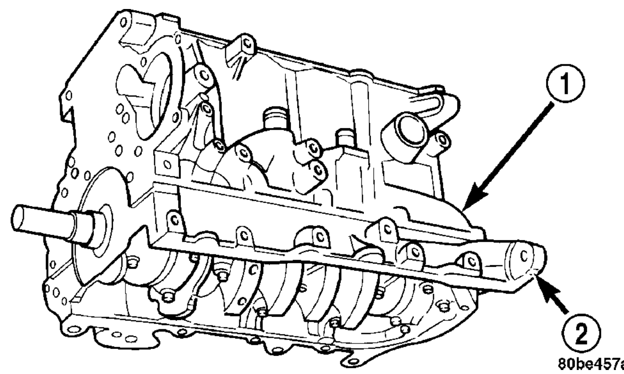


Fig. 35 2.4L Cylinder Block and Bedplate - Typical

1 - CYLINDER BLOCK
2 - BEDPLATE

STANDARD PROCEDURE

STANDARD PROCEDURE - PISTON TO CYLINDER BORE FITTING

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 14 mm (9/16 inch.) from the bottom of the skirt as shown in (Fig. 37). Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in (Fig. 36). Refer to for Engine Specifications (Refer to 9 - ENGINE - SPECIFICATIONS). Correct piston to bore clearance must be established in order to assure quiet and economical operation.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

STANDARD PROCEDURE - CYLINDER BORE HONING

(1) Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

ENGINE BLOCK (Continued)

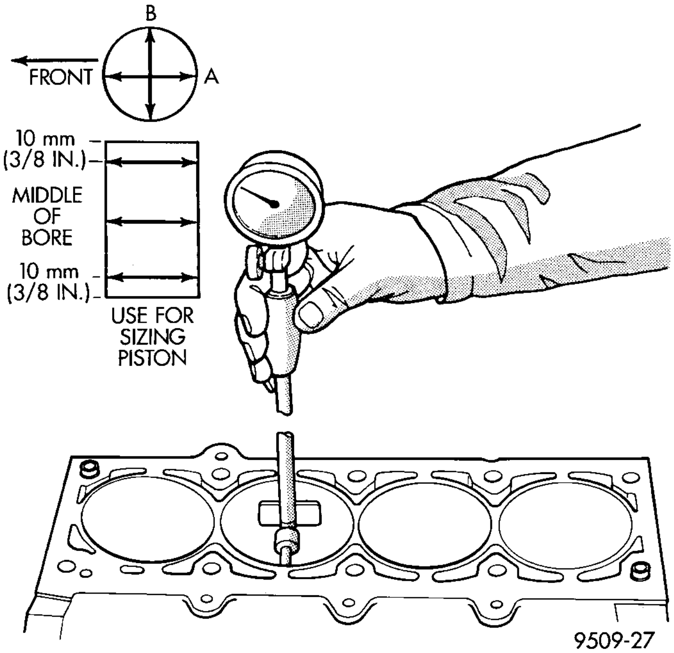


Fig. 36 Checking Cylinder Bore -Typical

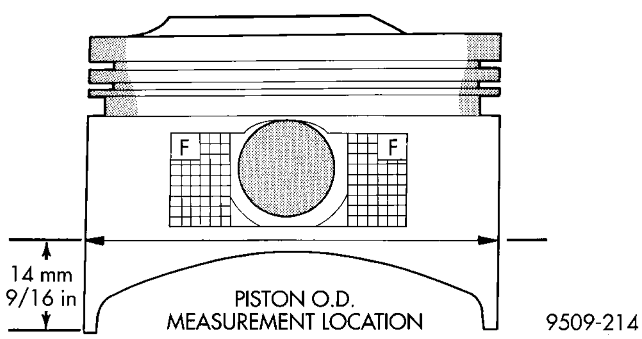


Fig. 37 Piston Measurement - Typical

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20–60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.** Inspect cylinder walls after each 20 strokes.

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 40-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 38).

(4) A controlled hone motor speed between 200–300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 40–60 degree angle. Faster up and down strokes increase the cross-hatch angle.

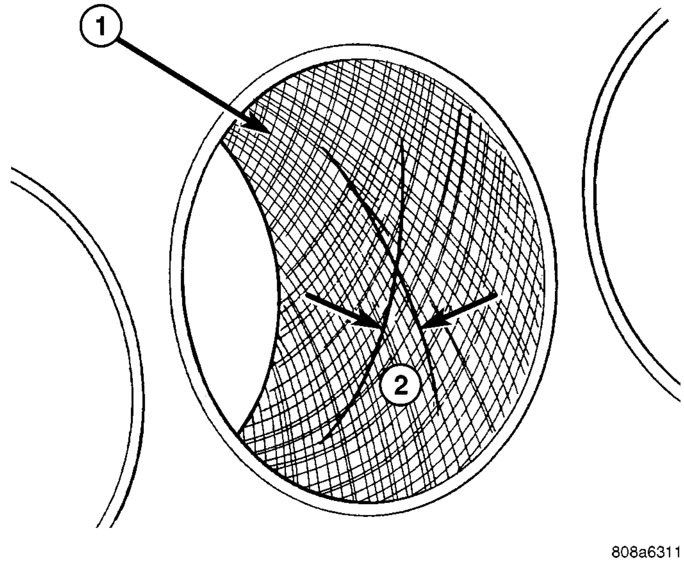


Fig. 38 Cylinder Bore Cross-Hatch Pattern

1 - CROSS-HATCH PATTERN
2 - 40°–60°

(5) After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION

ENGINE BLOCK

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are to be installed, (Refer to 9 - ENGINE - STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS).

(3) Examine block and cylinder bores for cracks or fractures.

(4) Check block deck surfaces for flatness. Deck surface must be within service limit of 0.1 mm (0.004 in.).

CYLINDER BORE

NOTE: The cylinder bores should be measured at normal room temperature, 21°C (70°F).

ENGINE BLOCK (Continued)

The cylinder walls should be checked for out-of-round and taper with Tool C119 or equivalent (Fig. 39) (Refer to 9 - ENGINE - SPECIFICATIONS). If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

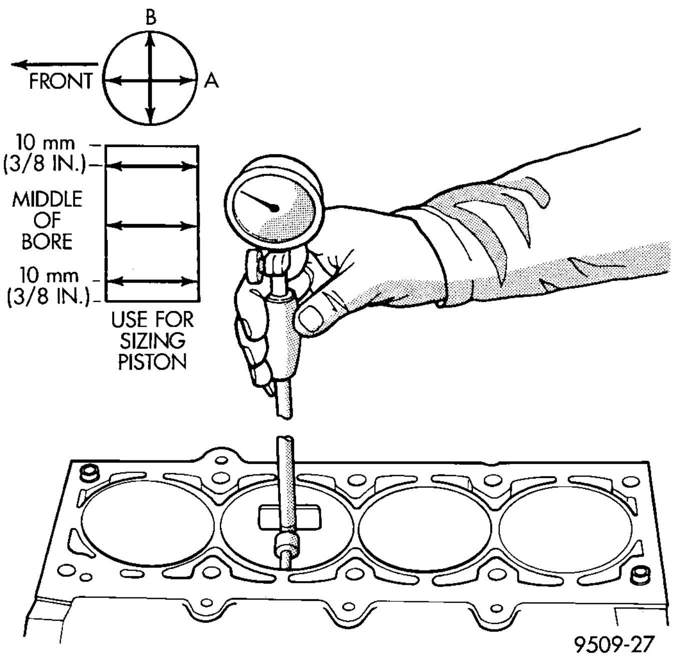


Fig. 39 Checking Cylinder Bore Size

Measure the cylinder bore at three levels in directions A and B (Fig. 39). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore. (Refer to 9 - ENGINE - SPECIFICATIONS).

CONNECTING ROD BEARINGS

STANDARD PROCEDURE

CONNECTING ROD - FITTING

(1) For measuring connecting rod bearing clearance procedure and use of Plastigage(Refer to 9 - ENGINE - STANDARD PROCEDURE). For bearing clearance refer to Engine Specifications. (Refer to 9 - ENGINE - SPECIFICATIONS)

NOTE: The rod bearing bolts should not be reused.

(2) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(3) Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

(4) Tighten the bolts to 27 N·m PLUS 1/4 turn (20 ft. lbs. PLUS 1/4 turn) **Do not use a torque wrench for last step.**

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 40). Refer to clearance specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

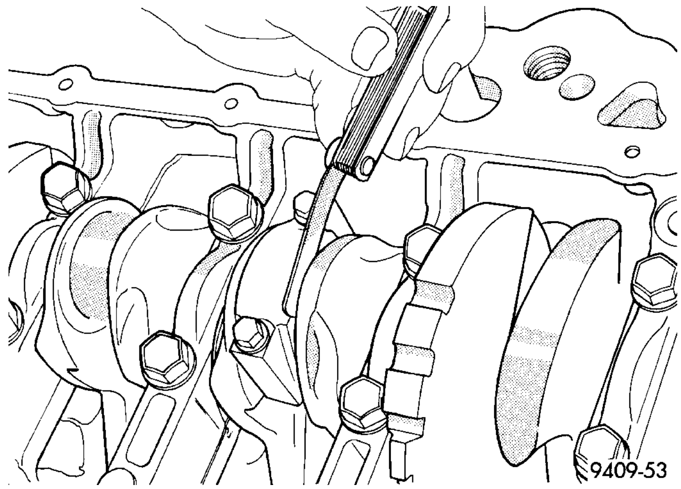


Fig. 40 Connecting Rod Side Clearance

CRANKSHAFT

DESCRIPTION

The crankshaft is made of nodular cast iron and includes five main bearing journals and four connecting rod journals (Fig. 41). The number three journal is the location for the thrust bearing. The mains and connecting rod journals have undercut fillet radiuses that are rolled for added strength. To optimize bearing loading, eight counterweights are used.

OPERATION

The crankshaft transfers force generated by combustion within the cylinder to the flywheel or flexplate.

STANDARD PROCEDURE - CRANKSHAFT END PLAY

(1) Using Dial Indicator C-3339 and Mounting Post L-4438, attach to front of engine, locating probe perpendicular on nose of crankshaft (Fig. 42).

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. Refer to Engine Specifications.

CRANKSHAFT (Continued)

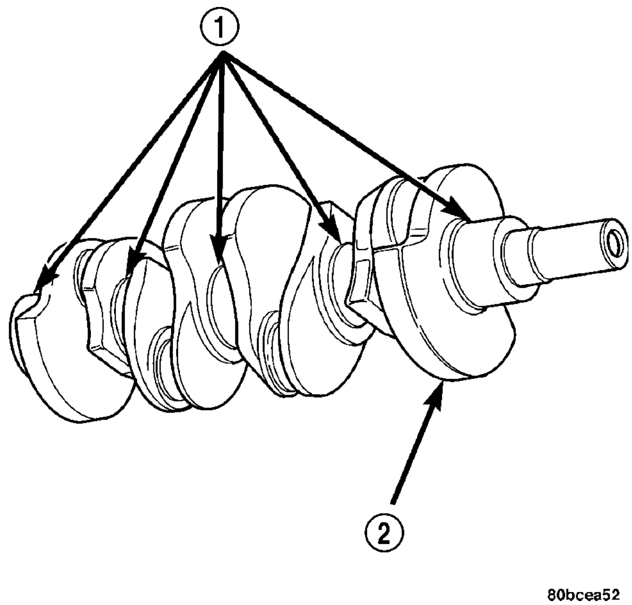


Fig. 41 Crankshaft - Typical

1 - MAIN BEARING JOURNALS
2 - COUNTER BALANCE WEIGHTS

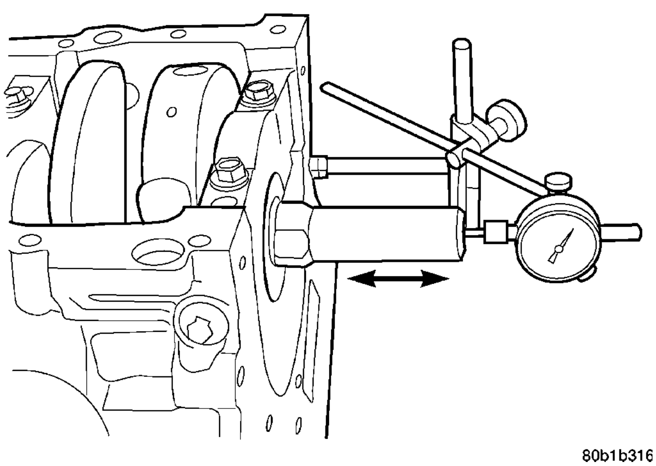


Fig. 42 CHECKING CRANKSHAFT END PLAY

REMOVAL

NOTE: Crankshaft can not be removed when engine is in vehicle.

(1) Remove engine assembly from vehicle. (Refer to 9 - ENGINE - REMOVAL)

(2) Remove flex plate and crankshaft rear oil seal.

(3) Mount engine on a repair stand.

(4) Drain engine oil and remove oil filter.

(5) Remove the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

(6) Remove the timing belt covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(7) Remove the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(8) Remove the oil pump. (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL)

(9) Remove balance shafts and housing assembly. (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL)

(10) Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap (Fig. 43).

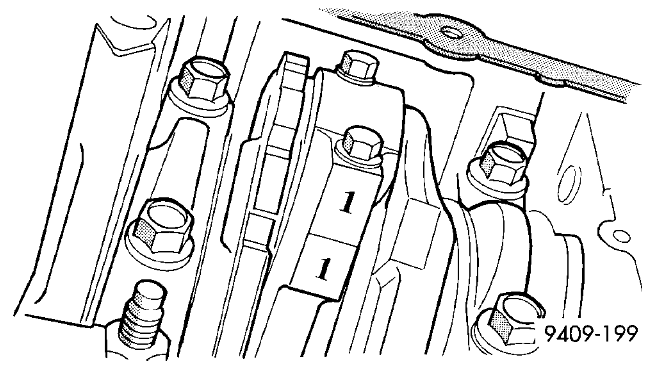


Fig. 43 Identify Connecting Rod to Cylinder-Typical

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

(11) Remove all connecting rod bolts and caps. Care should be taken not to damage the fracture rod and cap surfaces.

NOTE: Do not reuse connecting rod bolts.

(12) Remove all bedplate bolts from the engine block (Fig. 44).

(13) Using a mallet gently tap the bedplate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bedplate. Damage may occur to cylinder block to bedplate alignment and thrust bearing.

(14) Bedplate should be removed evenly from the cylinder block dowel pins to prevent damage to the dowel pins and thrust bearing.

(15) Lift out crankshaft from cylinder block. Do not damage the main bearings or journals when removing the crankshaft.

(16) Remove the target ring mounting screws and discard.

(17) Remove the target ring from the crankshaft.

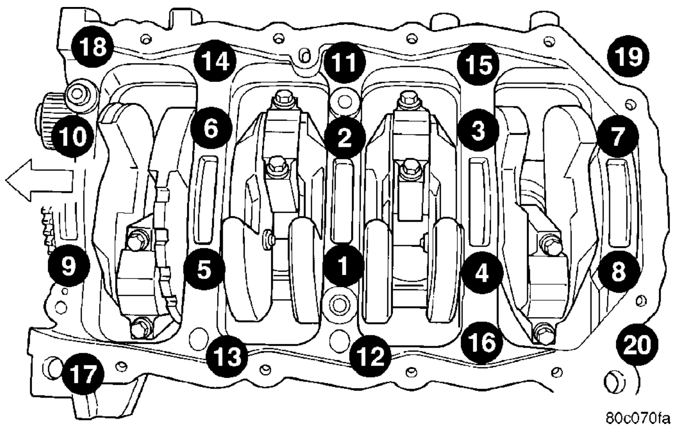


Fig. 44 Bedplate Bolt Tightening Sequence

INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring (Fig. 45). Limits of taper or out of round on any crankshaft journals should within specitifications. (Refer to 9 - ENGINE - SPECIFICATIONS) Journal grinding should not exceed 0.305 mm (0.012 in.) under the standard journal diameter. DO NOT grind thrust faces of No. 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts, it is important that the final paper or cloth polish be in the same direction as normal rotation in the engine.

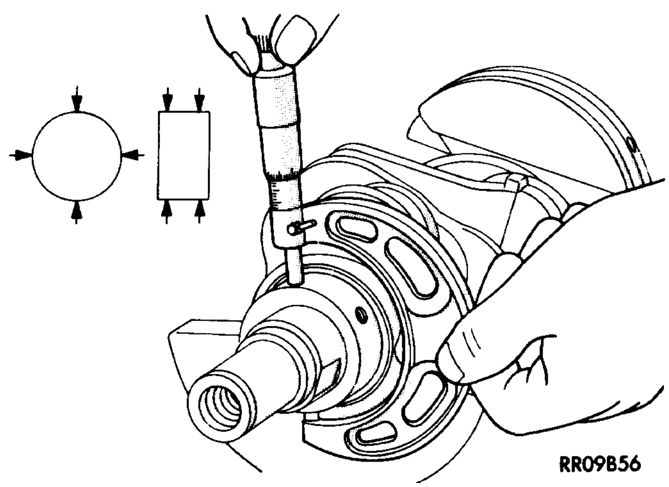


Fig. 45 Crankshaft Journal Measurements

INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 46).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

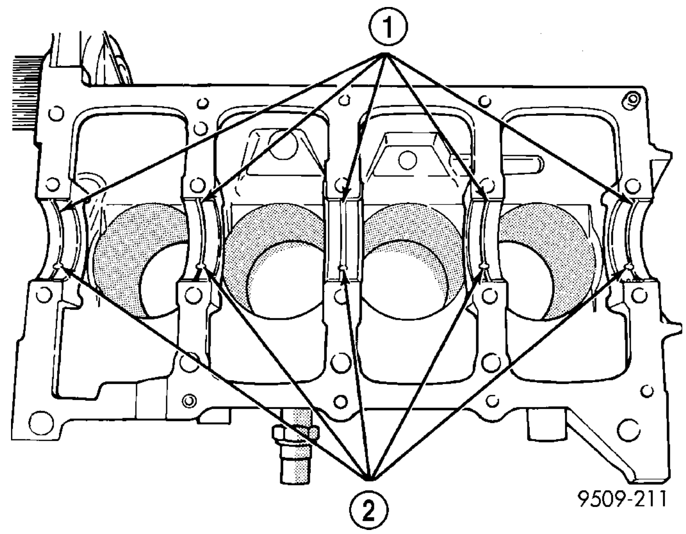


Fig. 46 Installing Main Bearing Upper Shell

1 - LUBRICATION GROOVES
2 - OIL HOLES

CAUTION: Do not get oil on the bedplate mating surface. It will affect the sealer ability to seal the bedplate to cylinder block.

NOTE: If the crankshaft is sent out for machine work, it must be balenced as an assembly with the target ring installed.

(3) Clean crankshaft and target ring with MOPAR® brake parts cleaner and dry with compressed air to ensure that the crankshaft mating surface and target ring mounting holes are free from oil and lock patch debris.

NOTE: Always use NEW mounting screws whether installing original or new target ring.

(4) Install **NEW** mounting screws finger tight starting with the #1 location. (Fig. 47) Make sure engagment occurs with the shoulder of the screw and mounting hole before starting all other screws.

(5) Torque all mounting screws with T30 torx bit to 13 Nm (110 in-lbs) following the torque sequence.

CAUTION: Use extreme care when handling crankshaft. Tone wheel damage can occur if crankshaft is mis-handled.

(6) Oil the bearings and journals. Install crankshaft.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine.

CRANKSHAFT (Continued)

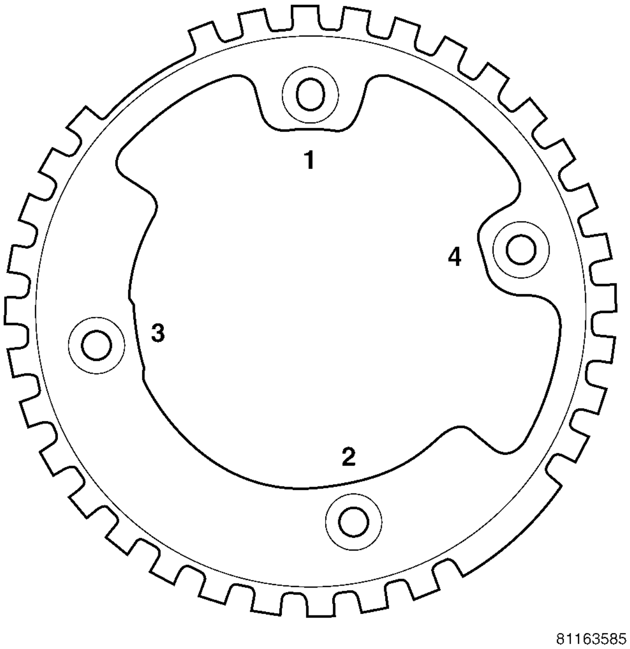


Fig. 47 Target Ring Torque Sequence

(7) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Bed Plate Sealant to cylinder block as shown in (Fig. 48).

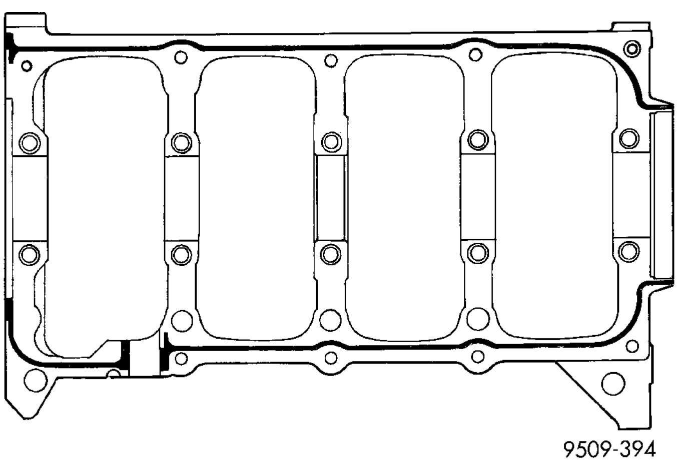


Fig. 48 Bedplate Sealing

(8) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots. Install the main bearing/bedplate into engine block.

(9) Before installing the bolts the threads should be oiled with clean engine oil, wipe off any excess oil.

(10) Install main bearing bedplate to engine block bolts 11, 17, and 20 finger tight. Tighten these bolts down together until the bedplate contacts the cylinder block.

(11) To ensure correct thrust bearing alignment, perform the following steps:

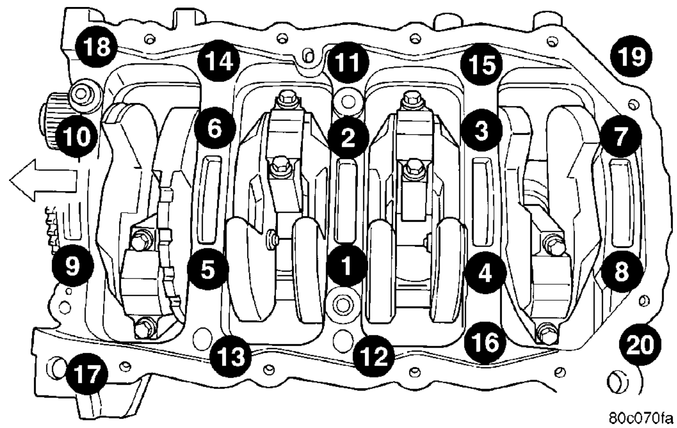


Fig. 49 Bedplate Bolt Torque Sequence

- Step 1: Rotate crankshaft until number 4 piston is at TDC.
- Step 2: Move crankshaft rearward to limits of travel.
- Step 3: Then, move crankshaft forward to limits of travel.
- Step 4: Wedge an appropriate tool between the rear of the cylinder block **(NOT BED PLATE)** and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.
- Step 5: Install and tighten bolts (1–10) in sequence shown in (Fig. 49) to 41 N·m (30 ft. lbs.).
- Step 6: Remove wedge tool used to hold crankshaft.

(12) Tighten bolts (1–10) again to 41 N·m (30 ft. lbs.) +1/4 turn in sequence shown in (Fig. 49).

(13) Install main bearing bedplate to engine block bolts (11–20), and torque each bolt to 28 N·m (20 ft. lbs.) in sequence shown in (Fig. 49).

(14) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(15) Install connecting rod bearings and caps. **Do Not Reuse Connecting Rod Bolts.** Torque connecting rod bolts to 27 N·m (20 ft. lbs.) plus 1/4 turn.

(16) Install balance shafts and housing assembly. (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION)

(17) Install the oil pump and pickup tube. (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION)

(18) Install the timing belt rear cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(19) Install the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(20) Install the timing belt front covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(21) Install engine support bracket.

CRANKSHAFT (Continued)

(22) Install the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

(23) Install the oil filter.

(24) Install crankshaft rear oil seal. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - INSTALLATION)

(25) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(26) Install the engine assembly. (Refer to 9 - ENGINE - INSTALLATION)

CRANKSHAFT MAIN BEARINGS

STANDARD PROCEDURE - MAIN BEARING - FITTING

For crankshaft specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

CRANKSHAFT MAIN BEARINGS

The crankshaft is supported in five main bearings. All upper and lower bearing shells in the crankcase have oil grooves. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 50).

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine (Fig. 50). All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersized: 0.025 mm (0.001 in.) and 0.250 mm (0.010 in.). Never install an undersize bearing that will reduce clearance below specifications. Replace or machine the crankshaft as necessary to obtain proper bearing clearances.

MAIN BEARING INSTALLATION

(1) Install the main bearing shells with the lubrication groove in the cylinder block (Fig. 51).

(2) Make certain oil holes in block line up with oil holes in bearings. Bearing tabs must seat in the block tab slots.

CAUTION: Do not get oil on the bedplate mating surface. It will may effect the sealer ability to seal the bedplate to cylinder block.

(3) Oil the bearings and journals and install crankshaft.

CAUTION: Use only the specified anaerobic sealer on the bedplate or damage may occur to the engine. Ensure that both cylinder block and bedplate surfaces are clean.

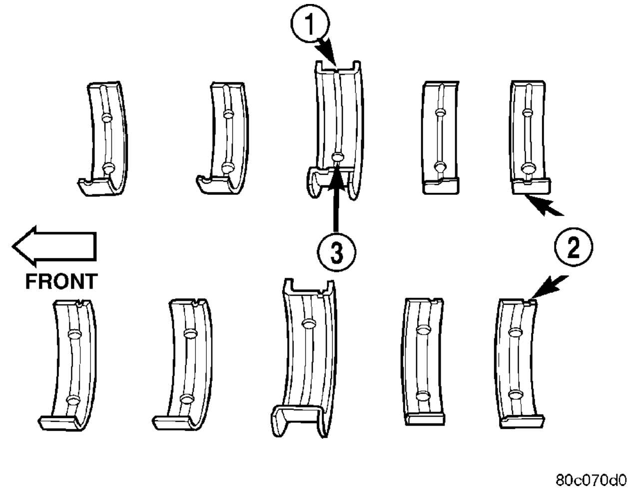


Fig. 50 Main Bearing Identification

1 - OIL GROOVE
2 - MAIN BEARINGS
3 - OIL HOLE

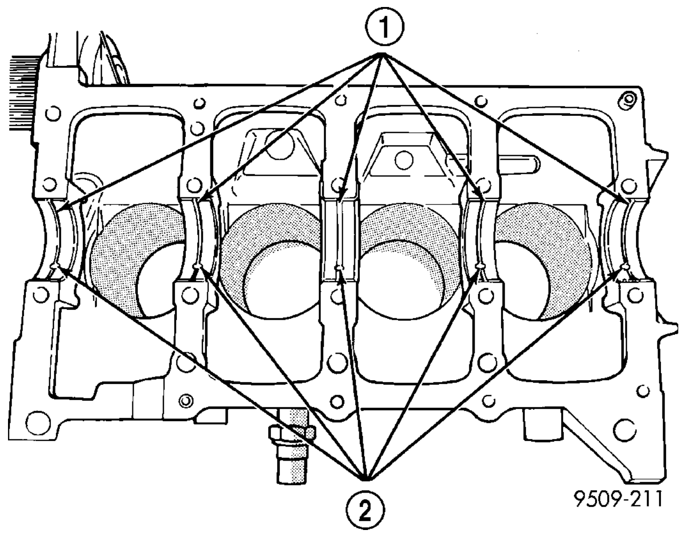


Fig. 51 Installing Main Bearing Upper Shell

1 - LUBRICATION GROOVES
2 - OIL HOLES

(4) Apply 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of anaerobic sealer Mopar® Bed Plate Sealant to cylinder block as shown in (Fig. 52).

(5) Install lower main bearings into main bearing cap/bedplate. Make certain the bearing tabs are seated into the bedplate slots.

(6) Position the main bearing/bedplate onto the engine block.

(7) Before installing bolts, lubricate the threads with clean engine oil, wipe off any excess oil.

CRANKSHAFT MAIN BEARINGS (Continued)

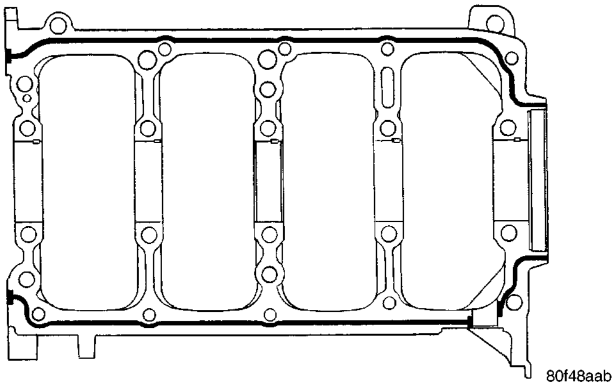


Fig. 52 Bed plate Sealing

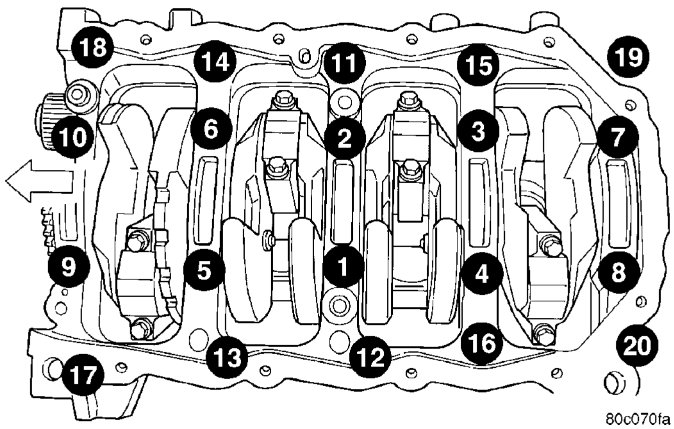


Fig. 53 Main Bearing Caps/Bedplate Tightening Sequence

(8) Install main bearing bedplate to engine block bolts 11, 17 and 20 finger tight. Tighten these bolts down together until the bedplate contacts the cylinder block.

(9) To ensure correct thrust bearing alignment, perform the following steps:

- Step 1: Rotate crankshaft until number 4 piston is at TDC.
- Step 2: Move crankshaft rearward to limits of travel.
- Step 3: Then, move crankshaft forward to limits of travel.
- Step 4: Wedge an appropriate tool between the rear of the cylinder block **(NOT BED PLATE)** and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.
- Step 5: Install and tighten bolts (1–10) in sequence shown in (Fig. 53) to 41 N·m (30 ft. lbs.).
- Step 6: Remove wedge tool used to hold crankshaft.

(10) Tighten bolts (1–10) again to 41 N·m (30 ft. lbs.) **PLUS** 1/4 turn in sequence shown in (Fig. 53).

(11) Install main bearing bedplate to engine block bolts (11–20), and torque each bolt to 28 N·m (20 ft. lbs.) in sequence shown in (Fig. 53).

(12) After the main bearing bedplate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Remove the crankshaft vibration damper (Fig. 54). (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)

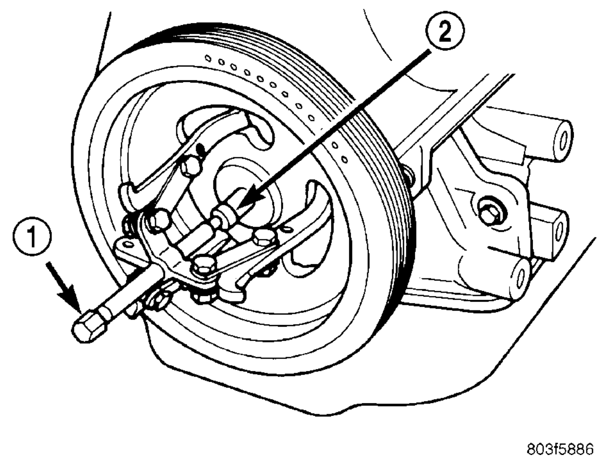


Fig. 54 Crankshaft Vibration Damper - Removal - Typical

1 - SPECIAL TOOL 1026 3-JAW PULLER
2 - SPECIAL TOOL 6827–A INSERT

(2) Remove timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 55).

CAUTION: Do not nick shaft seal surface or seal bore.

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 56). Be careful not to damage the seal surface of cover.

CRANKSHAFT OIL SEAL - FRONT (Continued)

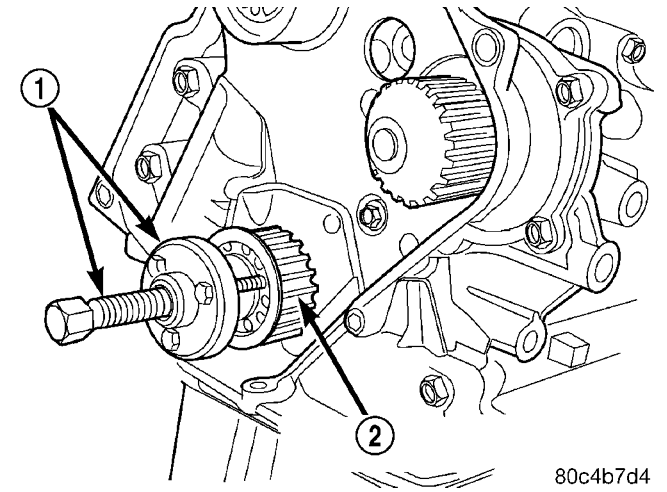


Fig. 55 Crankshaft Sprocket - Removal

1 - SPECIAL TOOL 6793
2 - CRANKSHAFT SPROCKET

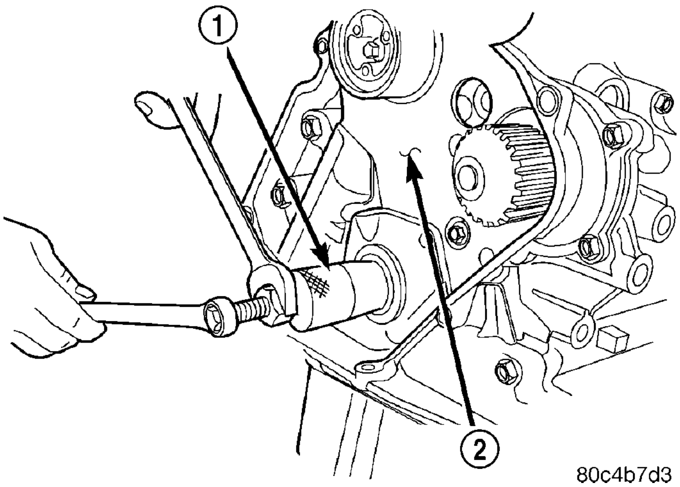


Fig. 56 Front Crankshaft Oil Seal - Removal

1 - SPECIAL TOOL 6771
2 - REAR TIMING BELT COVER

INSTALLATION

(1) Install new seal by using Special Tool 6780 (Fig. 57).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

(3) Install crankshaft sprocket using Special Tool 6792 (Fig. 58).

(4) Install timing belt. (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(5) Install crankshaft vibration damper (Fig. 59). (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

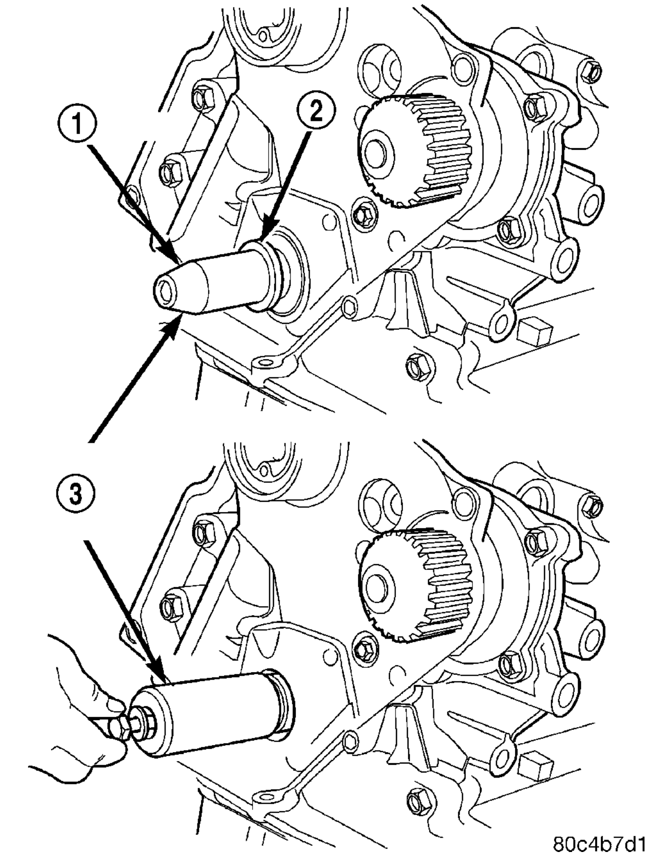


Fig. 57 Crankshaft Front Oil Seal - Installation

1 - PROTECTOR
2 - SEAL
3 - SPECIAL TOOL 6780

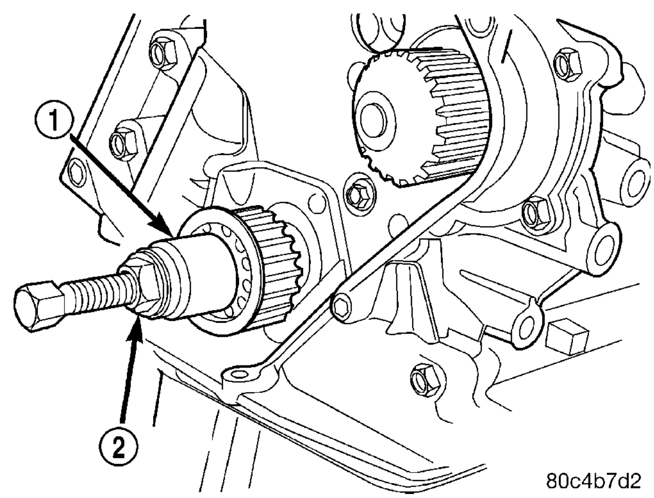


Fig. 58 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

CRANKSHAFT OIL SEAL - FRONT (Continued)

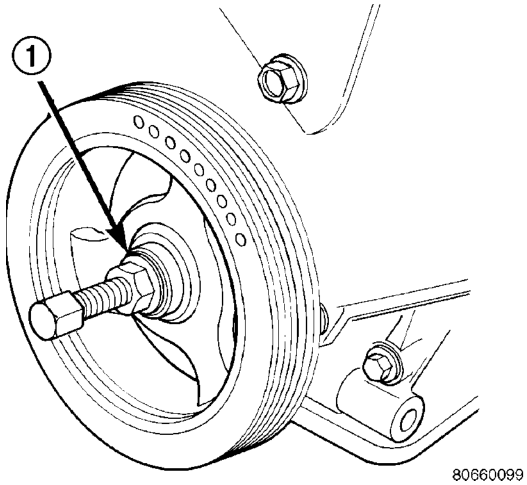


Fig. 59 Crankshaft Vibration Damper - Installation - Typical

1 - M12–1.75 × 150 MM BOLT, WASHER AND THRUST BEARING FROM SPECIAL TOOL 6792

CRANKSHAFT OIL SEAL - REAR

REMOVAL

(1) Remove transmission.
(2) Remove flex plate.
(3) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 60)through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

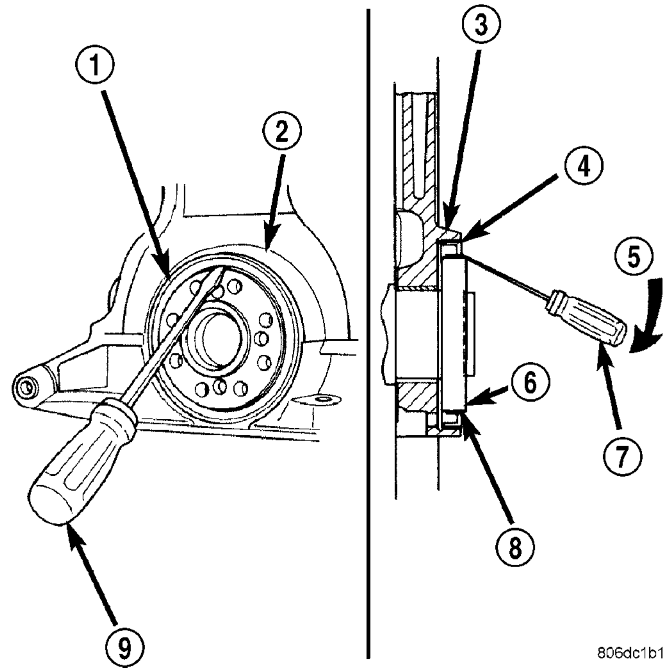


Fig. 60 Rear Crankshaft Oil Seal - Removal

1 - REAR CRANKSHAFT SEAL
2 - ENGINE BLOCK
3 - ENGINE BLOCK
4 - REAR CRANKSHAFT SEAL METAL CASE
5 - PRY IN THIS DIRECTION
6 - CRANKSHAFT
7 - SCREWDRIVER
8 - REAR CRANKSHAFT SEAL DUST LIP
9 - SCREWDRIVER

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

(1) Lubricate the crankshaft flange with engine oil.
(2) Place Special Tool 6926-1 Seal Guide on crankshaft (Fig. 61).
(3) Position seal over guide tool (Fig. 61). Guide tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(4) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 62) until the tool bottoms out against the block (Fig. 63).
(5) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten bolts to 95 N·m (70 ft. lbs.).
(6) Install the transmission.

CRANKSHAFT OIL SEAL - REAR (Continued)

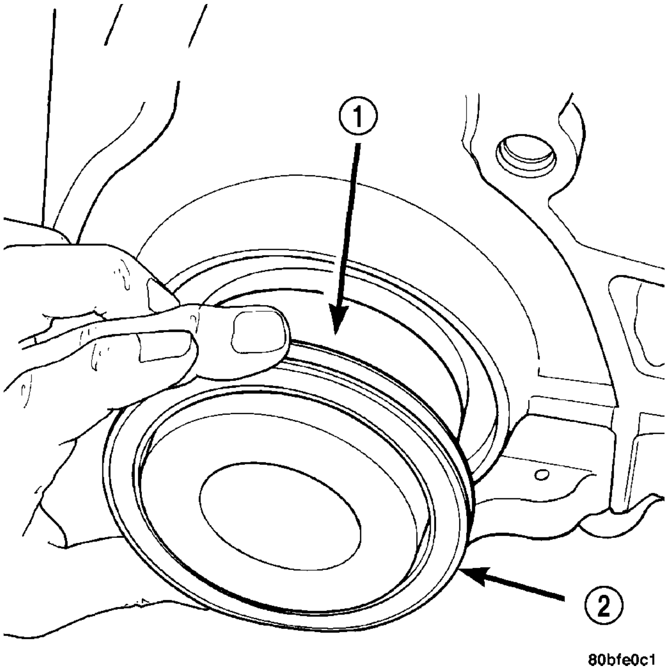


Fig. 61 Rear Crankshaft Seal and Special Tool 6926-1

1 - SPECIAL TOOL 6926–1 PILOT
2 - SEAL

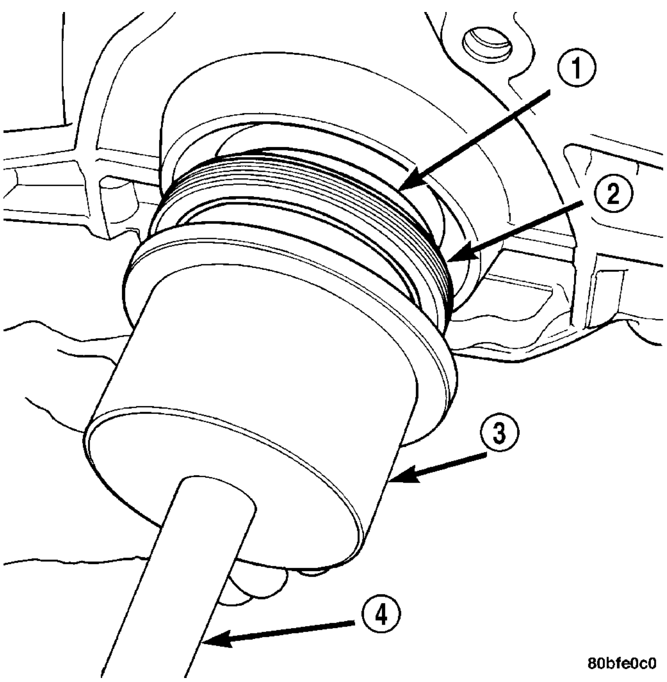


Fig. 62 Crankshaft Seal and Special Tools 6926-2 & C-4171

1 - SPECIAL TOOL 6926–1 PILOT
2 - SEAL
3 - SPECIAL TOOL 6926–2 INSTALLER
4 - SPECIAL TOOL C-4171

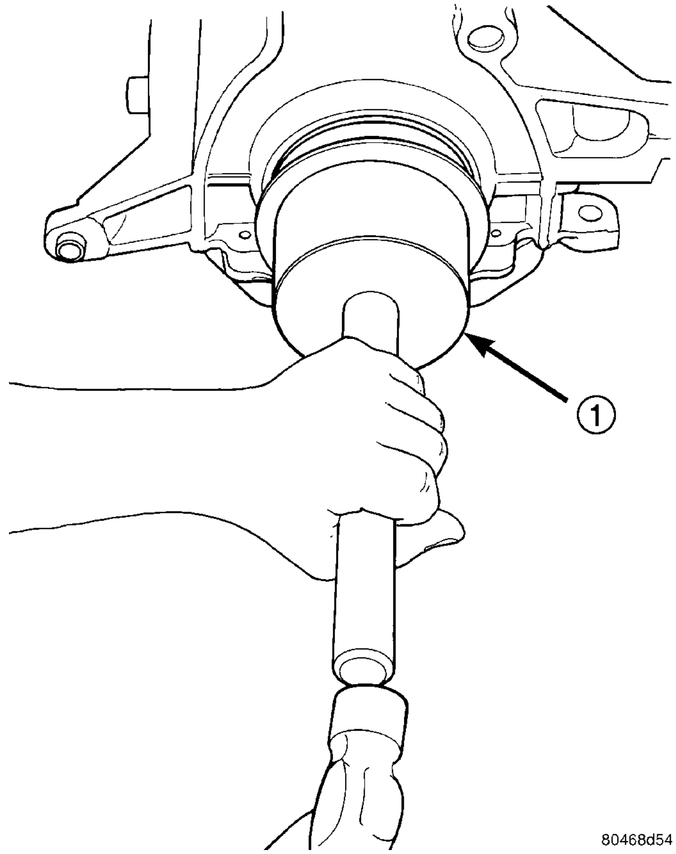


Fig. 63 Rear Crankshaft Seal - Installation

1 - SPECIAL TOOL 6926–2 INSTALLER

PISTON & CONNECTING ROD

DESCRIPTION

The pistons are made of a cast aluminum alloy. The pistons have pressed-in pins attached to forged powdered metal connecting rods. The pistons pin is offset 1 mm (0.0394 in.) towards the thrust side of the piston. The connecting rods are a cracked cap design and are not repairable. Hex head cap screws are used to provide alignment and durability in the assembly. The pistons and connecting rods are serviced as an assembly.

OPERATION

The piston and connecting rod is the link between the combustion force to the crankshaft.

REMOVAL

NOTE: Cylinder Head must be removed before Pistons and Rods. Refer to Cylinder Head Removal in this section.

PISTON & CONNECTING ROD (Continued)

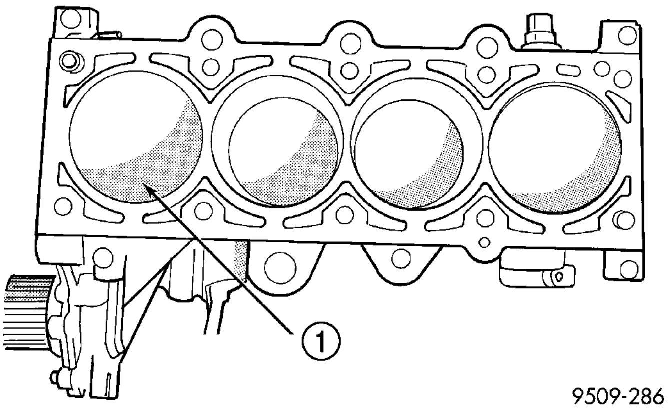


Fig. 64 Piston Markings

1 - DIRECTIONAL ARROW WILL BE IMPRINTED IN THIS AREA

(1) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation**. Mark piston with matching cylinder number (Fig. 64).

(2) Remove oil pan. Scribe the cylinder number on the side of the rod and cap (Fig. 65) for identification.

(3) Pistons have a directional stamping in the front half of the piston facing towards the **front** of engine.

(4) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(5) Remove Balance Shaft Assembly. Refer to Balance Shaft Removal in this section.

(6) Remove connecting rod cap bolts. Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(7) After removal, install bearing cap on the mating rod.

(8) Piston and Rods are serviced as an assembly.

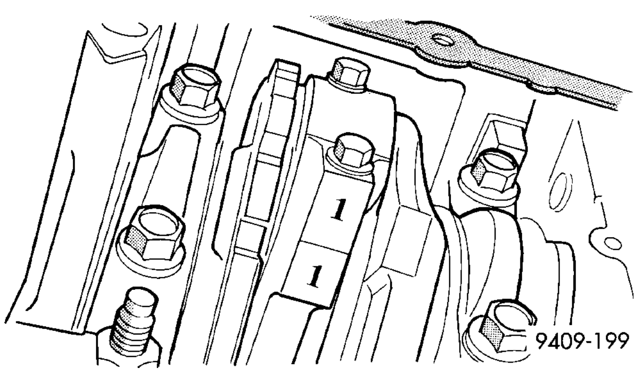


Fig. 65 Identify Connecting Rod to Cylinder

INSTALLATION

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 66). As viewed from top.

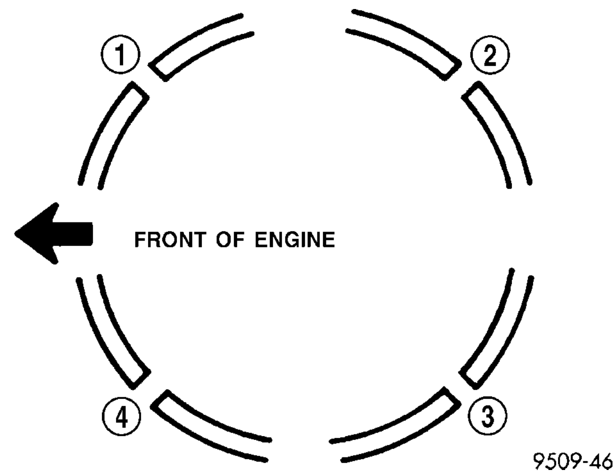


Fig. 66 Piston Ring End Gap Position

1 - GAP OF LOWER SIDE RAIL
2 - NO. 1 RING GAP
3 - GAP OF UPPER SIDE RAIL
4 - NO. 2 RING GAP AND SPACER EXPANDER GAP

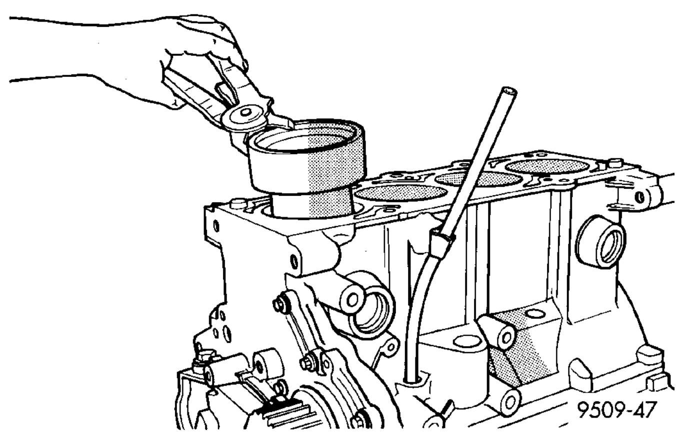


Fig. 67 Piston - Installation

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 67). **Be sure position of rings does not change during this operation** .

(4) The directional stamp on the piston should face toward the front of the engine.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

PISTON & CONNECTING ROD (Continued)

NOTE: The connecting rod cap bolts should not be reused.

(7) Before installing the **NEW** bolts the threads should be coated with clean engine oil.

(8) Install each bolt finger tight than alternately torque each bolt to assemble the cap properly.

CAUTION: Do not use a torque wrench for second part of last step.

(9) Tighten the bolts to 54 N·m PLUS 1/4 turn (40 ft. lbs. PLUS 1/4 turn).

(10) Using a feeler gauge, check connecting rod side clearance (Fig. 68).

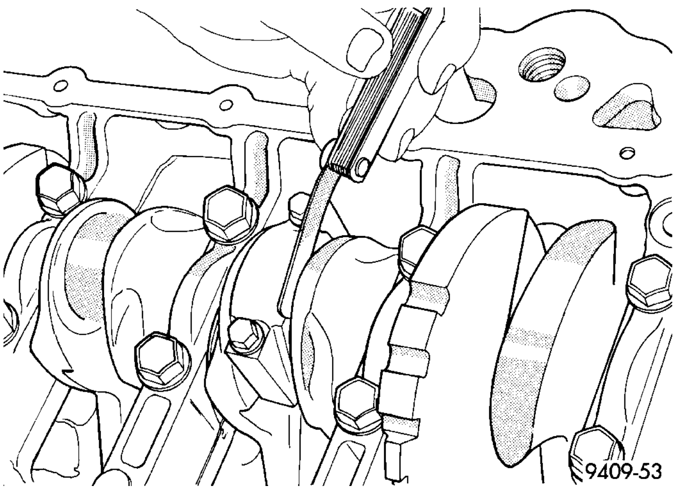


Fig. 68 Checking Connecting Rod Side Clearance

PISTON RINGS

STANDARD PROCEDURE

PISTON RING - FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 69). Refer to Engine Specifications.

(2) Check piston ring to groove side clearance (Fig. 70). Refer to Engine Specifications.

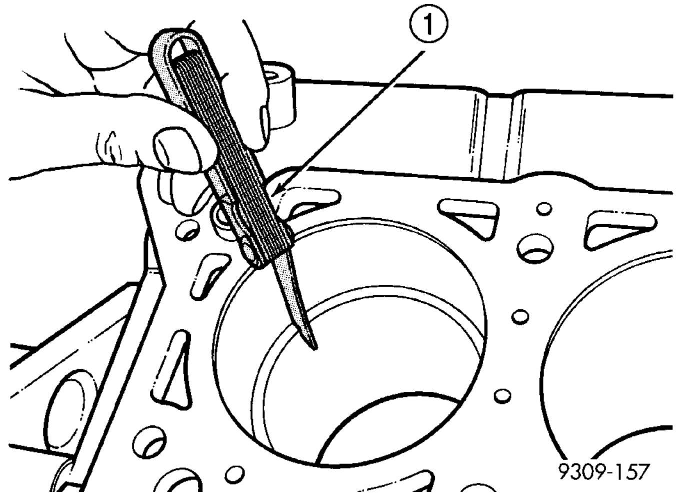


Fig. 69 Piston Ring Gap

1 - FEELER GAUGE

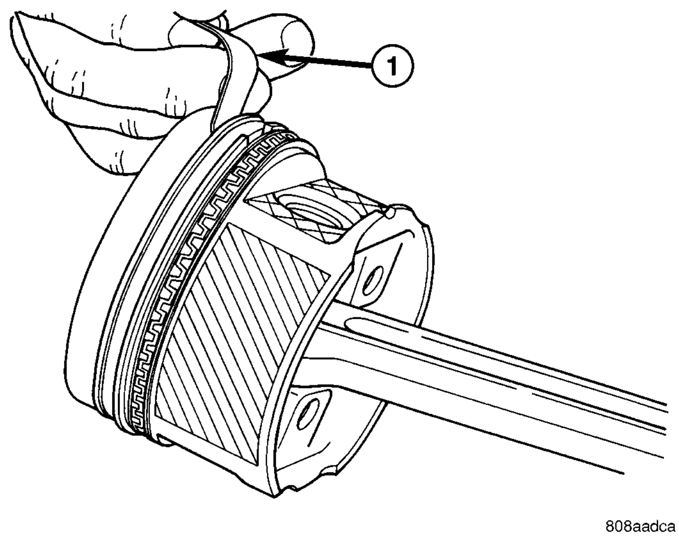


Fig. 70 Piston Ring Side Clearance

1 - FEELER GAUGE

PISTON RINGS (Continued)

PISTON RINGS - INSTALLATION

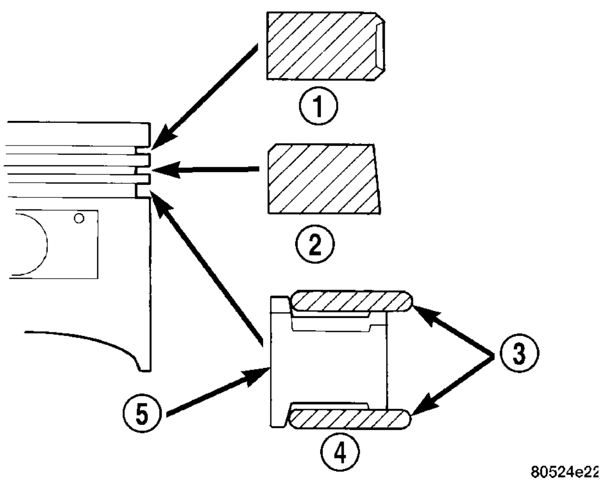


Fig. 71 Piston Ring Installation

1 - NO. 1 PISTON RING
2 - NO. 2 PISTON RING
3 - SIDE RAIL
4 - OIL RING
5 - SPACER EXPANDER

(1) Install rings with manufacturers I.D. mark facing up, to the top of the piston (Fig. 71).

CAUTION: Install piston rings in the following order:

a. Oil ring expander.
b. Upper oil ring side rail.
c. Lower oil ring side rail.
d. No. 2 Intermediate piston ring.
e. No. 1 Upper piston ring.

(2) Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander** (Fig. 72).

(3) Install upper side rail first and then the lower side rail.

(4) Install No. 2 piston ring and then No. 1 piston ring.

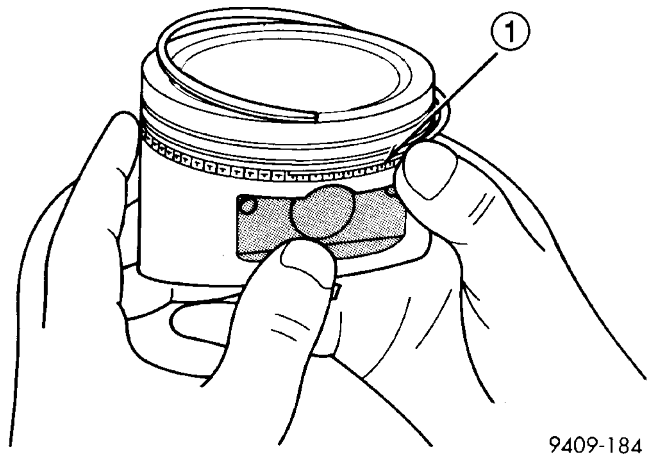


Fig. 72 Installing Side Rail - Typical

1 - SIDE RAIL END

(5) Position piston ring end gaps as shown in (Fig. 73).

(6) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

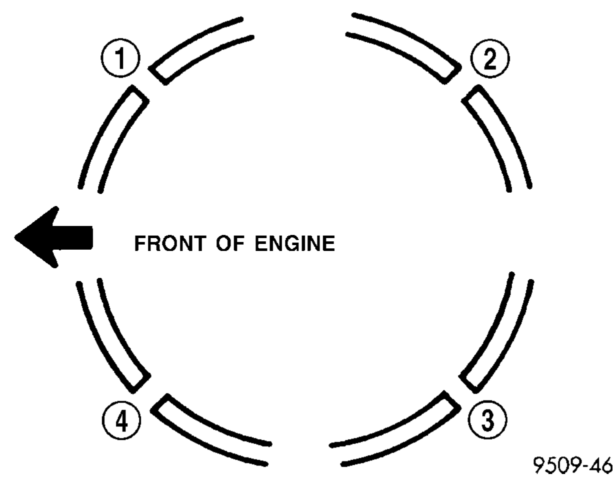


Fig. 73 Piston

1 - GAP OF LOWER SIDE RAIL
2 - NO. 1 RING GAP
3 - GAP OF UPPER SIDE RAIL
4 - NO. 2 RING GAP AND SPACER EXPANDER GAP

VIBRATION DAMPER

REMOVAL

(1) Remove accesory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

(2) Remove crankshaft damper bolt.

(3) Remove damper using Special Tool 3-Jaw Puller 1026 and Insert 6827–A (Fig. 74).

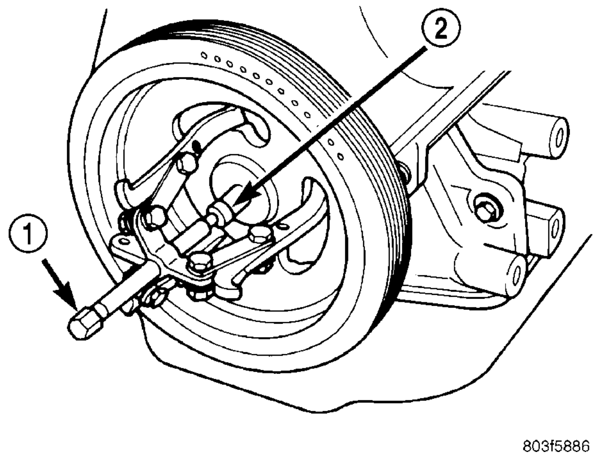


Fig. 74 Crankshaft Vibration Damper - Removal - Typical

1 - SPECIAL TOOL 1026 3-JAW PULLER
2 - SPECIAL TOOL 6827–A INSERT

INSTALLATION

(1) Install crankshaft vibration damper using M12 1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792 (Fig. 75).

(2) Install crankshaft vibration damper bolt and tighten to 142 N·m (105 ft. lbs.).

(3) Install accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

STRUCTURAL COLLAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove structural collar attaching bolts.

(3) Remove collar.

INSTALLATION

CAUTION: Torque procedure for the structural collar must be followed or damage could occur to oil pan and collar.

(1) Perform the following steps for installing structural collar.

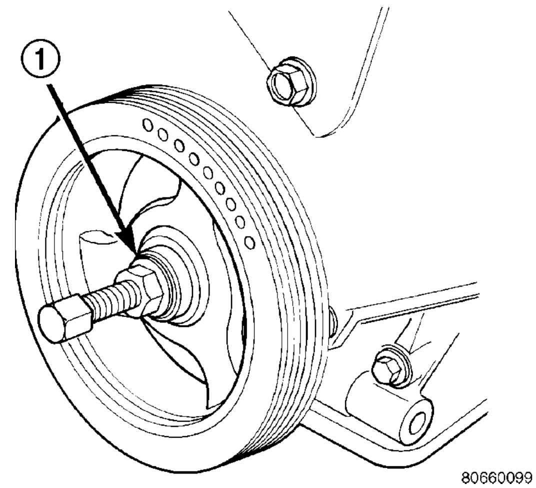


Fig. 75 Crankshaft Vibration Damper - Installation - Typical

1 - M12–1.75 × 150 MM BOLT, WASHER AND THRUST BEARING FROM SPECIAL TOOL 6792

- Step 1: Position collar between transmission and oil pan. Install collar to transmission bolts, **hand start only**.
- Step 2: Install collar to oil pan bolts, **hand snug only.**
- Step 3: Tighten collar to transmission bolts.
- Step 4: Tighten collar to oil pan bolts.

(2) Lower vehicle.

ENGINE MOUNTING

DESCRIPTION

The engine mounting system consist of three mounts; right and a left side support the powertrain, and rear mount to control powertrain torque. The mounts are of molded rubber material.

FRONT MOUNT

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove the front engine mount through bolt from the insulator.

(3) Remove the engine front mount bolts and remove the insulator assembly.

(4) Remove the front mounting bracket from engine, if necessary.

INSTALLATION

(1) Install the insulator mount assembly (Fig. 76)and (Fig. 77).

(2) Tighten the mount to engine bolts.

(3) Loosely install the front engine mount through bolt to the insulator.

FRONT MOUNT (Continued)

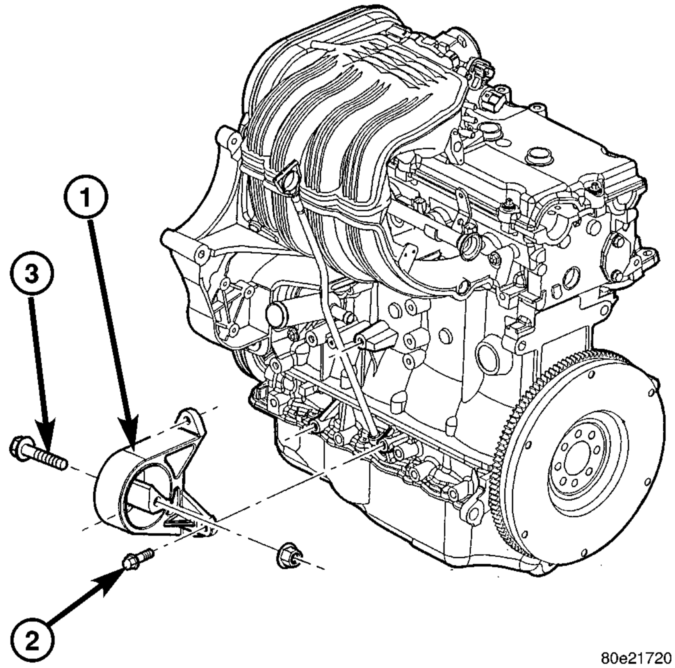


Fig. 76 LH ENGINE MOUNT

1 - ENGINE MOUNT
2 - ENGINE MOUNT BOLT (3)
3 - ENGINE MOUNT THROUGH BOLT

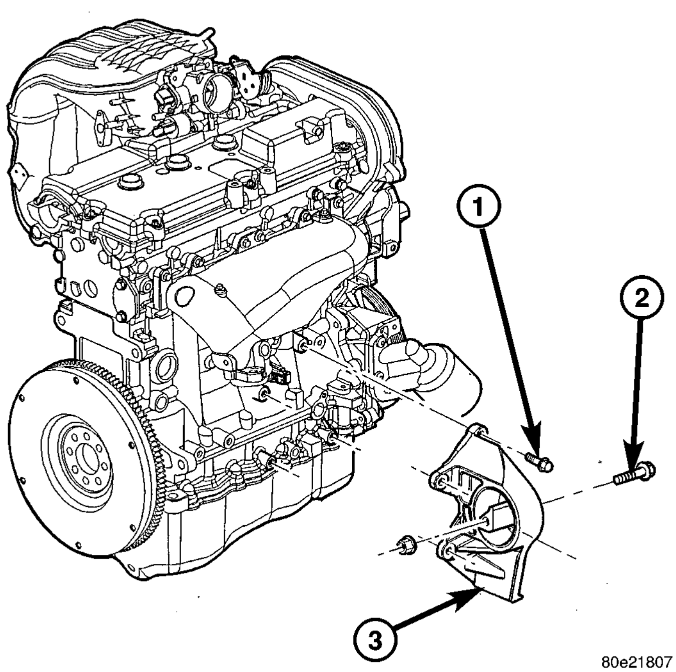


Fig. 77 RH ENGINE MOUNT

1 - ENGINE MOUNT BOLT (4)
2 - ENGINE MOUNT THROUGH BOLT
3 - ENGINE MOUNT

(4) Lower the engine.
(5) Tighten the through bolt.
(6) Lower the vehicle.

REAR MOUNT

REMOVAL

NOTE: A resilient rubber cushion supports the transmission at the rear between the transmission extension housing and the rear support crossmember or skid plate.

(1) Disconnect negative cable from battery.
(2) Raise the vehicle and support the transmission.
(3) Remove the nuts holding the support cushion to the crossmember. Remove the crossmember.

MANUAL TRANSMISSION

a. Remove the support cushion nuts and remove the cushion.
b. Remove the transmission support bracket bolts and remove the bracket from the transmission.

AUTOMATIC TRANSMISSION

c. Remove the support cushion bolts and remove the cushion and the support bracket from the transmission (4WD) or from the adaptor bracket (2WD).
d. On 2WD vehicles, remove the bolts holding the transmission support adaptor bracket to the transmission. Remove the adaptor bracket.

INSTALLATION

MANUAL TRANSMISSION:

(1) Install the support cushion to the transmission (Fig. 78)or (Fig. 79). Install the bolts and tighten.
(2) Position the crossmember in the vehicle. Install the crossmember to mount through bolt and nut.
(3) Install crossmember-to-sill bolts and tighten to 41 N·m (30 ft. lbs.) torque.
(4) Remove the transmission support.
(5) Lower the vehicle.
(6) Connect negative cable to battery.

AUTOMATIC TRANSMISSION:

(1) Install the transmission mount to transmission (Fig. 80) and (Fig. 81). Install the bolts.
(2) Position the crossmember in the vehicle. Install the crossmember to mount through bolt and nut.
(3) Remove the transmission support.
(4) Lower the vehicle.
(5) Connect negative cable to battery.

REAR MOUNT (Continued)

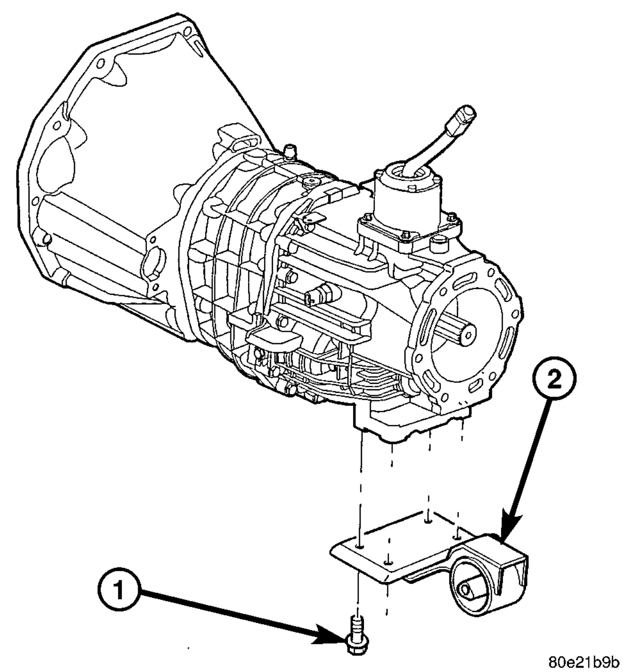


Fig. 78 TRANSMISSION MOUNT - 2.4L MANUAL TRANS

1 - TRANSMISSION MOUNT
2 - MOUNTING BOLT

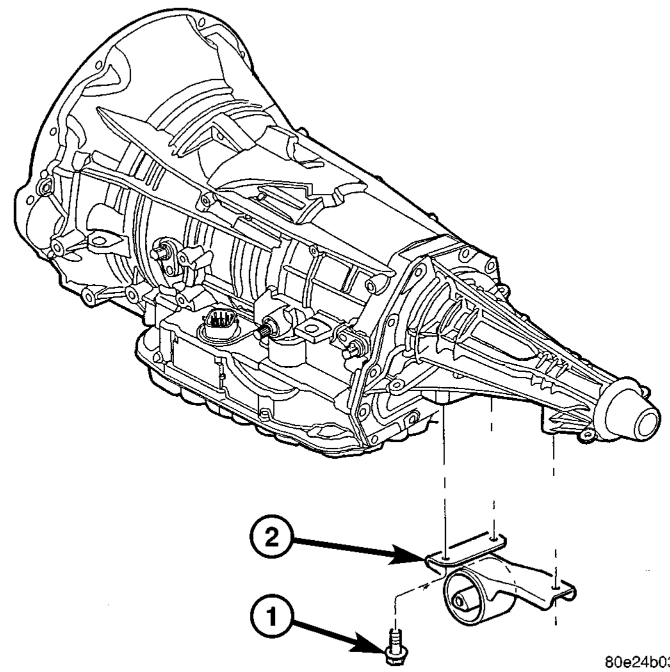


Fig. 80 TRANSMISSION MOUNT - 3.7L 2WD AUTO TRANS

1 - BOLT
2 - MOUNT

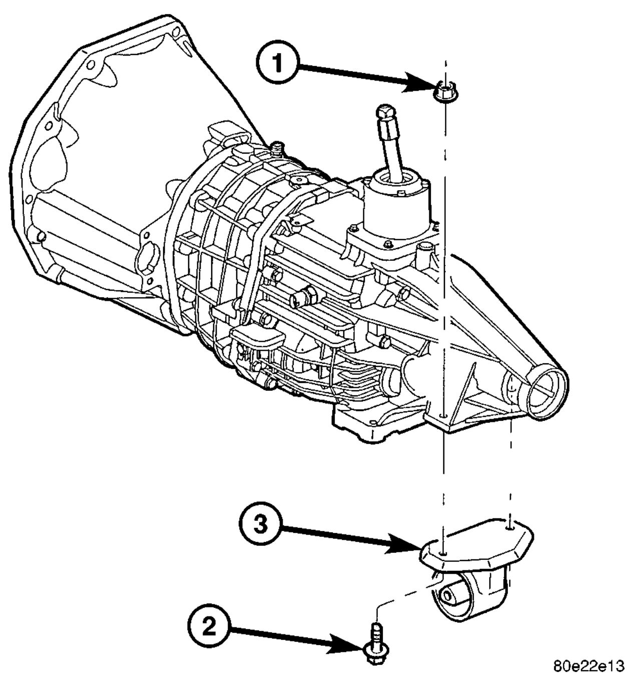


Fig. 79 TRANSMISSION MOUNT - 3.7L MANUAL TRANS 2WD

1 - NUT
2 - BOLT
3 - TRANS MOUNT

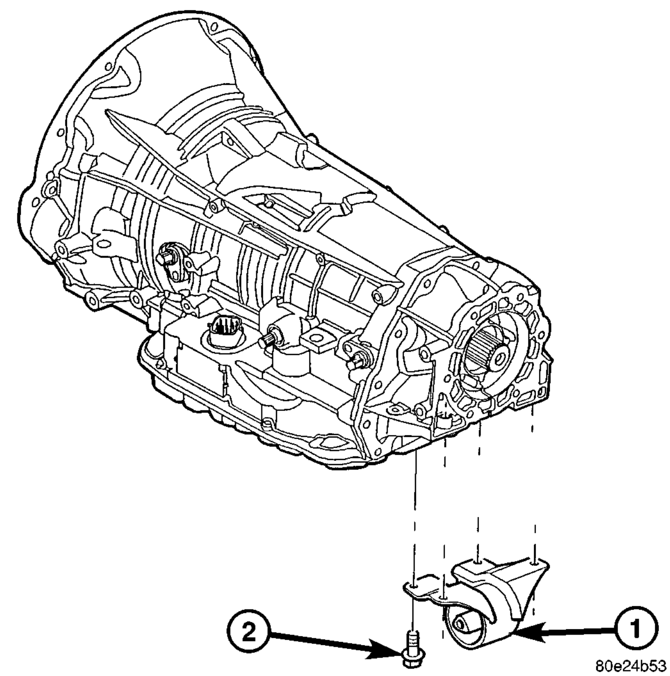


Fig. 81 TRANSMISSION MOUNT - 3.7L 4WD AUTO TRANS

1 - MOUNT
2 - BOLT

LUBRICATION

DESCRIPTION

The lubrication system is a full-flow filtration, pressure feed type. The oil pump is mounted in the front engine cover and driven by the crankshaft.

OPERATION

Engine oil drawn up through the pickup tube and is pressurized by the oil pump and routed through the full-flow filter to the main oil gallery running the length of the cylinder block. A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals. Balance shaft lubrication is provided through an oil passage from the number one main bearing cap through the balance shaft carrier support leg. This passage directly supplies oil to the front bearings and internal machined passages in the shafts that routes oil from front to the rear shaft bearing journals. A vertical hole at the number five bulkhead routes pressurized oil through a restrictor (integral to the cylinder head gasket) up past a cylinder head bolt to an oil gallery running the length of the cylinder head. The camshaft journals are partially slotted to allow a predetermined amount of pressurized oil to pass into the bearing cap cavities. Lubrication of the camshaft lobes are provided by small holes in the camshaft bearing caps that are directed towards each lobe. Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE CHECKING

(1) Disconnect and remove oil pressure switch. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL)

(2) Install Special Tools C-3292 Gauge with 8406 Adaptor fitting.

(3) Start engine and record oil pressure. Refer to Specifications for correct oil pressure requirements. (Refer to 9 - ENGINE - SPECIFICATIONS)

CAUTION: If oil pressure is 0 at idle, do not perform the 3000 RPM test

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.

(5) After test is complete, remove test gauge and fitting.

(6) Install oil pressure switch and connector. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - INSTALLATION)

OIL

STANDARD PROCEDURE

ENGINE OIL LEVEL CHECK

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick and observe oil level. Add oil only when the level is at or below the ADD mark (Fig. 82).

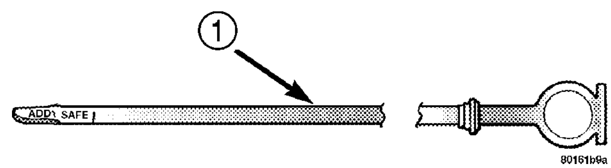


Fig. 82 Oil Level

1 - ENGINE OIL LEVEL DIPSTICK

STANDARD PROCEDURE - ENGINE OIL AND FILTER CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

OIL (Continued)

(Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Remove oil filter. (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL)

(7) Install and tighten drain plug in crankcase.

(8) Install new oil filter. (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION)

(9) Lower vehicle and fill crankcase with specified type and amount of engine oil. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION)

(10) Install oil fill cap.

(11) Start engine and inspect for leaks.

(12) Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

OIL FILTER

DESCRIPTION

The engine oil filter is a high quality full-flow, disposable type. Replace the oil filter with a Mopar® or the equivalent.

REMOVAL

(1) Raise vehicle on hoist.

(2) Position an oil collecting container under oil filter location.

CAUTION: When servicing the oil filter avoid deforming the filter can by installing the remove/install tool band strap against the can to base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

(3) Using a suitable filter wrench, turn oil filter counterclockwise to remove (Fig. 83).

INSTALLATION

(1) Clean and check filter mounting surface. The surface must be smooth, flat and free of debris or pieces of gasket.

(2) Lubricate new oil filter gasket with clean engine oil.

(3) Screw oil filter on until the gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

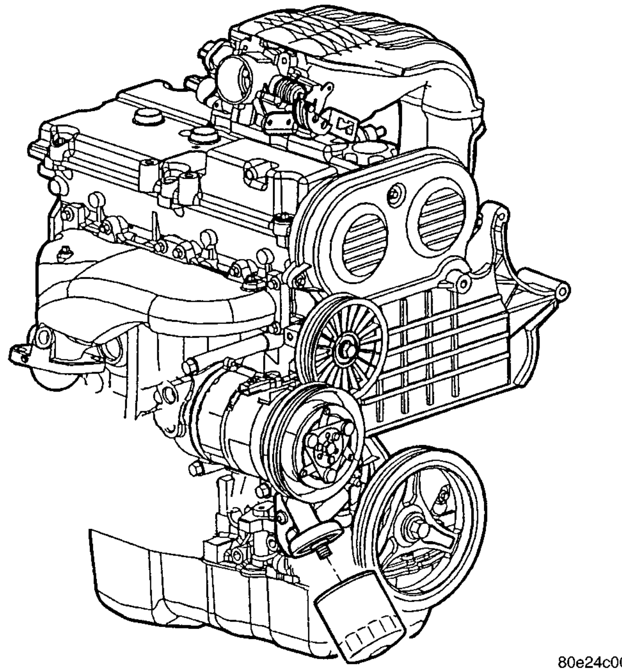


Fig. 83 2.4 OIL FILTER

OIL PAN

REMOVAL

(1) Remove air cleaner assembly.

(2) Raise vehicle on hoist and drain engine oil.

(3) Loosen the engine mount thru bolts.

(4) Disconnect exhaust pipe at manifold.

(5) Remove structural collar, if equipped.

(6) Remove front axle mounting bolts, and lower axle as far possible, if equipped.

(7) Position Special Tool 8534 on fender lip and align the slots in the brackets with the fender mounting holes.

(8) Secure brackets to the fender using four M6 X 1.0 X 25 MM flanged cap screws.

(9) Tighten the thumbscrews to secure the sleeves to the support tube.

(10) Secure the support tube in an upright position.

(11) Assemble the flat washer, thrust bearing, hook and T handle.

(12) Using the M10 X 1.5 X 40 mm capscrew supplied with the support fixture, secure the chain to the front cover and the hook.

(13) Support engine as needed.

(14) Remove oil pan attaching bolts.

(15) Remove oil pan.

(16) Clean oil pan and all gasket surfaces.

INSTALLATION

(1) Install the oil pan gasket to the block.

OIL PAN (Continued)

(2) Apply a 3MM (1/8 inch) bead of Mopar® Engine RTV at the oil pump to engine block parting line (Fig. 84).

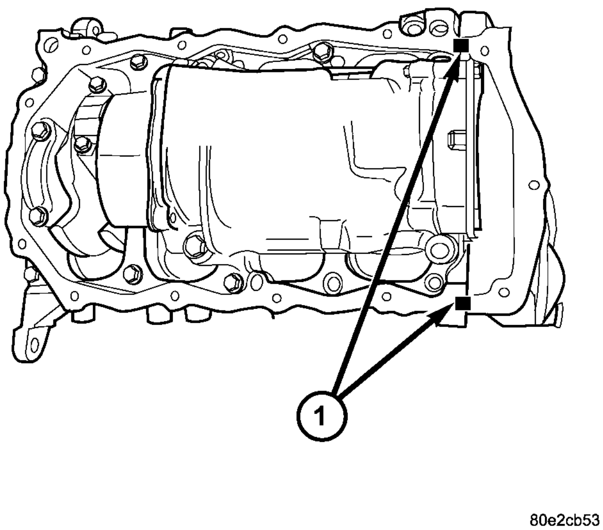


Fig. 84 OIL PAN GASKET INSTALLATION

1 - SEALER LOCATION

(3) Install pan and tighten the screws to 12 N·m (105 in. lbs.).

(4) Lower engine, and remove Special Tool 8534.

(5) Tighten engine mount thru bolts.

(6) Raise the front axle into position, and reinstall front axle mounting bolts. If equipped.

(7) Reconnect exhaust pipe to manifold.

(8) Install structural collar, if equipped.

(9) Lower vehicle.

(10) Fill engine crankcase with proper oil to correct level.

(11) Reinstall air cleaner assembly.

OIL PRESSURE SENSOR/ SWITCH

DESCRIPTION

The 3–wire, electrical/mechanical engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

OIL PUMP

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(3) Remove timing belt rear cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(4) Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

(5) Remove crankshaft sprocket using Special Tools 6793 and C-4685-C2 (Fig. 85).

(6) Remove crankshaft key (Fig. 86).

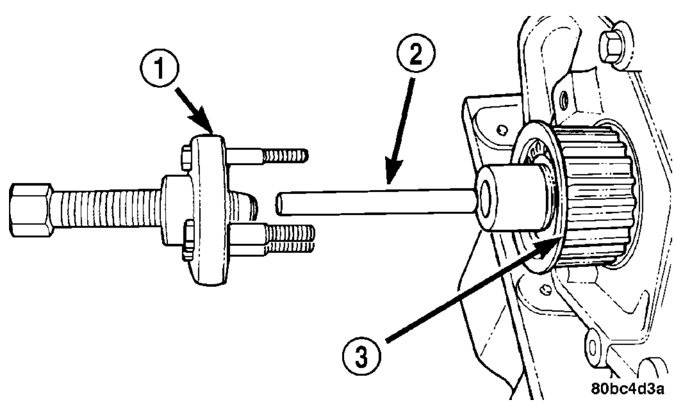


Fig. 85 Crankshaft Sprocket - Removal

1 - SPECIAL TOOL 6793
2 - SPECIAL TOOL C-4685–C2
3 - CRANKSHAFT SPROCKET

(7) Remove oil pick-up tube.

(8) Remove oil pump (Fig. 87) and front crankshaft seal.

OIL PUMP (Continued)

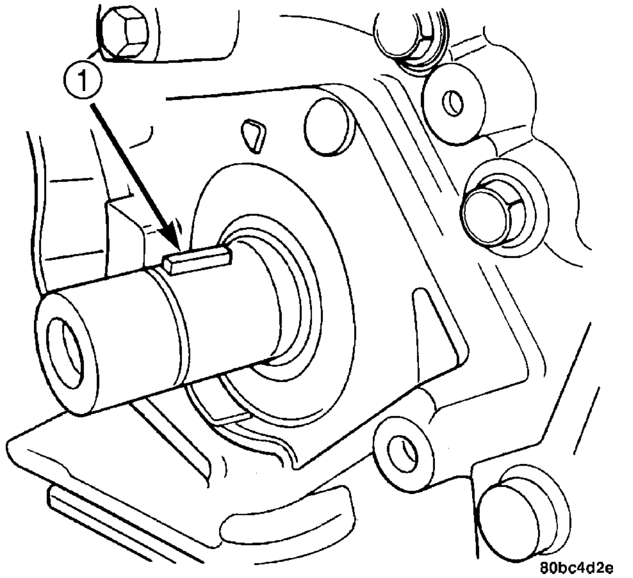


Fig. 86 Crankshaft Key

1 - CRANKSHAFT KEY

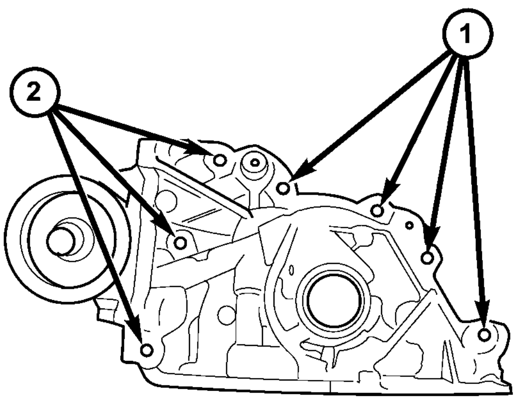


Fig. 87 2.4L OIL PUMP

1 - BOLTS
2 - BOLTS

DISASSEMBLY

(1) To remove the relief valve, proceed as follows:

(a) Remove the threaded plug and gasket from the oil pump.

(b) Remove spring and relief valve.

(2) Remove oil pump cover fasteners, and lift off cover.

(3) Remove pump rotors.

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

CLEANING

(1) Clean all parts thoroughly in a suitable solvent.

INSPECTION

(1) Inspect the mating surface of the oil pump. Surface should be smooth. Replace pump cover if scratched or grooved.

(2) Lay a straightedge across the pump cover surface (Fig. 88). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 9.40 mm (0.370 in.) or less (Fig. 89), or if the diameter is 79.95 mm (3.148 in.) or less, replace outer rotor.

(4) If inner rotor measures 9.40 mm (0.370 in.) or less replace inner rotor (Fig. 90).

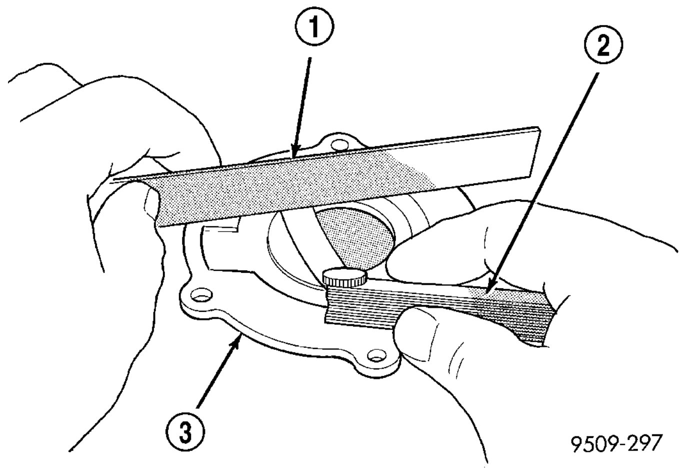


Fig. 88 Checking Oil Pump Cover Flatness

1 - STRAIGHT EDGE
2 - FEELER GAUGE
3 - OIL PUMP COVER

ASSEMBLY

(1) Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**

(2) Prime oil pump before installation by filling rotor cavity with engine oil.

(3) Install cover and tighten fasteners to 12 N·m (105 in. lbs.).

CAUTION: Oil pump pressure relief valve must be installed correctly or serious engine damage may occur.

(4) Install relief valve, spring, gasket and cap. Tighten cap to 41 N·m (30 ft. lbs.).

OIL PUMP (Continued)

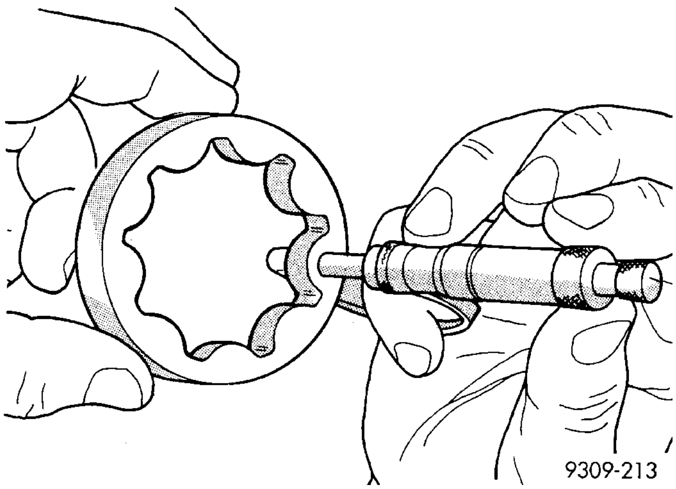


Fig. 89 Measuring Outer Rotor Thickness

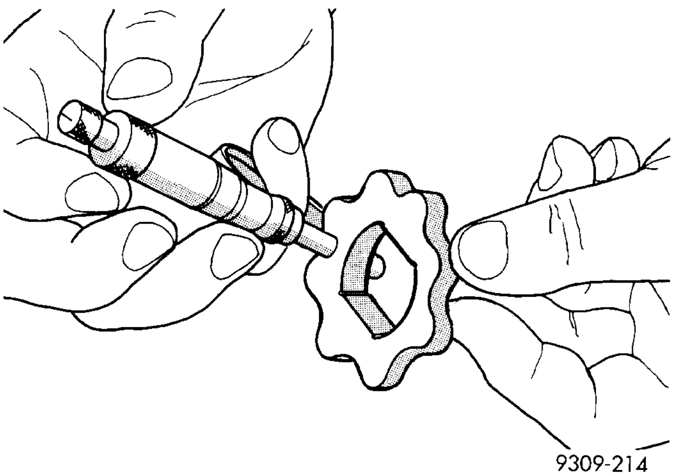


Fig. 90 Measuring Inner Rotor Thickness

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 91). Install O-ring into oil pump body discharge passage.

(3) Prime oil pump with engine oil before installation.

(4) Align oil pump rotor flats with flats on crankshaft. Install the oil pump to the block.

CAUTION: To align, the front crankshaft seal MUST be out of pump, or damage may result.

(5) Install new front crankshaft seal using Special Tool 6780 (Fig. 92).

(6) Install crankshaft key (Fig. 86).

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

(7) Install crankshaft sprocket using Special Tool 6792 (Fig. 93).

(8) Install oil pump pick-up tube.

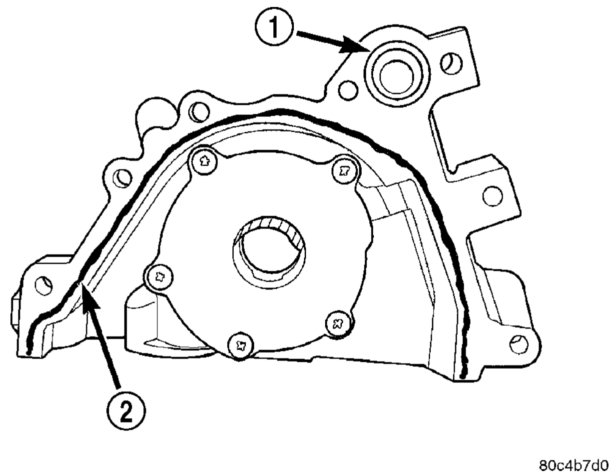


Fig. 91 Oil Pump Sealing - Typical

1 - O-RING
2 - SEALER LOCATION

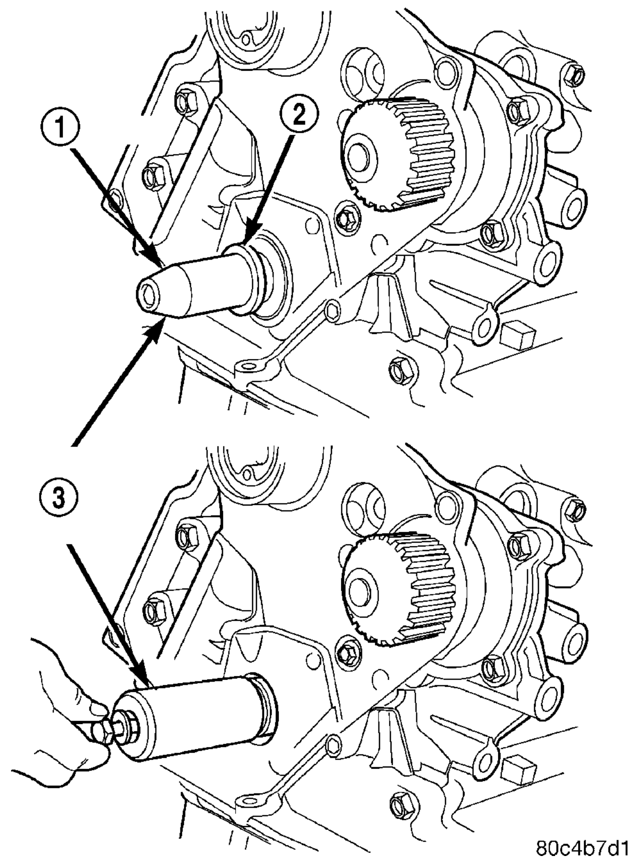


Fig. 92 Front Crankshaft Seal - Installation

1 - PROTECTOR
2 - SEAL
3 - SPECIAL TOOL 6780

OIL PUMP (Continued)

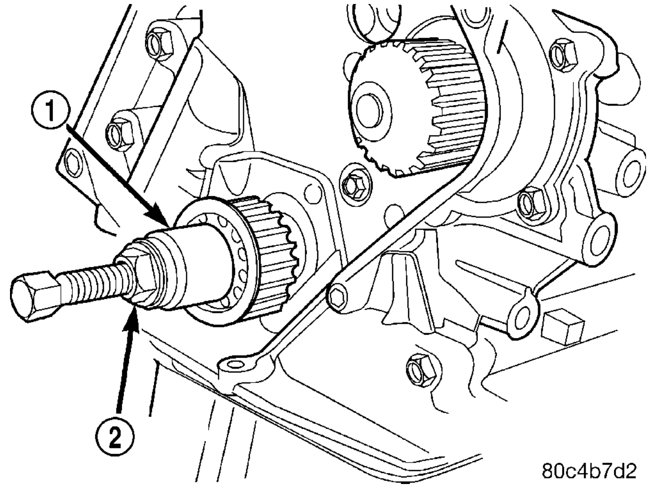


Fig. 93 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

(9) Install oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION)

(10) Install timing belt rear cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(11) Install timing belt. (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

INTAKE MANIFOLD

DESCRIPTION

The intake manifold is a one piece composite module that attaches to the cylinder head with fasteners. The manifold is a long branch design to enhance low and mid-range torque

OPERATION

The intake manifold delivers air to the combustion chambers. This air allows the fuel delivered by the fuel injectors to ignite when the spark plug fire.

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water (Spray Bottle) at the suspected leak area.

(3) If engine RPM'S change, the area of the suspected leak has been found.

(4) Repair as required.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect connector from inlet air temperature sensor.

(3) Disconnect air intake tube at throttle body and remove upper air cleaner housing.

(4) Disconnect connector from throttle position sensor (TPS).

(5) Disconnect connector from idle air control (IAC) motor.

(6) Disconnect connector from MAP sensor.

(7) Remove vacuum lines for purge solenoid and PCV valve at intake manifold.

(8) Remove vacuum lines for power brake booster, LDP, EGR transducer, and speed control vacuum reservoir (if equipped) at intake manifold fittings.

(9) Disconnect throttle, speed control (if equipped), and transaxle control (if equipped) and cables from throttle lever and bracket. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/THROTTLE CONTROL CABLE - REMOVAL)

(10) Perform fuel system pressure release procedure **before attempting any repairs.** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)

(11) Disconnect fuel line. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

(12) Disconnect coolant temperature sensor/fuel injector wire harness connector.

(13) Disconnect fuel injector harness.

(14) Remove intake manifold to cylinder head fasteners.

(15) Remove the manifold from engine.

CAUTION: Cover intake manifold openings to prevent foreign material from entering engine.

(16) Inspect the manifold. (Refer to 9 - ENGINE/ MANIFOLDS/INTAKE MANIFOLD - INSPECTION)

INSPECTION

(1) Check manifold surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(2) Inspect manifold for cracks or distortion. Replace manifold if necessary.

INTAKE MANIFOLD (Continued)

INSTALLATION

(1) Clean manifold sealing surfaces.

(2) Install new manifold to cylinder head seals.

(3) Install manifold to head.

(4) Install and tighten intake manifold fasteners to 28 N·m (250 in. lbs.) in the sequence shown (Fig. 94). Repeat procedure until all bolts are at specified torque.

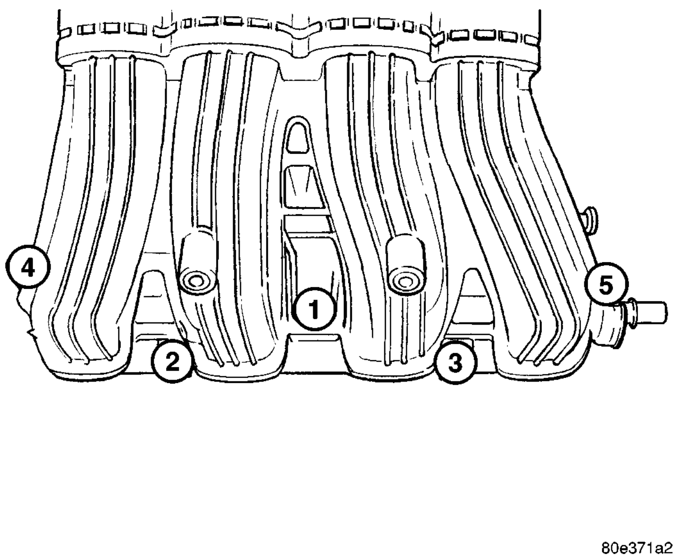


Fig. 94 LOWER INTAKE MANIFOLD TIGHTENING SEQUENCE

(5) Install throttle cables in bracket.

(6) Connect throttle, speed control, (if equipped), cables to throttle lever.

(7) Connect vacuum lines for power brake booster, LDP, EGR transducer, and speed control vacuum reservoir (if equipped) at upper intake manifold fittings.

(8) Connect vacuum lines for purge solenoid and PCV valve.

(9) Connect electrical connectors for MAP sensor, throttle position sensor (TPS), and idle air control (IAC) motor.

(10) Connect the fuel line. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

(11) Connect coolant temperature sensor/fuel injector wiring harness electrical connector.

(12) Install the air cleaner housing and air intake tube to throttle body.

(13) Connect inlet air temperature sensor connector.

(14) Connect negative cable to battery.

EXHAUST MANIFOLD

DESCRIPTION

The exhaust manifold is made of Hi-Silicone Moly nodular cast iron for strength and high temperatures. The manifold attaches to the cylinder head.

OPERATION

The exhaust manifold collects the exhaust gasses exiting the combustion chambers. Then it channels the exhaust gasses to the exhaust pipe attached to the manifold.

REMOVAL

(1) Raise vehicle and disconnect exhaust pipe from the exhaust manifold.

(2) Lower the vehicle.

(3) Disconnect upstream oxygen sensor connector at the rear of exhaust manifold.

(4) Remove the air cleaner bracket (Fig. 95).

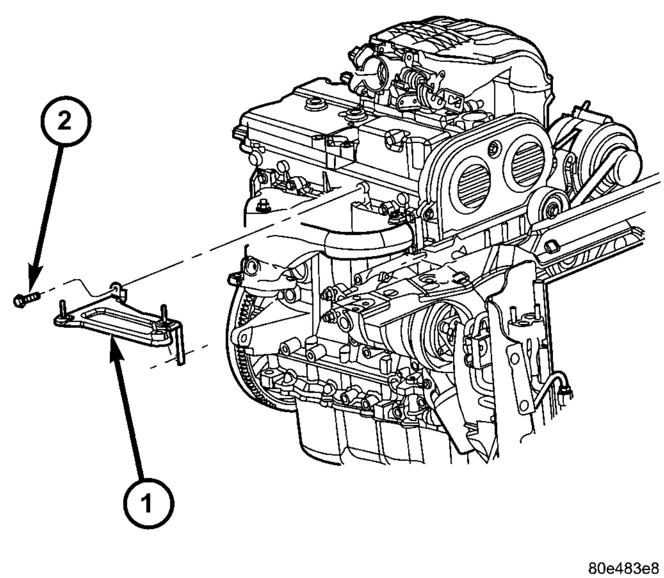


Fig. 95 AIR CLEANER BRACKET

1 - AIR CLEANER BRACKET
2 - BOLT (2)

(5) Remove the heat shield.

(6) Remove the bolts attaching the manifold to the cylinder head.

(7) Remove exhaust manifold.

(8) Inspect the manifold. (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - INSPECTION)

EXHAUST MANIFOLD (Continued)

CLEANING

(1) Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

INSPECTION

(1) Inspect manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

(2) Inspect manifolds for cracks or distortion. Replace manifold as necessary.

INSTALLATION

(1) Clean the manifold mating surfaces.

(2) Install exhaust manifold with a new gasket. Tighten attaching nuts to 20 N·m (175 in. lbs.).

(3) Attach exhaust pipe to exhaust manifold and tighten fasteners to 37 N·m (27 ft. lbs.).

(4) Install and connect the oxygen sensor. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/O2 SENSOR - COMPONENT LOCATION)

(5) Install the heat shield.

(6) Install the air cleaner bracket.

TIMING BELT COVER(S)

REMOVAL

FRONT COVER

(1) Remove crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)

(2) Remove generator drive belt tensioner assembly. (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)

(3) Remove timing belt front cover bolts, and remove covers.

REAR COVER

(1) Remove front covers.

(2) Remove timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(3) Hold camshaft sprocket with Special Tool 6847 while removing center bolt.

(4) Remove timing belt idler pulley.

(5) Remove rear cover fasteners and remove cover from engine.

INSTALLATION

REAR COVER

(1) Install timing belt rear cover and bolts (Fig. 96). Torque bolts to 12 N·m (105 in. lbs).

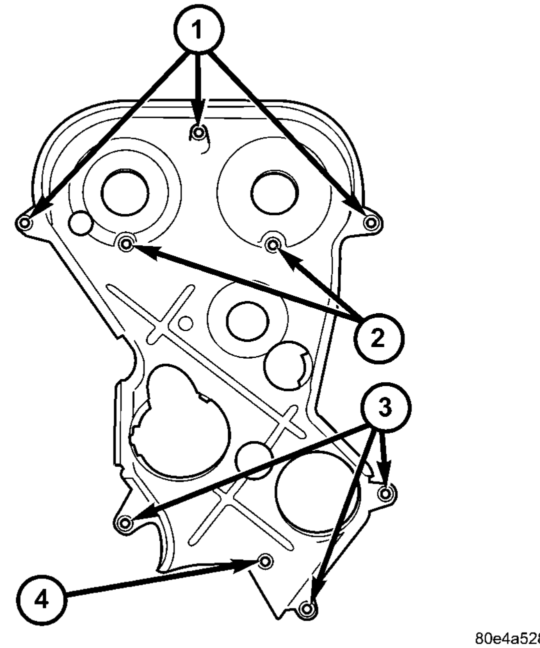


Fig. 96 TIMING BELT REAR COVER FASTENERS

1 - OUTER COVER TO REAR COVER FASTENERS (3)
2 - REAR COVER TO CYLINDER HEAD FASTENERS
3 - OUTER COVER TO REAR COVER FASTENERS (3)
4 - INNER COVER TO BLOCK FASTENERS

CAUTION: Do not use an impact wrench for tightening camshaft sprocket bolt. Damage to the timing locating pin can occur. Hand tighten using a wrench ONLY.

(2) Install camshaft sprockets, and camshaft target ring. Hold sprockets with Special Tool 6848 and tighten center bolt to 101 N·m (75 ft. lbs.).

(3) Install timing belt idler pulley and tighten mounting bolt to 61 N·m (45 ft. lbs.).

(4) Install timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(5) Install accessory drive bracket (Fig. 97).

(6) Install front covers.

FRONT COVER

(1) Install timing belt front covers (Fig. 98). Tighten fasteners to 7 N·m (60 in. lbs.).

(2) Install generator drive belt tensioner. (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - INSTALLATION)

(3) Install crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

TIMING BELT COVER(S) (Continued)

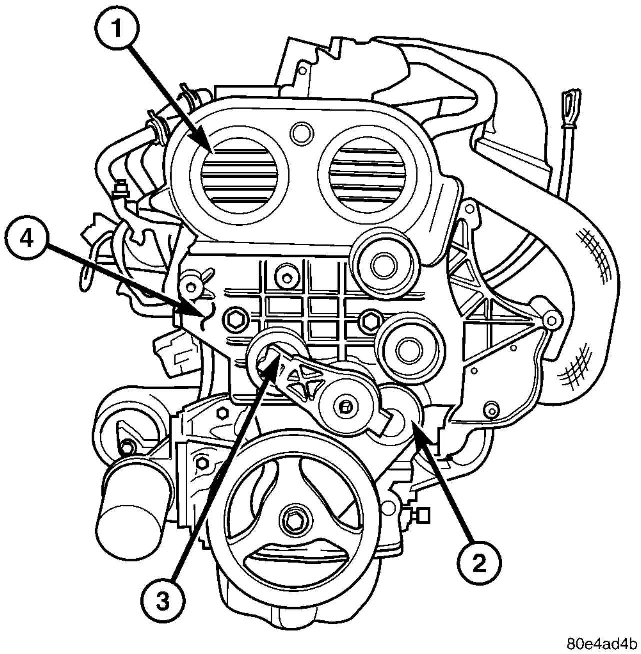


Fig. 97 ACCESSORY DRIVE BRACKET

1- UPPER TIMING BELT COVER
2- LOWER TIMING BELT COVER
3- BELT TENSIONER
4- ACCESSORY DRIVE BRACKET

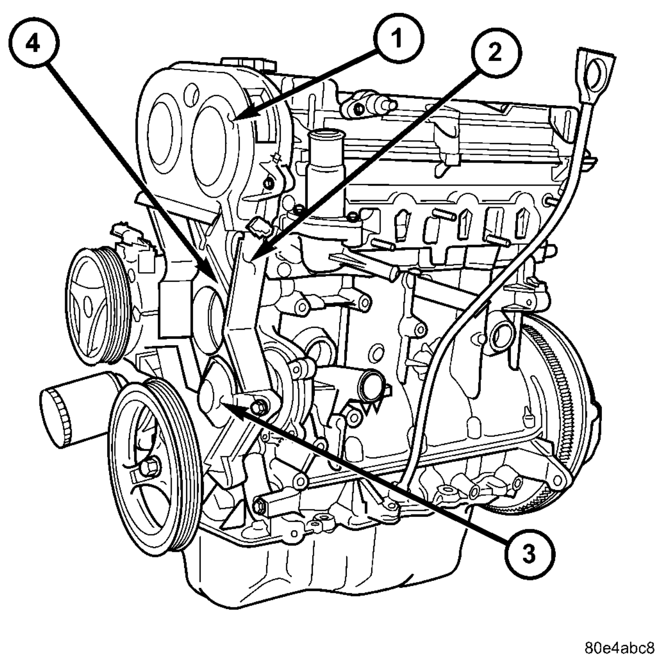


Fig. 98 TIMING BELT COVERS

1- UPPER TIMING BELT COVER
2- REAR TIMING BELT COVER
3- LOWER TIMING BELT COVER
4- ACCESSORY DRIVE BRACKET NOT SHOWN

TIMING BELT AND SPROCKET(S)

REMOVAL

REMOVAL - TIMING BELT

(1) Remove air cleaner upper cover, housing, and clean air tube.

(2) Raise vehicle on hoist.

(3) Remove accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)

(4) Remove crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)

(5) Remove air conditioner/generator belt tensioner and pulley assembly. (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - REMOVAL)

(6) Remove timing belt lower front cover bolts and remove cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

(7) Lower vehicle.

(8) Remove bolts attaching timing belt upper front cover and remove cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)

CAUTION: When aligning crankshaft and camshaft timing marks always rotate engine from crankshaft. Camshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

(9) Before the removal of the timing belt, rotate crankshaft until the TDC mark on oil pump housing aligns with the TDC mark on crankshaft sprocket (trailing edge of sprocket tooth) (Fig. 99).

NOTE: The crankshaft sprocket TDC mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to TDC mark on oil pump housing will cause the camshaft timing marks to be misaligned.

(10) Install 6 mm Allen wrench into belt tensioner. Before rotating the tensioner, insert the long end of a 1/8” or 3 mm Allen wrench into the pin hole on the front of the tensioner (Fig. 100). While rotating the tensioner counterclockwise, push in lightly on the 1/8” or 3 mm Allen wrench, until it slides into the locking hole.

(11) Remove timing belt.

TIMING BELT AND SPROCKET(S) (Continued)

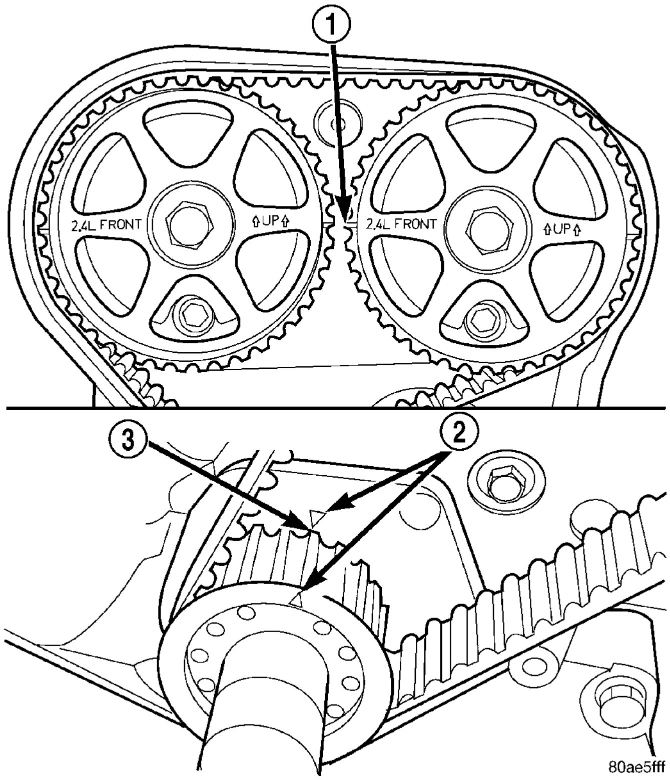


Fig. 99 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

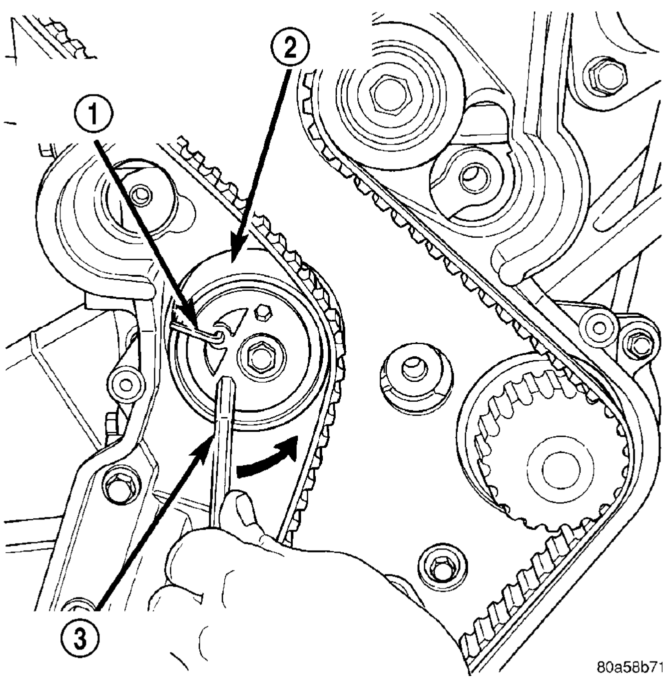


Fig. 100 Locking Timing Tensioner

1 - 1/8 OR 3mm ALLEN WRENCH
2 - BELT TENSIONER
3 - 6mm ALLEN WRENCH

REMOVAL - CRANKSHAFT SPROCKET

(1) Disconnect negative battery cable.

(2) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(3) Remove crankshaft sprocket using Special Tools 6793 and insert C-4685-C2 (Fig. 101).

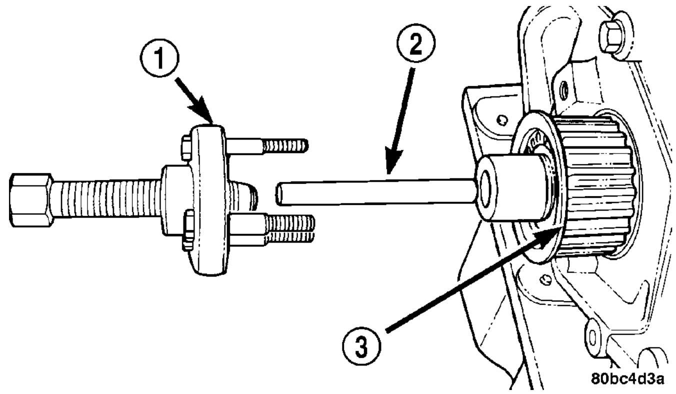


Fig. 101 Crankshaft Sprocket - Removal

1 - SPECIAL TOOL 6793
2 - SPECIAL TOOL C-4685–C2
3 - CRANKSHAFT SPROCKET

CLEANING

Do Not attempt to clean a timing belt. If contamination from oil, grease, or coolants have occurred, the timing belt should be replaced.

Clean all sprockets using a suitable solvent. Clean all sprocket grooves of any debris.

INSTALLATION

INSTALLATION - CRANKSHAFT SPROCKET

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

(1) Install crankshaft sprocket using Special Tool 6792 (Fig. 102).

(2) Install timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

TIMING BELT AND SPROCKET(S) (Continued)

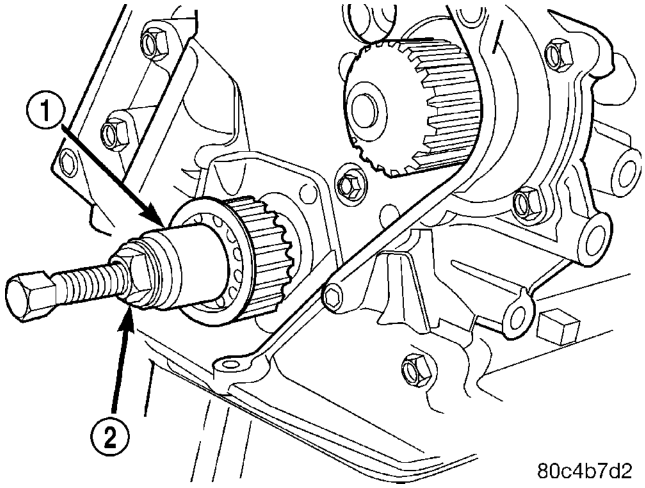


Fig. 102 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

INSTALLATION - TIMING BELT

CAUTION: The crankshaft sprocket is set to a pre-determined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing.

(2) Set camshafts timing marks so that the exhaust camshaft sprocket is a 1/2 notch below the intake camshaft sprocket (Fig. 103).

CAUTION: Ensure that the arrows on both camshaft sprockets are facing up.

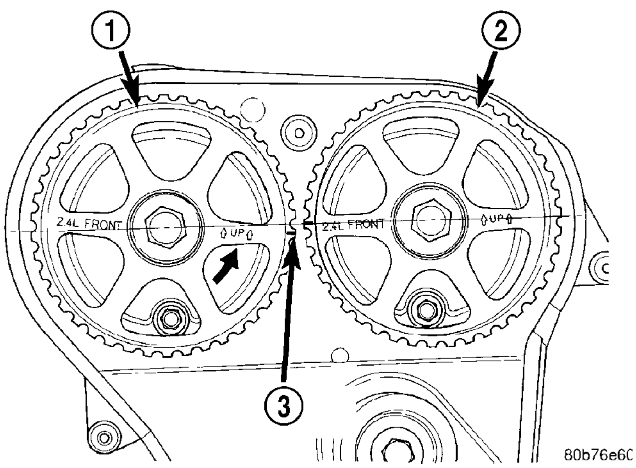


Fig. 103 Camshaft Sprocket Alignment

1 - CAMSHAFT SPROCKET-EXHAUST
2 - CAMSHAFT SPROCKET-INTAKE
3 - 1/2 NOTCH LOCATION

(3) Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner (Fig. 104).

(4) Move the exhaust camshaft sprocket counter-clockwise (Fig. 104) to align marks and take up belt slack.

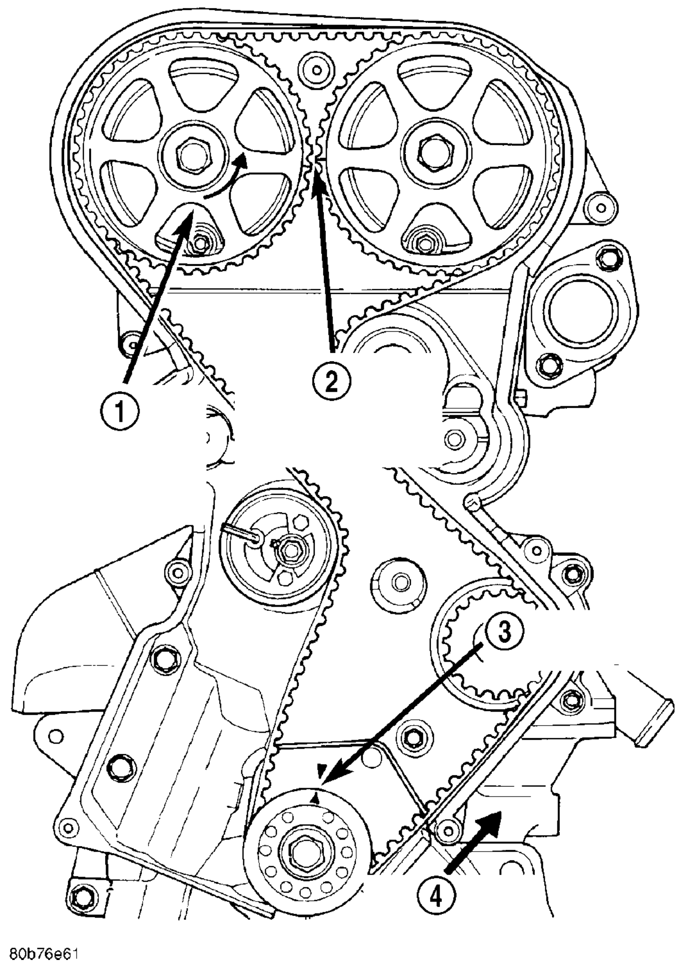


Fig. 104 Timing Belt - Installation - Typical

1 - ROTATE CAMSHAFT SPROCKET TO TAKE UP BELT SLACK
2 - CAMSHAFT TIMING MARKS 1/2 NOTCH LOCATION
3 - CRANKSHAFT AT TDC
4 - INSTALL BELT IN THIS DIRECTION

(5) Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley. Rotate the top plate **COUNTERCLOCKWISE**. The tensioner pulley will move against the belt and the tensioner setting notch will eventually start to move clockwise. Watching the movement of the setting notch, continue rotating the top plate counterclockwise until the setting notch is aligned with the spring tang (Fig. 105). Using the allen wrench to prevent the top plate from moving, torque the tensioner lock nut to 30 N·m (22 ft. lbs.). Setting notch and spring tang should remain aligned after lock nut is torqued.

TIMING BELT AND SPROCKET(S) (Continued)

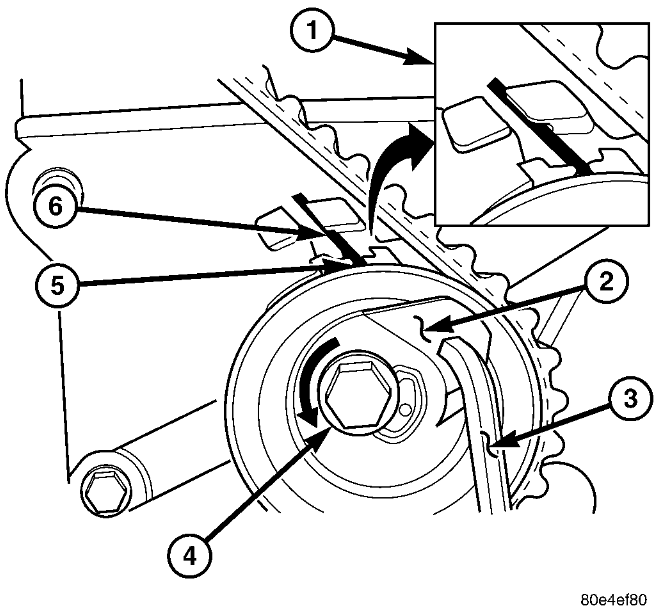


Fig. 105 Timing Belt Tension Adjustment

1 - ALIGN SETTING NOTCH WITH SPRING TANG
2 - TOP PLATE
3 - 6mm ALLEN WRENCH
4 - LOCK NUT
5 - SETTING NOTCH
6 - SPRING TANG

(6) Remove allen wrench and torque wrench.

NOTE: Repositioning the crankshaft to the TDC position must be done only during the CLOCKWISE rotation movement. If TDC is missed, rotate a further two revolutions until TDC is achieved. DO NOT rotate crankshaft counterclockwise as this will make verification of proper tensioner setting impossible.

(7) Once the timing belt has been installed and tensioner adjusted, rotate the crankshaft CLOCKWISE two complete revolutions manually for seating of the belt, until the crankshaft is repositioned at the TDC position. Verify that the camshaft and crankshaft timing marks are in proper position (Fig. 106).

(8) Check if the spring tang is within the tolerance window (Fig. 107). If the spring tang is within the tolerance window, the installation process is complete and nothing further is required. If the spring tang is not within the tolerance window, repeat Steps 5 through 7.

(9) Install timing belt front covers and bolts. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(10) Install air conditioning/generator belt tensioner and pulley. (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - INSTALLATION)

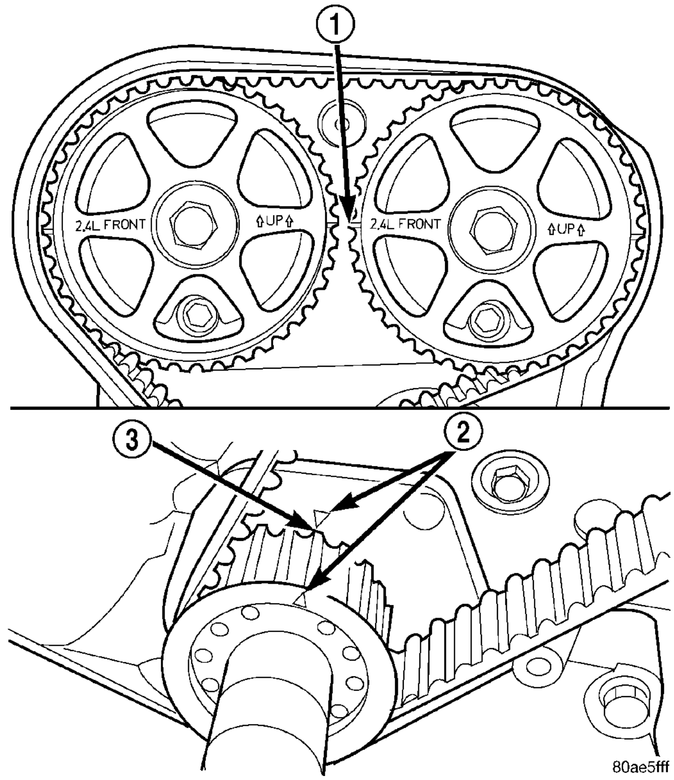


Fig. 106 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

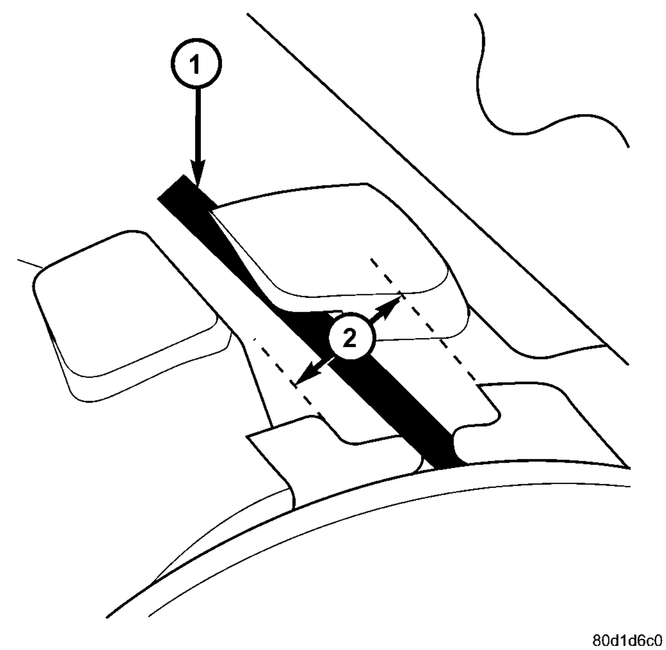


Fig. 107 Timing Belt Tension Verification

1 - SPRING TANG
2 - TOLERANCE WINDOW

TIMING BELT AND SPROCKET(S) (Continued)

(11) Install crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

(12) Install accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

(13) Install drive belt splash shield.

(14) Install air cleaner housing, upper cover, and clean air tube.

TIMING BELT TENSIONER & PULLEY

REMOVAL

(1) Remove the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(2) Remove timing belt idler pulley.

(3) Hold camshaft sprocket with Special Tool 6847 while removing bolt (Fig. 108). Remove both cam sprockets.

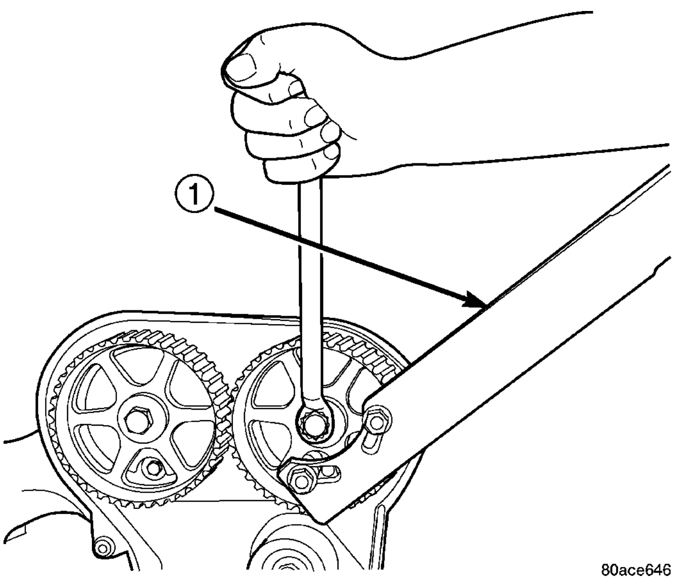


Fig. 108 Camshaft Sprocket - Removal/Installation

1 - SPECIAL TOOL 6847

(4) Remove rear timing belt cover fasteners and remove cover from engine (Fig. 109).

(5) Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner **as an assembly**.

INSTALLATION

(1) Align timing belt tensioner assembly to engine and install lower mounting bolt **but do not tighten**. To properly align tensioner assembly—install one of the engine bracket mounting bolts (M10) 5 to 7 turns into the tensioner's upper mounting location.

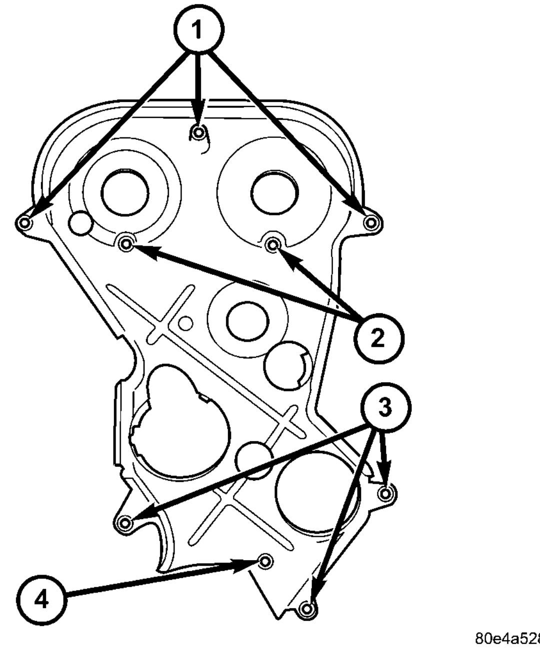


Fig. 109 TIMING BELT REAR COVER FASTENERS

1 - OUTER COVER TO REAR COVER FASTENERS (3)
2 - REAR COVER TO CYLINDER HEAD FASTENERS
3 - OUTER COVER TO REAR COVER FASTENERS (3)
4 - INNER COVER TO BLOCK FASTENERS

(2) Torque the tensioner's lower mounting bolt to 61 N·m (45 ft. lbs.). Remove the upper bolt used for tensioner alignment.

(3) Install rear timing belt cover and fasteners.

(4) Install timing belt idler pulley and torque mounting bolt to 61 N·m (45 ft. lbs.).

(5) Install camshaft sprockets. Use Special Tool 6847 to hold sprockets, torque bolts to 101 N·m (75 ft. lbs.).

(6) Install the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

BALANCE SHAFTS AND CARRIER ASSEMBLY

DESCRIPTION

The 2.4L engine is equipped with two nodular cast iron balance shafts installed in a cast aluminum carrier attached to the lower cylinder block (Fig. 110).

OPERATION

The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

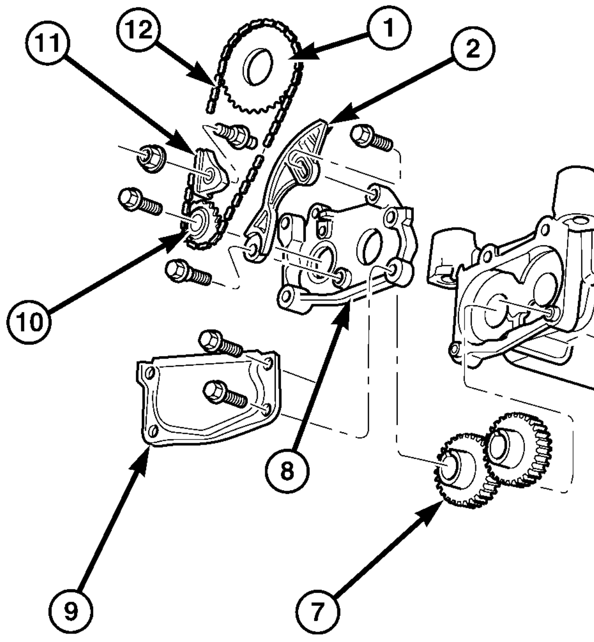


Fig. 110 Balance Shafts and Carrier Assembly

1 - SPROCKET	7 - GEARS
2 - TENSIONER	8 - GEAR COVER
3 - PLUG	9 - CHAIN COVER
4 - CARRIER	10 - SPROCKET
5 - REAR COVER	11 - GUIDE
6 - BALANCE SHAFTS	12 - CHAIN

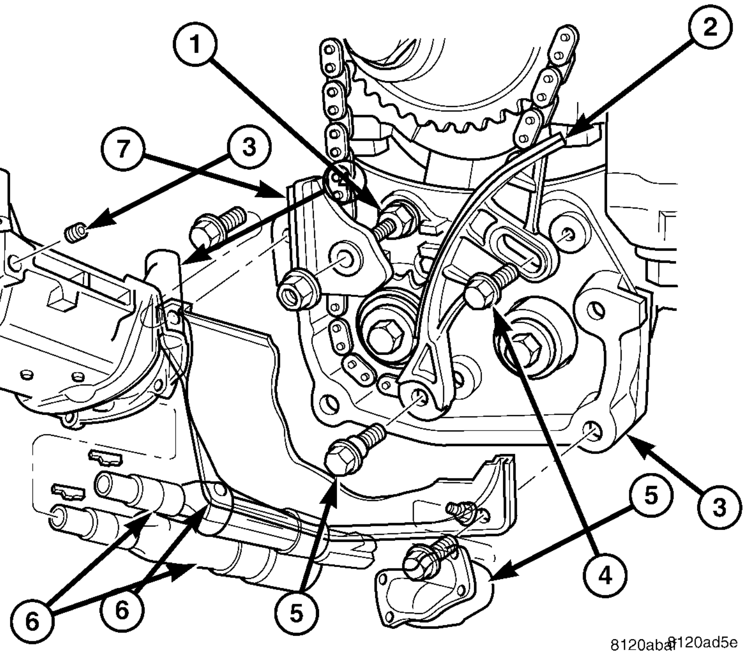


Fig. 111 Chain Cover, Guide and Tensioner

1 - STUD
2 - TENSIONER (ADJUSTER)
3 - GEAR COVER
4 - ADJUSTER SCREW
5 - SHOULDERED PIVOT SCREW
6 - CHAIN COVER (CUTAWAY)
7 - GUIDE

REMOVAL

BALANCE SHAFTS/CHAIN/SPROCKETS

NOTE: For service procedures requiring only temporary relocation of carrier assembly refer to BALANCE SHAFT CARRIER procedure below.

(1) Drain engine oil.

(2) Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) If replacing crankshaft sprocket, remove oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(4) Remove chain cover, guide and tensioner. Discard pivot screw and adjuster screw. (Fig. 111).

(5) Remove screw retaining balance shaft drive sprocket (Fig. 112). Remove chain and sprocket.

(6) Using two wide pry bars, work the crankshaft sprocket back and forth until it is off the crankshaftshaft.

(7) Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears (Fig. 113).

(8) Remove rear cover and balance shafts (Fig. 114).

(9) Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

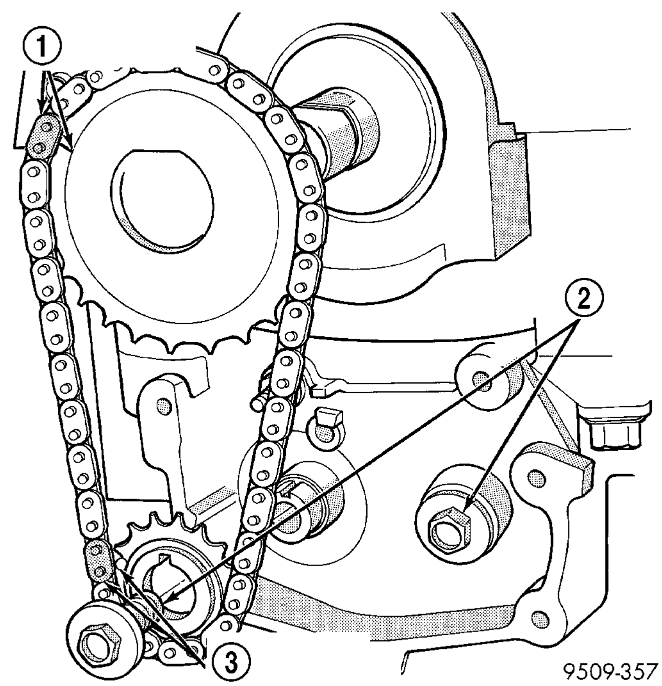


Fig. 112 Drive Chain and Sprockets

1 - NICKEL PLATED LINK AND MARK
2 - GEAR/SPROCKET SCREWS
3 - NICKEL PLATED LINK AND DOT

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

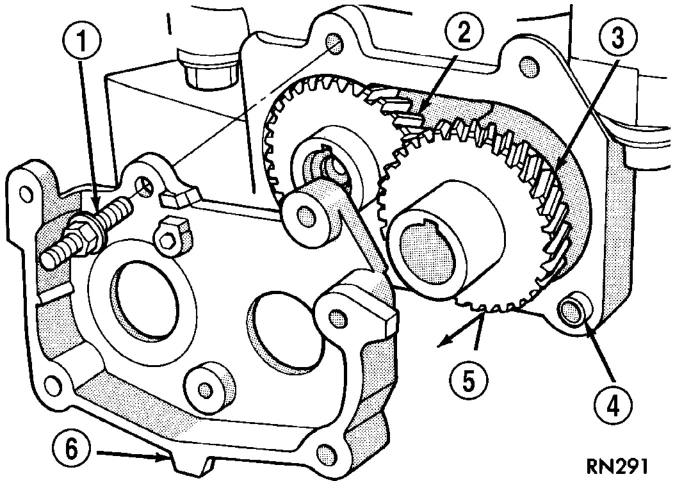


Fig. 113 Gear Cover and Gears

1 - STUD (DOUBLE ENDED)
2 - DRIVE GEAR
3 - DRIVEN GEAR
4 - CARRIER DOWEL
5 - GEAR(S)
6 - GEAR COVER

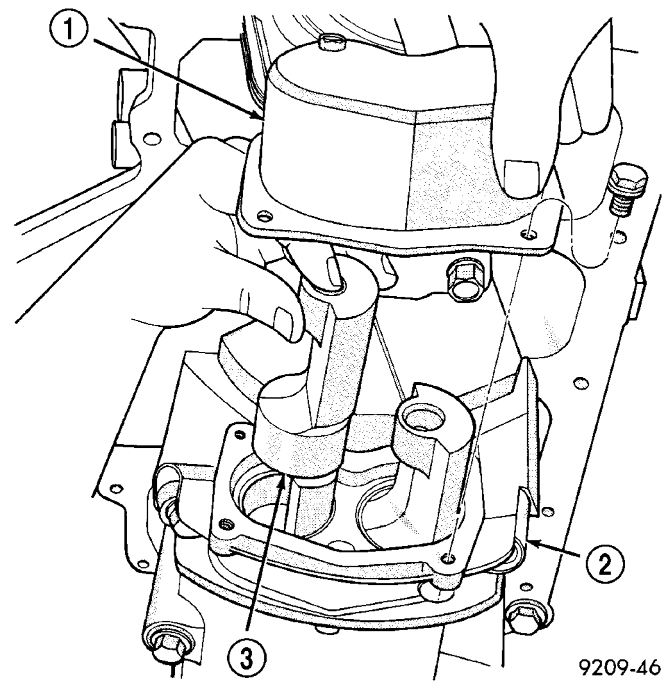


Fig. 114 Balance Shaft(s)—Removal/Installation

1 - REAR COVER
2 - CARRIER
3 - BALANCE SHAFT

BALANCE SHAFT CARRIER

The following components will remain intact during carrier removal: Gear cover, gears, balance shafts and the rear cover (Fig. 110).

(1) Drain engine oil.

(2) Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(3) Remove chain cover, guide and tensioner (Fig. 111).

(4) Remove screw retaining balance shaft drive sprocket (Fig. 112).

(5) Move balance shaft inboard through drive chain sprocket. Sprocket will hang in lower chain loop.

(6) Remove carrier to crankcase attaching bolts to remove carrier.

INSTALLATION

BALANCE SHAFT INSTALLATION/TIMING

Balance shaft and carrier assembly installation is the reverse of the removal procedure. **During installation crankshaft-to-balance shaft timing must be established. Refer to Timing procedure in this section.**

(1) With balance shafts installed in carrier (Fig. 110) position carrier on crankcase and install four attaching bolts and tighten to 54 N·m (40 ft. lbs.).

(2) Turn balance shafts until both shaft key ways are up, parallel to vertical centerline of engine. Install short hub drive gear on sprocket driven shaft and long hub gear on gear driven shaft. After installation gear and balance shaft keyways must be up with gear timing marks meshed as shown in (Fig. 115).

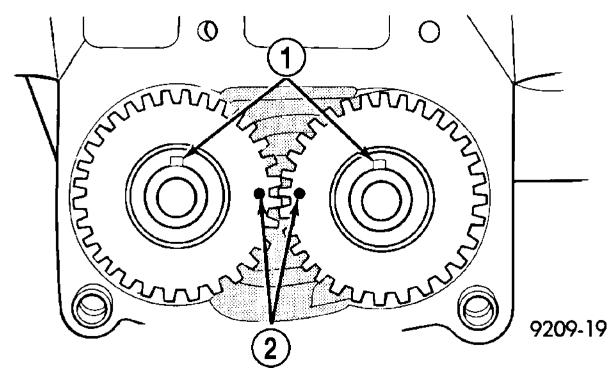


Fig. 115 Gear Timing

1 - KEY WAYS UP
2 - GEAR ALIGNMENT DOTS

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

(3) Install gear cover and tighten double ended stud/washer fastener to 12 N·m (105 in. lbs.).

(4) Align flat on balance shaft drive sprocket to the flat on crankshaft (Fig. 116).

(5) Install balance shaft drive sprocket on crankshaft using Special Tool 6052 (Fig. 117).

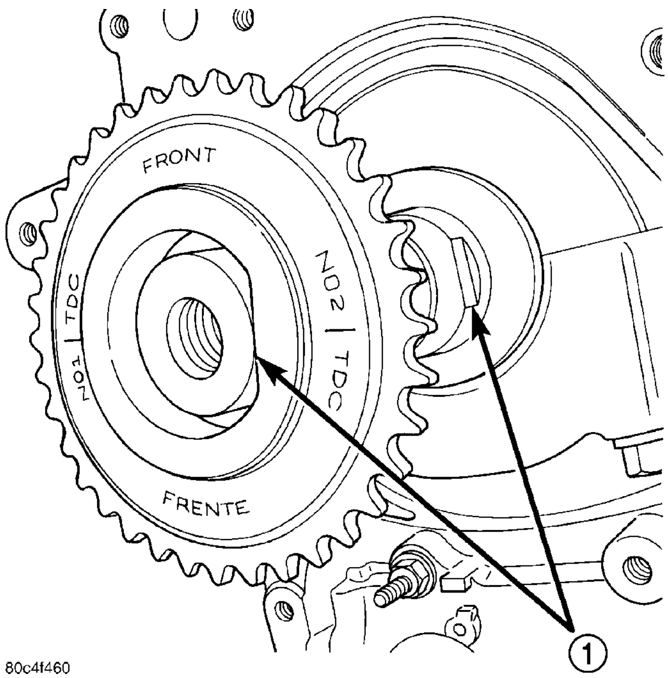


Fig. 116 Balance Shaft Sprocket Alignment to Crankshaft

1 - ALIGN FLATS

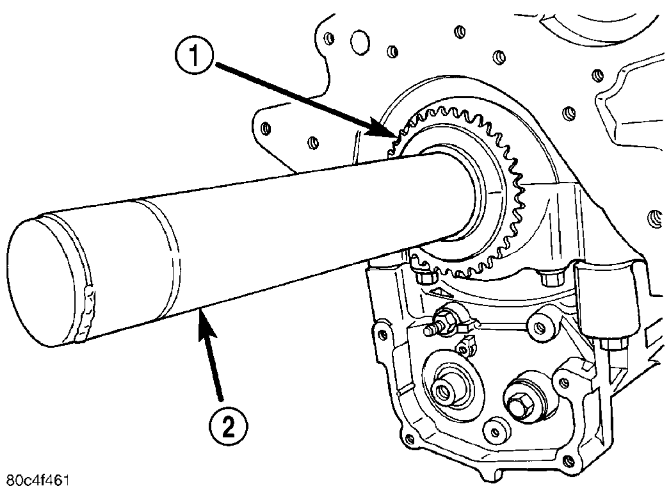


Fig. 117 Balance Shaft Drive Sprocket - Installation

1 - SPROCKET
2 - SPECIAL TOOL 6052

(6) Turn crankshaft until number 1 cylinder is at top dead center (TDC). The timing marks on the chain sprocket should line up with the parting line on the left side of number one main bearing cap. (Fig. 118).

(7) Place chain over crankshaft sprocket so that the plated link of the chain is over the number 1 cylinder timing mark on the balance shaft crankshaft sprocket (Fig. 118).

(8) Place balance shaft sprocket into the timing chain (Fig. 118) and align the timing mark on the sprocket (dot) with the (lower) plated link on the chain.

NOTE: The lower plated link is 8 links from the upper link.

(9) With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance.

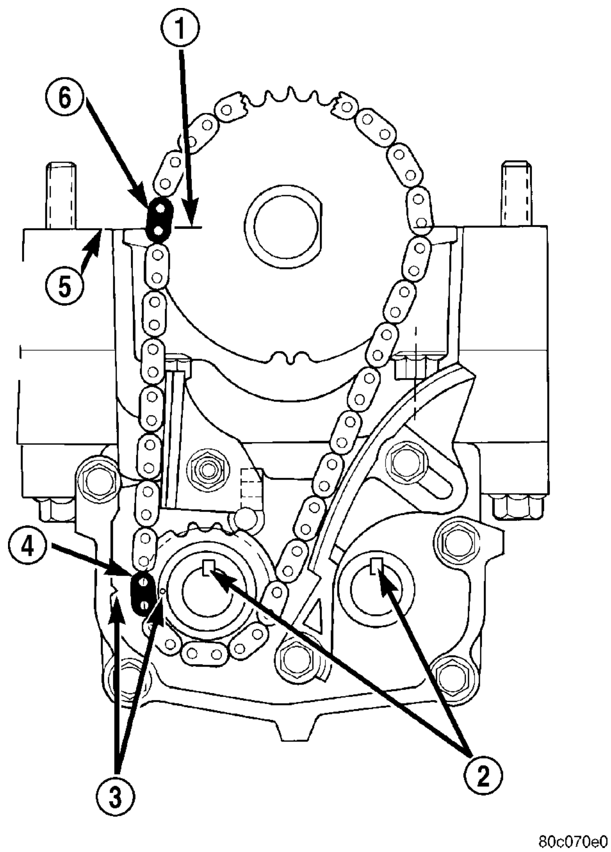


Fig. 118 Balance Shaft Timing

1 - MARK ON SPROCKET
2 - KEYWAYS UP
3 - ALIGN MARKS
4 - PLATED LINK
5 - PARTING LINE (BEDPLATE TO BLOCK)
6 - PLATED LINK

NOTE: THE TIMING MARK ON THE SPROCKET, THE (LOWER) NICKEL PLATED LINK, AND THE ARROW ON THE SIDE OF THE GEAR COVER SHOULD LINE UP WHEN THE BALANCE SHAFTS ARE TIMED CORRECTLY.

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

(10) If the sprockets are timed correctly, install the balance shaft bolts and tighten to 28 N·m (250 in. lbs.). A wood block placed between crankcase and crankshaft counterbalance will prevent crankshaft and gear rotation.

(11) **CHAIN TENSIONING:**

(a) Install chain tensioner loosely assembled with **new** adjuster screw and shouldered pivot screw.

(b) Position guide on double ended stud making sure tab on the guide fits into slot on the gear cover. Install and tighten nut/washer assembly to 12 N·m (105 in. lbs.).

(c) Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long between tensioner and chain. Push tensioner and shim up against the chain. **Apply firm pressure 2.5–3 Kg (5.5–6.6 lbs.) directly behind the adjustment slot to take up all slack.** Chain must have shoe radius contact as shown in (Fig. 119).

(d) With the load applied, tighten top tensioner adjuster bolt first, then bottom shouldered pivot bolt. Tighten bolts to 12 N·m (105 in. lbs.). Remove shim.

(e) Install carrier covers and tighten screws to 12 N·m (105 in. lbs.).

(12) If removed, install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(13) Install pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(14) Fill engine crankcase with proper oil to correct level.

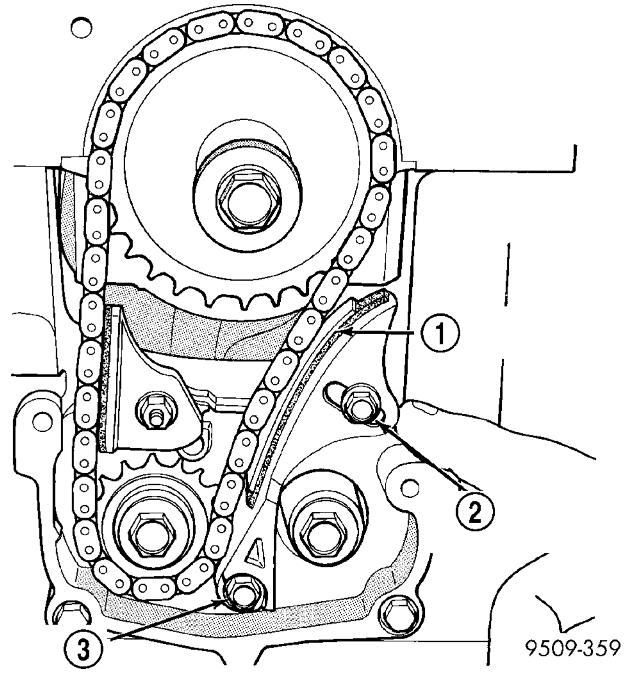


Fig. 119 Chain Tension Adjustment

1 - 1MM (0.039 IN.) SHIM
2 - TENSIONER (ADJUSTER) BOLT
3 - SHOULDERED PIVOT BOLT

REMOVAL

(Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL)

INSTALLATION

(Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION)

BALANCE SHAFT CARRIER

DESCRIPTION

The 2.4L engine is equipped with two nodular cast iron balance shafts installed in a cast aluminum carrier attached to the lower cylinder block (Fig. 120).

OPERATION

The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

BALANCE SHAFT CARRIER (Continued)

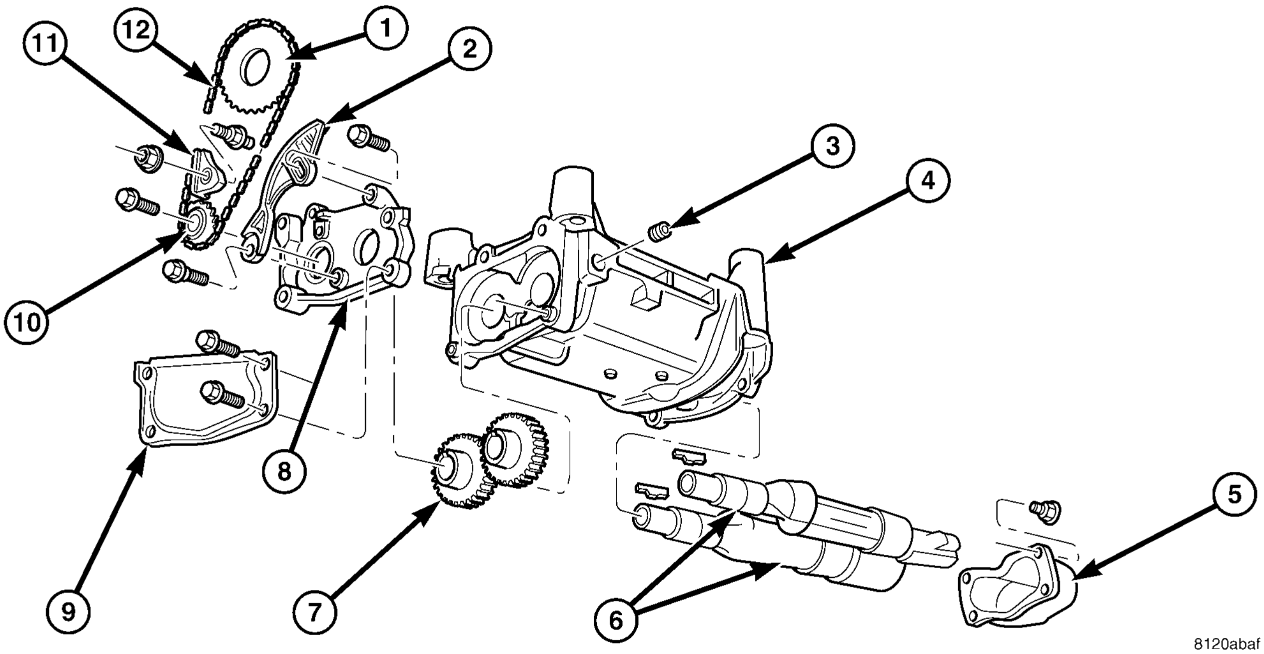


Fig. 120 Balance Shafts and Carrier Assembly

1 - SPROCKET
2 - TENSIONER
3 - PLUG
4 - CARRIER
5 - REAR COVER
6 - BALANCE SHAFTS
7 - GEARS
8 - GEAR COVER
9 - CHAIN COVER
10 - SPROCKET
11 - GUIDE
12 - CHAIN

BALANCE SHAFT CHAIN

REMOVAL

(Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL)

INSTALLATION

(Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION)

ENGINE 4.0L

TABLE OF CONTENTS

ENGINE 4.0L

DESCRIPTION

DESCRIPTION - ENGINE BLOCK

The cylinder block is a cast iron inline six cylinder design. The cylinder block is drilled forming galleries for both oil and coolant (Fig. 1).

DESCRIPTION - ENGINE

The 4.0 Liter (242 CID) six-cylinder engine is an In-line, lightweight, overhead valve engine.

This engine is designed for unleaded fuel. The engine cylinder head has dual quench-type combustion chambers that create turbulence and fast burning of the air/fuel mixture. This results in good fuel economy.

The cylinders are numbered 1 through 6 from front to rear. The firing order is 1-5-3-6-2-4 (Fig. 2).

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within seven main bearings. The camshaft rotates within four bearings.

BUILD DATE CODE

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No.2 and No.3 cylinders (Fig. 3).

The digits of the code identify:

- 1st Digit—The year (0 = 2000).
- 2nd & 3rd Digits—The month (01 - 12).
- 4th & 5th Digits—The engine type/fuel system/compression ratio (MX = A 4.0 Liter (242 CID) engine with a multi-point fuel injection system).
- 6th & 7th Digits—The day of engine build (01 - 31).

(1) **FOR EXAMPLE:** Code * 001MX12 * identifies a 4.0 Liter (242 CID) engine with a multi-point fuel injection system, and built on January 12, 2000.

ENGINE 4.0L (Continued)

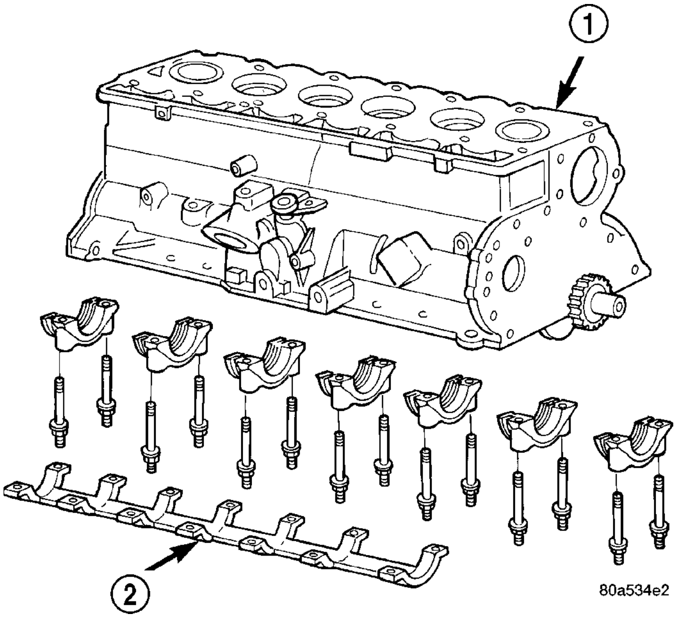


Fig. 1 4.0L Cylinder Block with Main Bearing Caps and Cap Brace

1 - BLOCK
2 - MAIN BEARING CAP BRACE

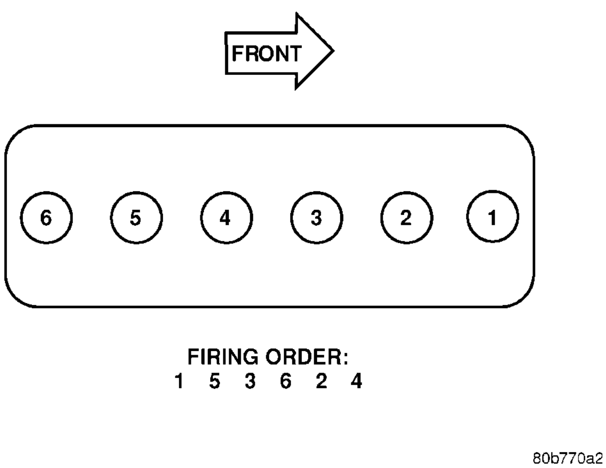


Fig. 2 Engine Firing Order

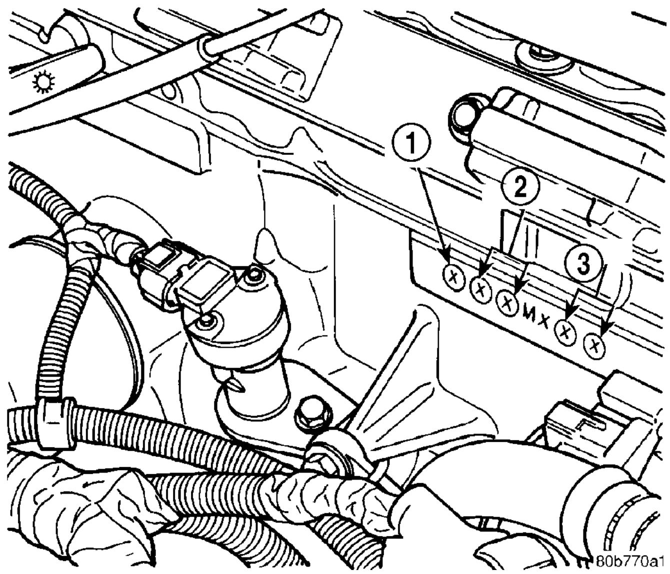


Fig. 3 Build Date Code Location

1 - YEAR
2 - MONTH
3 - DAY

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) (PERFORMANCE) or (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) (MECHANICAL) for possible causes and corrections of malfunctions.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) (PERFORMANCE)
- (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) (MECHANICAL)

ENGINE 4.0L (Continued)

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

ENGINE PERFORMANCE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or dead battery	1. Charge/Replace Battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY - STANDARD PROCEDURE), for correct procedures. Check charging system. (Refer to 8 - ELECTRICAL/ CHARGING - DIAGNOSIS AND TESTING), for correct procedures.
	2. Corroded or loose battery connections	2. Clean/tighten suspect battery/starter connections
	3. Faulty starter or related circuit(s)	3. Check starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING), for correct diagnostics/ procedures
	4. Siezed accessory drive component	4. Remove accessory drive belt and attempt to start engine. If engine starts, repair/replace siezed component.
	5. Engine internal mechanical failure or hydro-static lock	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), for correct diagnostics/ procedures
ENGINE CRANKS BUT WILL NOT START	1. No spark	1. Check for spark. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS), for correct procedures.
	2. No fuel	2. Perform fuel pressure test (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ FUEL PUMP - DIAGNOSIS AND TESTING), and if necessary, inspect fuel injector(s) and driver circuits. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - DIAGNOSIS AND TESTING), for correct procedures.
	3. Low or no engine compression	3. Perform cylinder compression pressure test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
ENGINE LOSS OF POWER	1. Worn or burned distributor rotor	1. Install new distributor rotor
	2. Worn camshaft position sensor shaft	2. Remove and repair camshaft position sensor.(Refer to 8 - ELECTRICAL/ IGNITION CONTROL/CAMSHAFT POSITION SENSOR - REMOVAL).
	3. Worn or incorrect gapped spark plugs	3. Clean plugs and set gap. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/ SPARK PLUG - CLEANING).
	4. Dirt or water in fuel system	4. Clean system and replace fuel filter
	5. Faulty fuel pump	5. Install new fuel pump

ENGINE 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Incorrect valve timing	6. Correct valve timing
	7. Blown cylinder head gasket	7. Install new cylinder head gasket
	8. Low compression	8. Test cylinder compression. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	9. Burned, warped, or pitted valves	9. Install/Reface valves as necessary
	10. Plugged or restricted exhaust system	10. Install new parts as necessary
	11. Faulty ignition coil rail	11. Test and replace, as necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL).
ENGINE STALLS OR ROUGH IDLE	1. Carbon build-up on throttle plate	1. Remove throttle body and de-carbon. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/THROTTLE BODY - REMOVAL) for correct procedure.
	2. Engine idle speed too low	2. Check Idle Air Control circuit.
	3. Worn or incorrectly gapped spark plugs	3. Replace or clean and re-gap spark plugs. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING)
	4. Faulty coil rail	4. Test and replace, if necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL)
	5. Intake manifold vacuum leak	5. Inspect intake manifold gasket and vacuum hoses. Replace if necessary. (Refer to 9 - ENGINE/MANIFOLDS/ INTAKE MANIFOLD - DIAGNOSIS AND TESTING).
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs	1. Replace spark plugs or clean and set gap.
	2. Spark plug cables defective or crossed	2. Replace spark plug cables.
	3. Dirt in fuel system	3. Clean fuel system
	4. Burned, warped or pitted valves	4. Install new valves
	5. Faulty coil rail	5. Test and replace as necessary. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL)

ENGINE 4.0L (Continued)

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

ENGINE MECHANICAL DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES/LIFTERS	1. High or low oil level in crankcase	1. Check for correct oil level. Adjust oil level by draining or adding as needed
	2. Thin or diluted oil	2. Change oil. (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE)
	3. Low oil pressure	3. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) for engine oil pressure test/ specifications
	4. Dirt in tappets/lash adjusters	4. Clean/replace hydraulic tappets/lash adjusters
	5. Bent push rod(s)	5. Install new push rods
	6. Worn rocker arms	6. Inspect oil supply to rocker arms and replace worn arms as needed
	7. Worn tappets/lash adjusters	7. Install new hydraulic tappets/lash adjusters
	8. Worn valve guides	8. Inspect all valve guides and replace as necessary
	9. Excessive runout of valve seats or valve faces	9. Grind valves and seats
CONNECTING ROD NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. (Refer to 9 - ENGINE/ LUBRICATION/OIL - STANDARD PROCEDURE) for correct procedure/engine oil specifications
	4. Excessive connecting rod bearing clearance	4. Measure bearings for correct clearance with plasti-gage. Repair as necessary
	5. Connecting rod journal out of round	5. Replace crankshaft or grind journals
	6. Misaligned connecting rods	6. Replace bent connecting rods

ENGINE 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)
	3. Thin or diluted oil	3. Change oil to correct viscosity.
	4. Excessive main bearing clearance	4. Measure bearings for correct clearance. Repair as necessary
	5. Excessive end play	5. Check crankshaft thrust bearing for excessive wear on flanges
	6. Crankshaft main journal out of round or worn	6. Grind journals or replace crankshaft
	7. Loose flywheel or torque converter	7. Inspect crankshaft, flexplate/ flywheel and bolts for damage. Tighten to correct torque
LOW OIL PRESSURE	1. Low oil level	1. Check oil level and fill if necessary
	2. Faulty oil pressure sending unit	2. Install new sending unit
	3. Clogged oil filter	3. Install new oil filter
	4. Worn oil pump	4. Replace oil pump assembly.
	5. Thin or diluted oil	5. Change oil to correct viscosity.
	6. Excessive bearing clearance	6. Measure bearings for correct clearance
	7. Oil pump relief valve stuck	7. Remove valve to inspect, clean and reinstall
	8. Oil pickup tube loose, broken, bent or clogged	8. Inspect oil pickup tube and pump, and clean or replace if necessary
	9. Oil pump cover warped or cracked	9. Install new oil pump
OIL LEAKS	1. Misaligned or deteriorated gaskets	1. Replace gasket
	2. Loose fastener, broken or porous metal part	2. Tighten, repair or replace the part
	3. Front or rear crankshaft oil seal leaking	3. Replace seal
	4. Leaking oil gallery plug or cup plug	4. Remove and reseal threaded plug. Replace cup style plug

ENGINE 4.0L (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. CCV System malfunction	1. (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS - DESCRIPTION) for correct operation
	2. Defective valve stem seal(s)	2. Repair or replace seal(s)
	3. Worn or broken piston rings	3. Hone cylinder bores. Install new rings
	4. Scuffed pistons/cylinder walls	4. Hone cylinder bores and replace pistons as required
	5. Carbon in oil control ring groove	5. Remove rings and de-carbon piston
	6. Worn valve guides	6. Inspect/replace valve guides as necessary
	7. Piston rings fitted too tightly in grooves	7. Remove rings and check ring end gap and side clearance. Replace if necessary

DIAGNOSIS AND TESTING—CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise, the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(3) Secure the throttle in the wide-open position.

(4) Disconnect the ignition coil.

(5) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(6) Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

(Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

(1) Check the coolant level and fill as required. DO NOT install the radiator cap.

(2) Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

(3) Remove the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(4) Remove the oil filler cap.

(5) Remove the air cleaner.

(6) Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

(7) Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

ENGINE 4.0L (Continued)

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

STANDARD PROCEDURE

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.**Care must be taken when applying form-in-place gaskets. Bead size, continuity and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area (Mopar® Silicone Rubber Adhesive Sealant and Mopar® Gasket Maker). Each have different properties and cannot be used interchangeably.

MOPAR® SILICONE RUBBER ADHESIVE SEALANT

Mopar® Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar® Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar® Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE 4.0L (Continued)

STANDARD PROCEDURE - HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure .

(2) Disconnect the negative cable from the battery.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (i.e. coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs. Tighten the spark plugs to 37 N·m (27 ft. lbs.) torque.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

STANDARD PROCEDURE - SERVICE ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement engine assembly (short block) may be installed whenever the original cylinder block is defective or damaged beyond repair. It consists of the cylinder block, crankshaft, piston and rod assemblies. If needed, the camshaft must be procured separately and installed before the engine is installed in the vehicle.

A short block is identified with the letter “S” stamped on the same machined surface where the build date code is stamped for complete engine assemblies.

Installation includes the transfer of components from the defective or damaged original engine. Follow the appropriate procedures for cleaning, inspection and torque tightening.

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE - ENGINE PERFORMANCE

It is important that the vehicle is operating to its optimum performance level to maintain fuel economy and the lowest emission levels. If vehicle is not operating to these standards, refer to Engine Diagnosis outlined in this section. The following procedures can assist in achieving the proper engine diagnosis.

(1) Test cranking amperage draw. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING).

(2) Check intake manifold bolt torque (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(3) Perform cylinder compression test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

(4) Clean (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - CLEANING) or replace spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL) as necessary.

(5) Test coil output voltage and primary resistance. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS) Replace parts as necessary.

(6) Test fuel pump for pressure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING).

(7) The air filter elements should be replaced as specified.

(8) Inspect crankcase ventilation system.

(9) Road test vehicle as a final test.

REMOVAL

(1) Disconnect the battery negative cable.

(2) Mark the hinge locations on the hood panel for alignment reference during installation. Remove the engine compartment lamp. Remove the hood.

(3) Drain engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE), drain the coolant into a clean container for reuse.

ENGINE 4.0L (Continued)

(4) Remove the upper radiator hose and coolant recovery hose (Fig. 4).

(5) Remove the lower radiator hose.

(6) Remove upper radiator support retaining bolts and remove radiator support.

(7) Remove the fan assembly from the water pump (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).

(8) Remove the fan shroud (Fig. 4).

(9) Disconnect the transmission fluid cooler lines (automatic transmission).

(10) Discharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(11) Remove the service valves and cap the compressor ports.

(12) Remove the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL) or radiator/condenser (if equipped with A/C).

(13) Disconnect the heater hoses at the engine thermostat housing and water pump (Fig. 4).

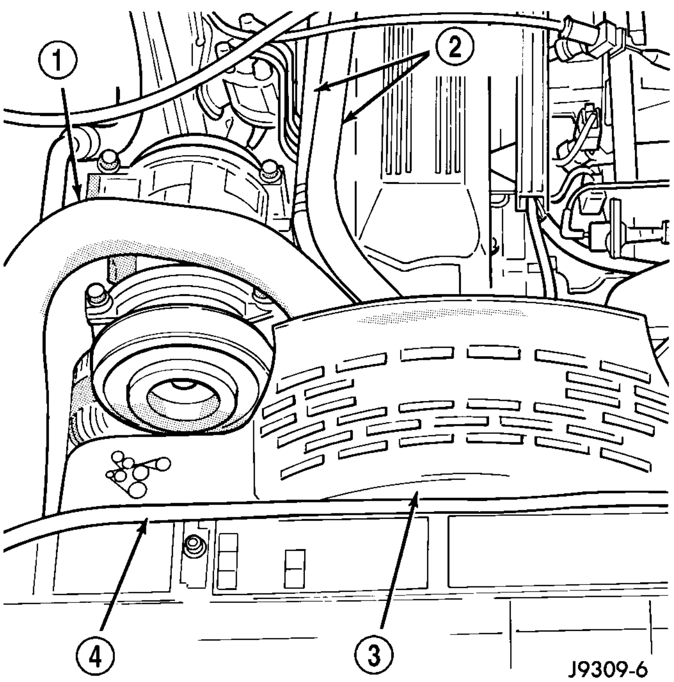


Fig. 4 Upper Radiator Hose, Coolant Recovery Hose, Fan Shroud

1 - UPPER RADIATOR HOSE
2 - HEATER HOSES
3 - FAN SHROUD
4 - COOLANT RECOVERY HOSE

(14) Disconnect the accelerator cable, transmission line pressure cable and speed control cable (if equipped) from the throttle body (Fig. 5).

(15) Remove cables from the bracket and secure out of the way.

(16) Disconnect the body ground at the engine.

(17) Disconnect the following connectors and secure their harness out of the way.

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors
- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor
- Generator connector and B+ terminal wire

(18) Disconnect the coil rail electrical connections and the oil pressure switch connector.

(19) Perform the fuel pressure release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(20) Disconnect the fuel supply line at the injector rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

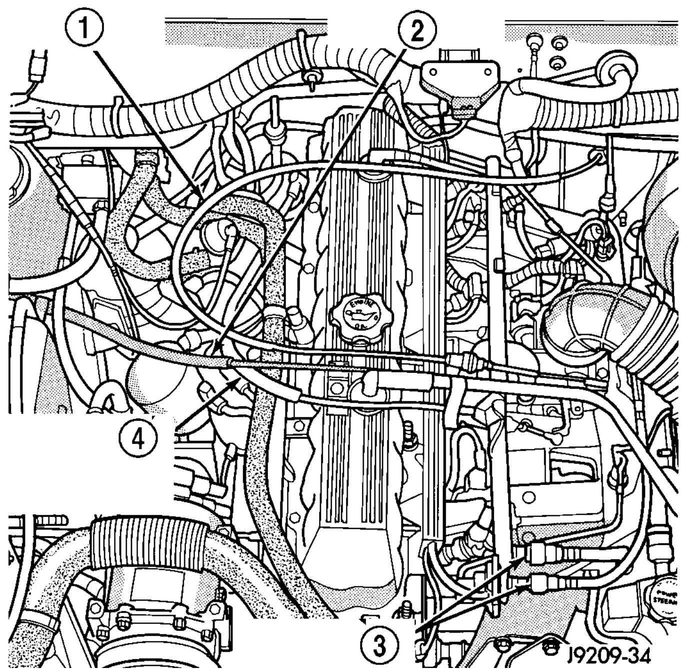


Fig. 5 Accelerator Cable, Vehicle Speed Control Cable, Automatic Transmission

1 - ACCELERATOR CABLE
2 - SPEED CONTROL CABLE
3 - QUICK-CONNECT FUEL LINES
4 - AUTOMATIC TRANSMISSION CONTROL CABLE

(21) Remove the fuel line bracket from the intake manifold.

(22) Remove the air cleaner assembly (Fig. 6).

(23) Disconnect the hoses from the fittings at the steering gear.

(24) Drain the pump reservoir.

ENGINE 4.0L (Continued)

(25) Cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system.

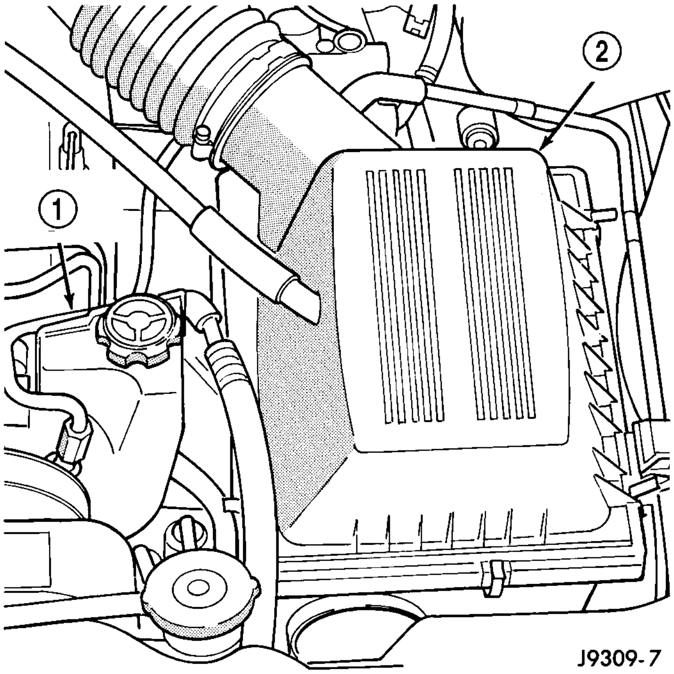


Fig. 6 Air Cleaner Assembly & Power Steering Pump

1 - POWER STEERING PUMP
2 - AIR CLEANER ASSEMBLY

(26) Raise and support the vehicle.

(27) Disconnect the wires from the engine starter motor solenoid.

(28) Remove the engine starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

(29) Disconnect the oxygen sensor from the exhaust pipe.

(30) Disconnect the exhaust pipe from the manifold.

(31) Remove the exhaust pipe support.

(32) Remove the bending brace (Refer to 9 - ENGINE/ENGINE BLOCK/WINDAGE TRAY / STRUCT SUPPORT - REMOVAL).

(33) Remove the engine flywheel/converter housing access cover.

(34) Mark the converter and drive plate location.

(35) Remove the converter-to-drive plate bolts.

(36) Remove the upper engine flywheel/converter housing bolts and loosen the bottom bolts.

(37) Remove the engine mount cushion-to-engine compartment bracket bolts.

(38) Lower the vehicle.

(39) Attach a lifting device to the engine.

(40) Raise the engine off the front supports.

(41) Place a support or floor jack under the converter (or engine flywheel) housing.

(42) Remove the remaining converter (or engine flywheel) housing bolts.

(43) Lift the engine out of the engine compartment.

INSTALLATION

CAUTION: When installing the engine into a vehicle equipped with an automatic transmission, be careful not to damage the trigger wheel on the engine flywheel.

(1) Attach a lifting device to the engine and lower the engine into the engine compartment. For easier installation, it may be necessary to remove the engine mount bracket as an aid in alignment of the engine to the transmission.

(2) Align the transmission torque converter housing with the engine.

(3) Loosely install the converter housing lower bolts and install the next higher bolt and nut on each side.

(4) Tighten all 4 bolts finger tight.

(5) Install the engine mount brackets (if removed).

(6) Lower the engine and engine mount brackets onto the engine compartment cushions. Install the bolts and finger tighten the nuts.

(7) Remove the engine lifting device.

(8) Raise and support the vehicle.

(9) Install the remaining engine flywheel/converter housing bolts. Tighten all bolts to 38 N·m (28 ft. lbs.) torque.

(10) Install the converter-to-drive plate bolts.

(11) Ensure the installation reference marks are aligned.

(12) Install the engine flywheel/converter housing access cover.

(13) Install the exhaust pipe support and tighten the screw.

(14) Install the engine bending brace (Refer to 9 - ENGINE/ENGINE BLOCK/WINDAGE TRAY / STRUCT SUPPORT - INSTALLATION).

(15) Tighten the engine mount-to-bracket bolts.

(16) Connect the vehicle speed sensor wire connections and tighten the screws.

(17) Connect the exhaust pipe to the manifold.

(18) Install the engine starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(19) Connect the wires to the engine starter motor solenoid.

(20) Lower the vehicle.

(21) Connect vacuum hoses and wire connectors disconnected during engine removal.

(22) Remove protective caps from the power steering hoses.

ENGINE 4.0L (Continued)

(23) Connect the hoses to the fittings at the steering gear. Tighten the nut to 52 N·m (38 ft. lbs.) torque.

(24) Fill the pump reservoir with fluid (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

(25) Inspect the fuel supply line o-ring(s) and replace if necessary. Connect fuel supply line to injector rail and verify connection by pulling outward on the line.

(26) Install the fuel line bracket to the intake manifold.

(27) Connect the coil rail electrical connectors and oil pressure switch connector.

(28) Connect the following electrical connectors:

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors
- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor
- Generator connector and B+ terminal wire

(29) Connect all previously removed vacuum hoses.

(30) Connect the body ground strap.

(31) Install the throttle, transmission line pressure, and speed control cables to their mounting bracket and connect them to the throttle body.

(32) Connect the heater hoses at the engine thermostat housing and water pump.

(33) Install the fan assembly to the water pump (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).

(34) Place the fan shroud in position over the fan.

(35) Install the radiator or radiator/condenser (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(36) Connect the service valves to the A/C compressor ports, if equipped with A/C.

(37) Charge the air conditioner system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(38) Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped.

(39) Install the fan shroud to the radiator or radiator/condenser (if equipped with A/C).

(40) Install upper radiator support.

(41) Connect the upper radiator hose and tighten the clamp.

(42) Connect the lower radiator hose and tighten the clamp.

(43) Fill crankcase with engine oil (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS).

(44) Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(45) Align the hood to the scribe marks. Install the hood.

(46) Install the air cleaner assembly.

(47) Install the battery and connect the battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(48) Start the engine, inspect for leaks and correct the fluid levels, as necessary.

SPECIFICATIONS

ENGINE - 4.0L

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	In-Line 6 Cylinder
Displacement	4.0 Liters / 4000 cc 242 (Cubic Inches)
Bore	98.4 mm (3.88 in.)
Stroke	86.69 mm (3.413 in.)
Compression Ratio	8.8:1
Firing Order	1-5-3-6-2-4
Lubrication	Pressure Feed-Full Flow-Filtration
Cooling System	Liquid Cooled-Forced Circulation
Cylinder Block	Cast Iron
Crankshaft	Cast Nodular Iron
Cylinder Head	Cast Iron
Camshaft	Cast Iron
Pistons	Aluminum Alloy
Combustion Chamber	Dual-Quench
Connecting Rods	Cast Malleable Iron

ENGINE 4.0L (Continued)

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
CylinderBore Diameter	98.45 - 98.48 mm	3.8759 - 3.8775 in.
Out of Round (MAX)	0.025 mm	0.001 in.
Taper (MAX)	0.025 mm	0.001 in.
Deck Height	240.03 - 240.18 mm	9.450 - 9.456 in.
Deck Clearance (Below Deck)	0.546 mm	0.0215 in.
Tappet Bore Diameter	23.000 - 23.025 mm	0.9055 - 0.9065
Flatness	0.03 mm per 25 mm 0.05 mm per 152 mm	0.001 in. per 1 in. 0.002 in. per 6 in.
Flatness (MAX)	0.20 mm (MAX) for total length	0.008 in. MAX) for total length
Main Bearing Bore Diameter	68.351 - 68.376 mm	2.691 - 2.692 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Weight (Less Pin)	417 - 429 grams	14.7 - 15.1 oz
Piston Pin Bore Diameter	23.650 - 23.658 mm	0.9312 - 0.9315 in.
Piston Pin To Bore (Centerline To Piston Top)	40.61 - 40.72 mm	1.599 - 1.603 in.
Piston To Bore Clearance	0.018 - 0.038 mm	0.0008 - 0.0015 in.
Piston Ring Groove Height		
Compression Rings	1.530 - 1.555 mm	0.0602 - 0.0612 in.
Oil Control Rings	4.035 - 4.060 mm	0.1589 - 0.1598 in.
Piston Ring Groove Diameter		
No. 1 Compression	88.39 - 88.65 mm	3.48 - 3.49 in
No. 2 Compression	87.63 - 87.88 mm	3.45 - 3.46 in.
No. 3 Oil Control	89.66 - 89.92 mm	3.53 - 3.54 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston To Pin Clearance	0.0102 - 0.0208 mm	0.0005 - 0.0009 in.
Diameter	23.637 - 23.640 mm	0.9306 - 0.9307 in.
Piston-Pin To Connecting Rod (Press Fit)	8.9kN	2000 lbf.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.229 - 0.610 mm	0.0090 - 0.0240 in.
Second Compression Ring	0.483 - 0.965 mm	0.0190 - 0.0380 in.
Oil Control (Steel Rails)	0.254 - 1.500 mm	0.010 - 0.060 in.
Side Clearance		
Top Compression Ring	.042 - .084 mm	0.0017 - 0.0033 in.
Second Compression Ring	0.042 - 0.084 mm	0.0017 - 0.0033 in.
Oil Ring (Steel Ring)	.06 - .21 mm	.0024 - .0083 in.

ENGINE 4.0L (Continued)

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.025 - 0.076 mm	0.001 - 0.003 in.
Preferred	0.044 - 0.050	0.0015 - 0.0020
Side Clearance	0.25 - 0.48 mm	0.010 - 0.019 in.
Piston Pin Bore Diameter	.023.59 - 23.62 mm	0.9288 - 0.9298 in.
Bearing Bore (Less Bearings)	56.08 - 56.09mm	2.2080 - 2.2085 in.
Total Weight (Less Bearing)	663 - 671 grams	23.39 - 23.67 oz.
Length (Center To Center)	155.52 - 155.62 mm	6.123 - 6.127 in.
Twist (MAX.)	0.002 mm per mm	0.002 in. per inch
Bend (MAX.)	0.002 mm per mm	0.002 in. per inch.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter		
No. 1-6	63.489 - 63.502 mm	2.499 - 2.500 in.
No. 7	63.449 - 63.487	2.498 - 2.499 in.
Bearing Clearance	0.03 - 0.06 mm	0.001 - 0.0025 in.
Preferred	0.051 mm	0.002 in.
Out of Round (MAX)	0.013 mm	0.0005 in.
Taper (MAX)	0.013 mm	0.0005 in.
End Play	0.038 - 0.165 mm	0.0015 - 0.0065 in.
Connecting Rod Journal Diameter	53.17 - 53.23 mm	2.0934 - 2.0955 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Hydraulic Tappet Clearance	Zero Lash	
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter		
No. 1	51.54 - 51.56 mm	2.029 - 2.030 in.
No. 2	51.28 - 51.31 mm	2.019 - 2.020 in.
No. 3	51.03 - 51.05 mm	2.009 - 2.010 in.
No. 4	50.78 - 50.80 mm	1.999 - 2.000 in.
Base Circle Runout (MAX)	0.033 mm	0.001 in.
Valve Lift		
Intake	10.350 mm	0.4075 in.
Exhaust	10.528 mm	0.4145 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	12.4°
Closes (ABDC)	60.9°
Duration	253.3°
Exhaust	
Opens (BBDC)	49.8°
Closes (ATDC)	29.2°
Duration	259.0°
Valve Overlap	41.6°

ENGINE 4.0L (Continued)

VALVES

DESCRIPTION	SPECIFICATION
Face Angle	46.5°
Head Diameter	
Intake	48.38 - 48.64 mm (1.905 - 1.915 in.)
Exhaust	37.97 - 38.22 mm (1.495 - 1.505 in.)
Length (Overall)	
Intake	122.47 - 122.86 mm (4.822 - 4.837)
Exhaust	122.86 - 123.24 mm (4.83 - 4.85 in.)
Stem Diameter	7.89 - 7.92 mm (0.311 - 0.312 in.)
Stem - to - Guide Clearance	0.025 - 0.076 mm (0.001 - 0.003 in.)
Tip Refinishing (Max. Allowable)	0.025 mm (0.010 in.)

VALVE SPRING

DESCRIPTION	SPECIFICATION
Free Length (Approx)	47.65 mm (1.876 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	316.0 - 351.0 N @ 41.65 mm (71.0 - 79.0 lbs. @ 1.64 in.)
Spring Force (Valve Open)	
Intake and Exhaust	898.6 - 969.7 N @ 30.89 mm (202.0 - 218.0 lbs. @ 1.216 in.)
Wire Diameter (Inside)	21.0 - 21.51 mm
Intake and Exhaust	(0.827 - 0.847 in.)
Installed Height (Spring Seat to Bottom of Retainer)	41.65 mm (1.64 in.)

CYLINDER HEAD

DESCRIPTION	SPECIFICATION
Combustion Chamber	55.22 - 58.22 cc (3.37 - 3.55 cu. in.)
Valve Seat Angle	44.5°
Valve Seat Runout (MAX)	0.064 mm (0.0025 in.)
Valve Seat Width	1.02 - 1.52 mm (0.040 - 0.060 in.)
Valve Guide I. D (Integral)	7.95 - 7.97 mm (0.313 - 0.314 in.)
Valve Stem to Guide Clearance	0.025 - 0.076 mm (0.001 - 0.003 in.)
Cylinder Head Warpage (Flatness)	0.03 mm per 25 mm (0.001 in. per 1 in.) 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness (MAX)	0.20 mm - max for total length

OIL PUMP

DESCRIPTION	SPECIFICATION
Gear to Body Clearance (Radial)	0.051 - 0.102 mm (0.002 - 0.004 in.)
Gear to Body Clearance (Radial Preferred)	0.051 mm (0.002 in.)
Gear End Clearance (Plastigage)	0.051 - 0.152 mm (0.002 - 0.006 in.)
Gear End Clearance (Plastigage Preferred)	.051 mm (.002 in.)
Gear End Clearance (FeelerGauge)	0.1016 - 0.2032 mm (0.004 - 0.008 in.)
Gear End Clearance (FeelerGauge Preferred)	0.1778 mm (0.007 in.)

ENGINE 4.0L (Continued)

OIL PRESSURE

SPECIFICATION	SPECIFICATION
At Curb Idle Speed*	89.6 kPa (13 psi)
@ 1600 and Higher Rpm	255 - 517 kPa (37 - 75 psi)
Oil Pressure Relief	517 kPa (75 psi.)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

TORQUE - 4.0L ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
A/C Compressor—Bolts	28	—	250
Block Heater—Nut	2	—	16
Camshaft Sprocket—Bolt	68	50	—
Camshaft Thrust Plate to Cylinder Block—Screws	24	18	—
Clutch Cover to Flywheel—Bolts	54	40	—
Coil Bracket to Block—Bolts	22	—	192
Connecting Rod—Nuts	45	33	—
Cylinder Block—Drain Plugs	34	25	—
Cylinder Head—Bolts	135	100	—
Cylinder Head Cover—Bolts	10	—	85
Distributor Clamp—Bolts	23	—	204
Engine Mounts—Front			
Support Bracket Bolts	61	45	—
Support Cushion Bolts/Nuts	41	30	—
Support Cushion Bracket Bolts	54	40	—
Support Cushion Bracket Stud Nuts	41	30	—
Support Cushion Thru-Bolt	65	48	—
Engine Mounts—Rear			
Crossmember to Sill Bolts—(Automatic)	41	30	—
Insulator Stud Assembly—Nut	41	30	—
Support Cushion/Crossmember—Nuts	22	—	192
Support Cushion/Bracket—Nuts (Manual)	75	55	—
Transmission Support Bracket—Bolt (Manual)	46	34	—
Transmission Support Bracket/Cushion—Bolt (4WD Auto)	75	55	—
Transmission Support Adaptor Bracket—Bolts (2WD Auto)	75	55	—
Exhaust Manifold/Pipe—Nuts	27	20	—
Intake/Exhaust Manifold			
Fasteners #1-5	33	24	—
Fasteners #6 and 7	14	—	126
Fasteners #8-11	33	24	—
Flywheel to Converter Housing—Bolts	38	28	—
Flywheel to Crankshaft—Bolts	143	105	—
Front Cover to Block—Bolts			
1/4-20	7	—	60
5/16-18	22	—	192
Fuel Rail—Bolts/Stud	12	—	108
Generator—Bolts	57	42	—
Generator Bracket to Engine—Bolts	47	35	—
Idler Pulley to Cylinder Head—Bolt	47	35	—
Main Bearing Cap—Bolts	108	80	—
Oil Filter	18	—	156
Oil Filter Connector to			
Adaptor	47	35	—
Block	68	50	—
Adaptor Bolts	102	50	—
Oil Galley—Plug	41	30	—
Oil Pan—Bolts			
1/4-20	9.5	—	84
5/16-18	15	—	132
Oil Pan—Drain Plug	34	25	—
Oil Pump			
Mounting Bolts	23	—	204
Cover Bolts	8	—	70
Rocker Arm Assembly to Cylinder Head—Capscrews	30	21	—
Spark Plugs	37	27	—

ENGINE 4.0L (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Starter Motor—Mounting Bolts	45	33	—
Thermostat Housing—Bolts	18	—	156
Throttle Body—Bolts	10	—	90
Vibration Damper—Bolt	108	80	—
Water Pump to Block—Bolts	23	17	—

AIR CLEANER ELEMENT

REMOVAL

(1) Loosen air tube clamp at housing cover (Fig. 7).
(2) Disconnect air tube at cover.
(3) Pry back the clips retaining air cleaner cover to air cleaner housing.
(4) Lift cover up to expose air cleaner element.
(5) Remove air cleaner element.
(6) Clean inside of air cleaner housing and its cover before installing new element.

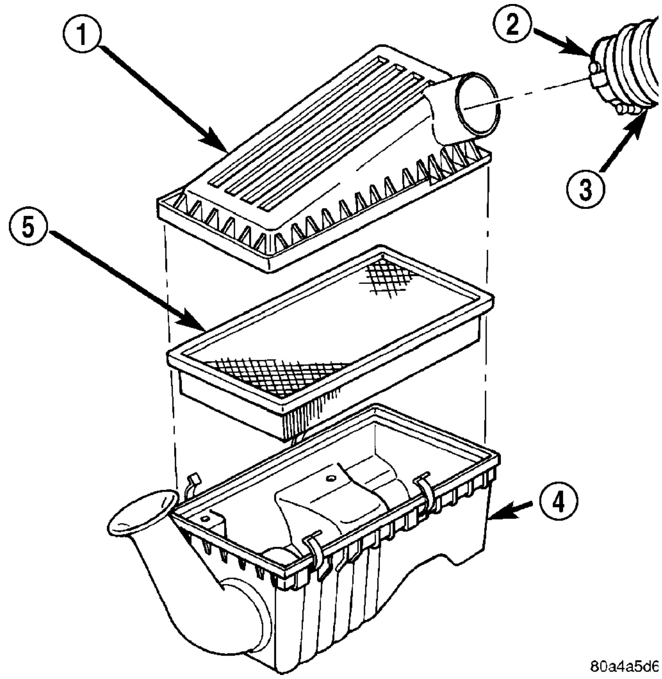


Fig. 7 AIR CLEANER ELEMENT

1 - COVER
2 - CLAMP
3 - AIR TUBE
4 - HOUSING
5 - FILTER

INSTALLATION

(1) Install air cleaner element into housing.
(2) Install housing cover to housing. Be sure cover is properly seated to air cleaner housing.
(3) Connect air tube at cover.

AIR CLEANER HOUSING

REMOVAL

(1) Loosen air tube clamp at housing cover.
(2) Disconnect air tube at cover. (Fig. 8)
(3) Pry back the clips retaining air cleaner cover to air cleaner housing.
(4) Lift cover up to expose air cleaner element.
(5) Remove air cleaner element.

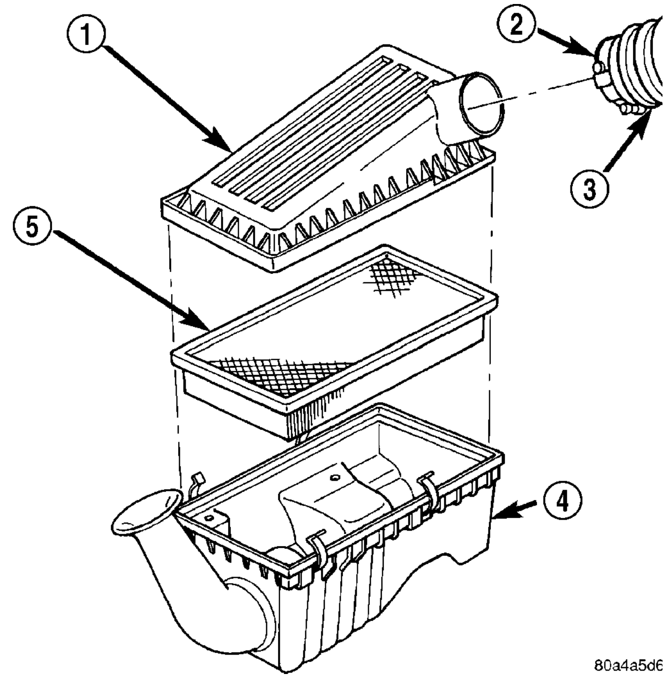


Fig. 8 AIR CLEANER ELEMENT

1 - COVER
2 - CLAMP
3 - AIR TUBE
4 - HOUSING
5 - FILTER

(6) Remove the air inlet duct.
(7) Lift up and remove the air cleaner housing.
(8)

INSTALLATION

(1) Push down on the air cleaner housing to lock in place.
(2) Install the air inlet tube.
(3) Install the air cleaner element.
(4) Pry back the clips retaining air cleaner cover to air cleaner housing. (Fig. 8)
(5) Install the air cleaner housing cover. Be sure cover is properly seated.
(6) Install the air out let tube.

CYLINDER HEAD

DESCRIPTION

The cylinder head is made of cast iron containing twelve valves made of chrome plated heat resistant steel, valve stem seals, springs, retainers and keepers. The cylinder head and valve seats can be resurfaced for service purposes.

The valve guides are integral to the cylinder head, They are not replaceable. However, they are serviceable.

The cylinder head uses dual quench-type design combustion chambers which cause turbulence in the cylinders allowing faster burning of the air/fuel mixture, resulting in better fuel economy (Fig. 9).

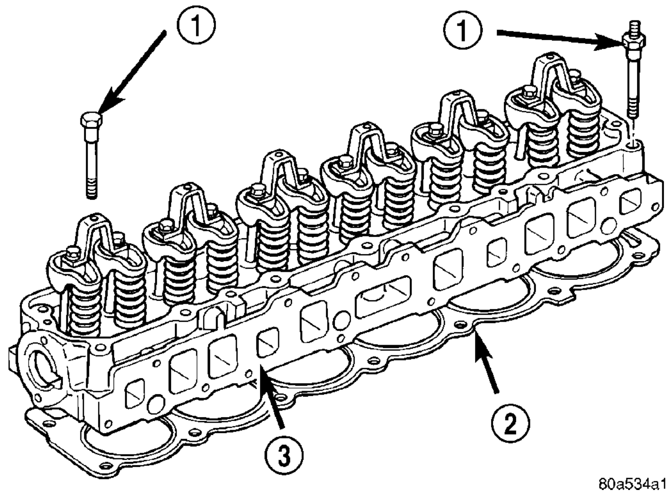


Fig. 9 Cylinder Head 4.0L Engine

1 - CYLINDER HEAD BOLTS
2 - CYLINDER HEAD GASKET
3 - CYLINDER HEAD

DIAGNOSIS AND TESTING - ENGINE CYLINDER HEAD GASKET FAILURE

A leaking engine cylinder head gasket usually results in loss of power, loss of coolant and engine misfiring.

An engine cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- An engine cylinder head gasket leaking between adjacent cylinders is indicated by a loss of power and/or engine misfire.
- An engine cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders; follow the procedures outlined . An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

Remove the radiator cap.

Start the engine and allow it to warm up until the engine thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

If bubbles are not visible, install a radiator pressure tester and pressurize the coolant system.

If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

REMOVAL

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Disconnect the battery negative cable.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(2) Drain the coolant (Refer to 7 - COOLING - STANDARD PROCEDURE) and disconnect the hoses at the engine thermostat housing and the water pump inlet. DO NOT waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

(3) Remove the air cleaner assembly.

(4) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Remove the capscrews, bridge and pivot assemblies and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

(6) Remove the push rods.**Retain the push rods, bridges, pivots and rocker arms in the same order as removed.**

(7) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

CYLINDER HEAD (Continued)

(8) Remove the A/C compressor mounting bolts and secure the compressor to the side.

(9) Remove the power steering pump and bracket from the intake manifold and water pump. Set the pump and bracket aside. DO NOT disconnect the hoses.

(10) Perform the Fuel System Pressure Release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(11) Disconnect the fuel supply line at the fuel rail.

(12) Remove the intake and exhaust manifolds from the engine cylinder head (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

(13) Disconnect the coil rail electrical connectors and remove the coil rail (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - REMOVAL).

(14) Remove spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(15) Disconnect the temperature sending unit wire connector.

(16) Remove the engine cylinder head bolts. Bolt No.14 cannot be removed until the head is moved forward (Fig. 10). Pull bolt No.14 out as far as it will go and then suspend the bolt in this position (tape around the bolt).

(17) Remove the engine cylinder head and gasket (Fig. 10).

(18) If this was the first time the bolts were removed, put a paint dab on the top of the bolt. If the bolts have a paint dab on the top of the bolt or it isn't known if they were used before, discard the bolts.

(19) Stuff clean lint free shop towels into the cylinder bores.

NOTE: If the valves, springs, or seals are to be inspected/replaced at this time, refer to Valves and Valve Springs in this section for proper inspection procedures.

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and engine exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

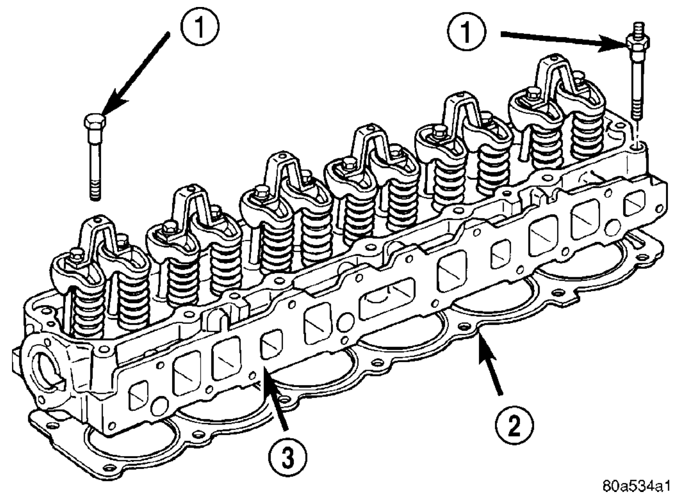


Fig. 10 Engine Cylinder

1 - CYLINDER HEAD BOLTS
2 - CYLINDER HEAD GASKET
3 - CYLINDER HEAD

INSTALLATION

NOTE: This procedure can be done with the engine in or out of the vehicle.

The engine cylinder head gasket is a composition gasket. The gasket is to be installed DRY. **DO NOT use a gasket sealing compound on the gasket.**

If the engine cylinder head is to be replaced and the original valves used, measure the valve stem diameter. Only standard size valves can be used with a service replacement engine cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems. Remove all carbon buildup and reface the valves.

(1) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(2) Position the engine cylinder head gasket (with the numbers facing up) using the alignment dowels in the cylinder block, to position the gasket.

CAUTION: Engine cylinder head bolts should be reused only once. Replace the head bolts if they were used before or if they have a paint dab on the top of the bolt.

(3) With bolt No.14 held in place (tape around bolt), install the engine cylinder head over the same dowels used to locate the gasket. Remove the tape from bolt No.14.

(4) Coat the threads of stud bolt No.11 with Loctite 592 sealant, or equivalent.

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 11).

CYLINDER HEAD (Continued)

CAUTION: During the final tightening sequence, bolt No.11 will be tightened to a lower torque than the rest of the bolts. DO NOT overtighten bolt No.11.

(a) Tighten all bolts in sequence (1 through 14) to 30 N·m (22 ft. lbs.) torque.

(b) Tighten all bolts in sequence (1 through 14) to 61 N·m (45 ft. lbs.) torque.

(c) Check all bolts to verify they are set to 61 N·m (45 ft. lbs.) torque.

(d) Tighten bolts in sequence:

• Bolts 1 through 10 to 149 N·m (110 ft. lbs.) torque.

• Bolt 11 to 135 N·m (100 ft. lbs.) torque.

• Bolts 12 through 14 to 149 N·m (110 ft. lbs.) torque.

(e) Check all bolts in sequence to verify the correct torque.

(f) If not already done, clean and mark each bolt with a dab of paint after tightening. Should you encounter bolts which were painted in an earlier service operation, replace them.

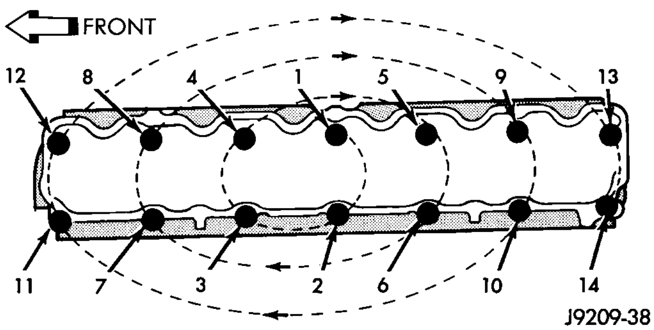


Fig. 11 Engine Cylinder Head Bolt Tightening Sequence

(6) Install the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - INSTALLATION).

(7) Connect the temperature sending unit wire connector.

(8) Install the ignition coil rail and coil rail electrical connectors (Refer to 8 - ELECTRICAL/IGNITION CONTROL/COIL RAIL - INSTALLATION).

(9) Install the intake and exhaust manifolds (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(10) Install the fuel line and the vacuum advance hose.

(11) Attach the power steering pump and bracket.

(12) Install the push rods, rocker arms, pivots and bridges in the order they were removed (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).

(13) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(14) Attach the air conditioner compressor mounting bracket to the engine cylinder head and block. Tighten the bolts to 40 N·m (30 ft. lbs.) torque.

(15) Attach the air conditioning compressor to the bracket. Tighten the bolts to 27 N·m (20 ft. lbs.) torque.

CAUTION: The serpentine drive belt must be routed correctly. Incorrect routing can cause the water pump to turn in the opposite direction causing the engine to overheat.

(16) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(17) Install the air cleaner and ducting.

(18) Connect the hoses to the engine thermostat housing and fill the cooling system to the specified level (Refer to 7 - COOLING - STANDARD PROCEDURE).

(19) The automatic transmission throttle linkage and cable must be adjusted after completing the engine cylinder head installation (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 30RH/THROTTLE VALVE CABLE - ADJUSTMENTS) or (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 32RH/THROTTLE VALVE CABLE - ADJUSTMENTS).

(20) Install the temperature sending unit and connect the wire connector.

(21) If equipped with air conditioning, install A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION) and charge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(22) Connect negative cable to battery.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(23) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the engine thermostat opens. Add coolant, if required.

CYLINDER HEAD COVER(S)

DESCRIPTION

The cylinder head cover (Fig. 12) is made of stamped steel and incorporates the Crankcase Ventilation (CCV) Hoses and the oil fill opening.

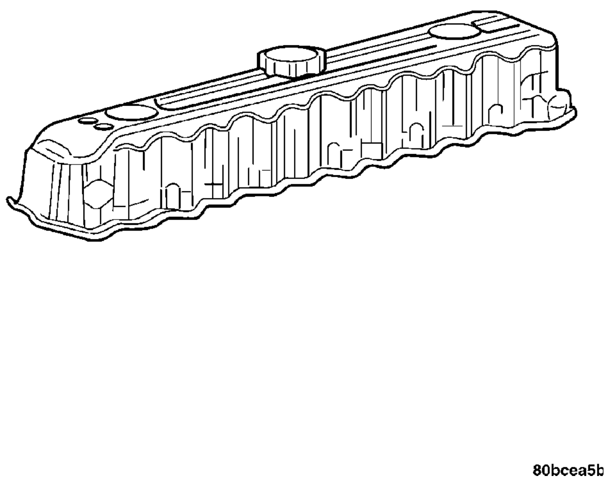


Fig. 12 Cylinder Head Cover

REMOVAL

The cylinder head cover is isolated from the cylinder head via grommets and a reusable molded rubber gasket. The grommet and limiter are retained in the cylinder head cover.

(1) Disconnect negative cable from battery.

(2) Disconnect the Crankcase Ventilation (CCV) vacuum hose from engine cylinder head cover.

(3) Disconnect the fresh air inlet hose from the engine cylinder head cover.

(4) Disconnect the accelerator, transmission, and speed (if equipped) control cables from the throttle body (Fig. 13).

(5) Remove the three bolts that fasten the control cable bracket to the intake manifold.

(6) Remove control cables from cylinder head cover clip.

(7) Position control cables and bracket away from cylinder head cover secure with tie straps.

NOTE: The wiring harness loom on the left hand side of the engine must be disconnected and moved over to the right hand side of the engine to gain clearance for cylinder head cover removal.

(8) Disconnect the left hand side of the wiring harness loom from all components.

(9) Remove fasteners from plastic wiring loom trough on rear of cylinder head cover.

NOTE: Before trying to move the Left side of the harness to the right side, remove the tie strap from the harness on the right side, just below the cover, near the coil pack area, if equipped.

(10) Move the left hand side harness loom and the plastic trough to the right side.

(11) Remove the engine cylinder head cover mounting bolts.

(12) Remove the engine cylinder head cover and gasket.

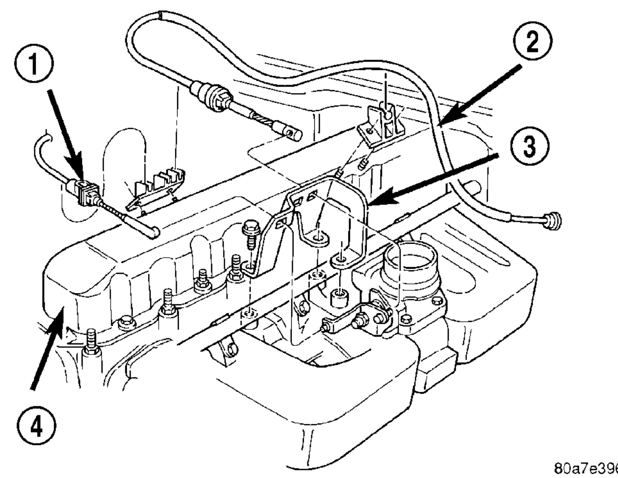


Fig. 13 Engine Cylinder Head Cover

1 - TRANS CONTROL CABLE
2 - ACCELERATOR CABLE
3 - CONTROL CABLE BRACKET
4 - CYLINDER HEAD COVER

CLEANING

Remove any original sealer from the cover sealing surface of the engine cylinder head and clean the surface using a fabric cleaner.

Remove all residue from the sealing surface using a clean, dry cloth.

INSPECTION

Inspect the engine cylinder head cover for cracks. Replace the cover, if cracked.

The original dark grey gasket material should NOT be removed. If sections of the gasket material are missing or are compressed, replace the engine cylinder head cover. However, sections with minor damage such as small cracks, cuts or chips may be repaired with a hand held applicator. The new material must be smoothed over to maintain gasket height. Allow the gasket material to cure prior to engine cylinder head cover installation.

INSTALLATION

The cylinder head cover is isolated from the cylinder head via grommets and a reusable molded rubber gasket. The grommet and limiter are retained in the cylinder head cover.

CYLINDER HEAD COVER(S) (Continued)

(1) If a replacement cover is installed, transfer the CCV valve grommet and oil filler cap from the original cover to the replacement cover.

(2) Install cylinder head cover and gasket (Fig. 14). Tighten the mounting bolts to 10 N·m (85 in. lbs.) torque.

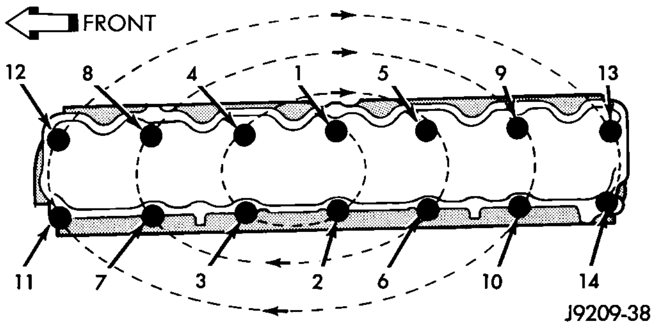


Fig. 14 Cylinder Head Cover Gasket Locator Pins at #8 & #9

(3) Reinstall the plastic wiring loom trough at the rear of cylinder head cover.

(4) Reconnect the left hand side of the wiring harness loom to all components.

(5) Connect the CCV hoses.

(6) Install control cables and bracket on intake manifold and tighten bolts to 8.7 N·m (77 in. lbs.) torque.

(7) Connect control cables to throttle body linkage.

(8) Snap control cables into cylinder head cover clip.

(9) Connect negative cable to battery.

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. All valves use three bead locks to promote valve rotation (Fig. 15).

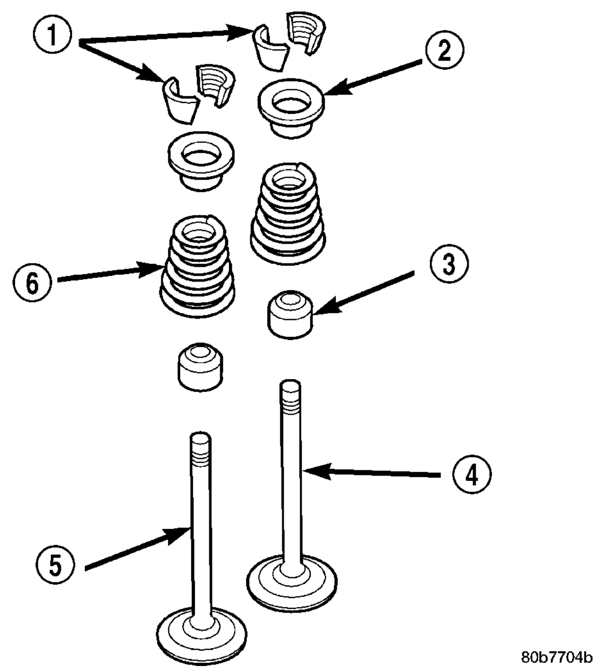


Fig. 15 VALVE AND KEEPER CONFIGURATION 4.0L

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

STANDARD PROCEDURE - VALVE SERVICE

VALVE REFACING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 0.787 mm (0.031 inch) must remain (Fig. 16). If the margin is less than 0.787 mm (0.031 inch), the valve must be replaced.

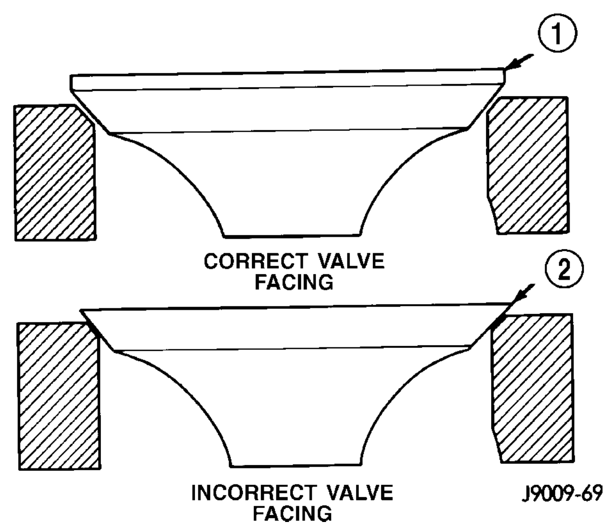


Fig. 16 Valve Facing

1 - VALVE MARGIN
2 - NO MARGIN

VALVE SEAT REFACING

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified

INTAKE/EXHAUST VALVES & SEATS (Continued)

angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.

(3) Control valve seat runout to a maximum of 0.0635 mm (0.0025 in.) (Fig. 17).

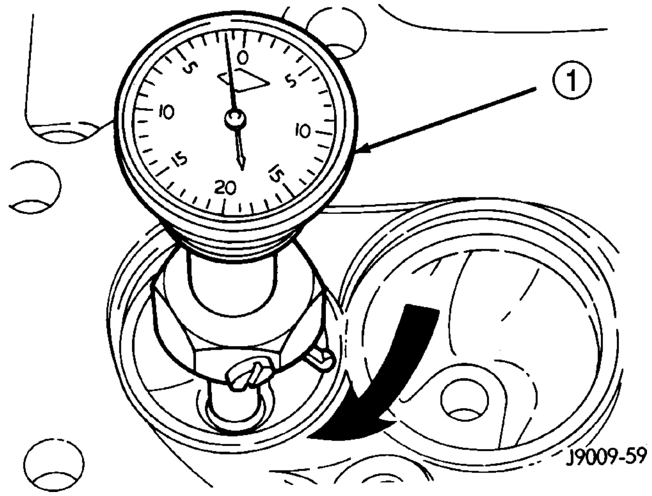


Fig. 17 Measurement of Valve Seat Runout

1 - DIAL INDICATOR

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

PREFERRED METHOD

(1) Remove the valve from the head.

(2) Clean the valve stem guide bore with solvent and a bristle brush.

(3) Insert a telescoping gauge into the valve stem guide bore approximately 9.525 mm (.375 inch) from the valve spring side of the head (Fig. 18).

(4) Remove and measure telescoping gauge with a micrometer.

(5) Repeat the measurement with contacts lengthwise to engine cylinder head.

(6) Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate an oversize valve stem.

(7) Compare the measured valve guide bore diameter with specifications (7.95-7.97 mm or 0.313-0.314 inch). If the measurement differs from specification by more than 0.076 mm (0.003 inch), ream the guide bore to accommodate an oversize valve stem.

ALTERNATIVE METHOD

(1) Use a dial indicator to measure the lateral movement of the valve stem (stem-to-guide clearance). This must be done with the valve installed in its guide and just off the valve seat (Fig. 19).

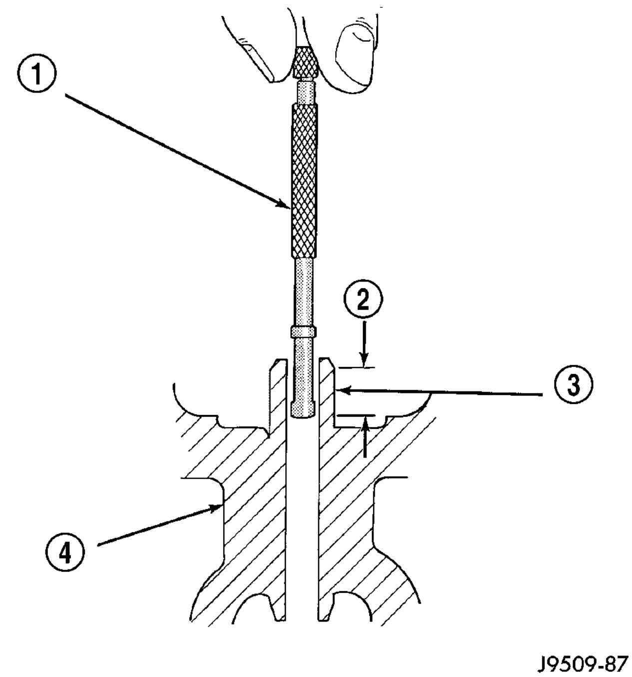


Fig. 18 Measurement of Valve Guide Bore Diameter

1 - GAUGE
2 - 9.525 MM (3/8 INCH)
3 - VALVE STEM GUIDE
4 - CYLINDER HEAD

(2) Correct clearance is 0.025-0.0762 mm (0.001-0.003 inch). If indicated movement exceeds the specification ream the valve guide to accommodate an oversize valve stem.

NOTE: Valve seats must be ground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.

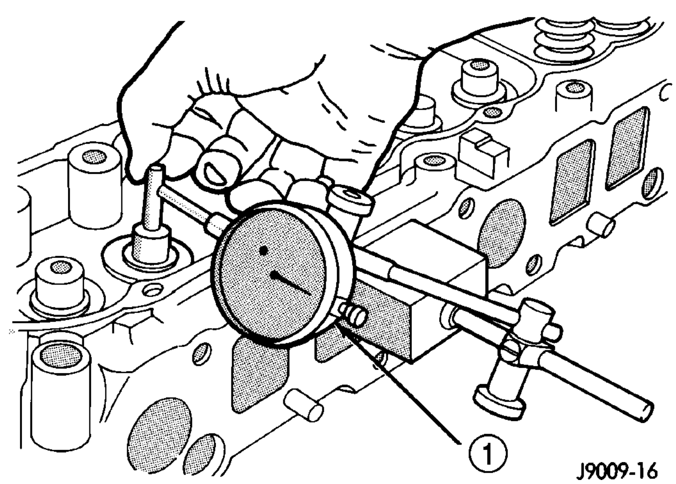


Fig. 19 Measurement of Lateral Movement Of Valve Stem

1 - DIAL INDICATOR

INTAKE/EXHAUST VALVES & SEATS (Continued)

REMOVAL

NOTE: This procedure is done with the engine cylinder head removed from the block.

(1) Remove the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) from the cylinder block.

(2) Use Valve Spring Compressor Tool MD-998772A and compress each valve spring.

(3) Remove the valve locks, retainers, springs and valve stem oil seals. Discard the oil seals (Fig. 20).

(4) Use a smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

(5) Remove the valves, and place them in a rack in the same order as removed.

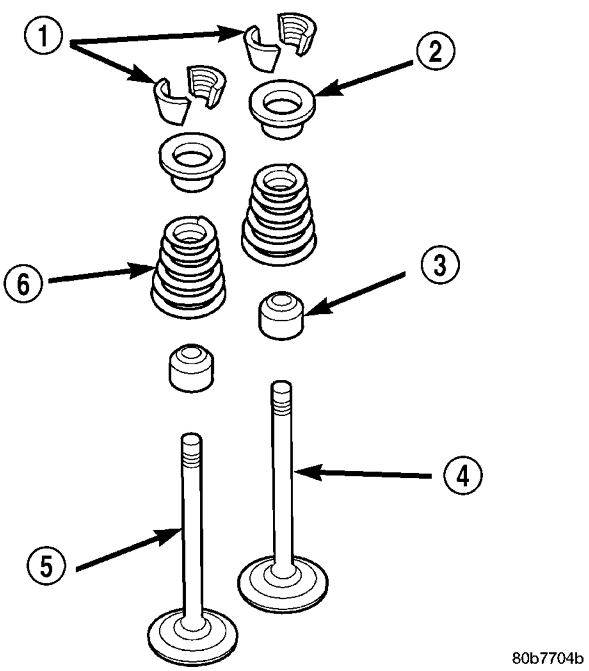


Fig. 20 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

INSTALLATION

NOTE: This procedure is done with the engine cylinder head removed from the block.

(1) Thoroughly clean the valve stems and the valve guide bores.

(2) Lightly lubricate the stem.

(3) Install the valve in the original valve guide bore.

(4) Install the replacement valve stem oil seals on the valve stems (Fig. 21). If the 0.381 mm (0.015 inch) oversize valve stems are used, oversize oil seals are required.

(5) Position the valve spring and retainer on the engine cylinder head and compress the valve spring with Valve Spring Compressor Tool MD-998772A.

(6) Install the valve locks and release the tool.

(7) Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the engine cylinder head. Also tap the top of the retainer to seat the valve locks.

(8) Install the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

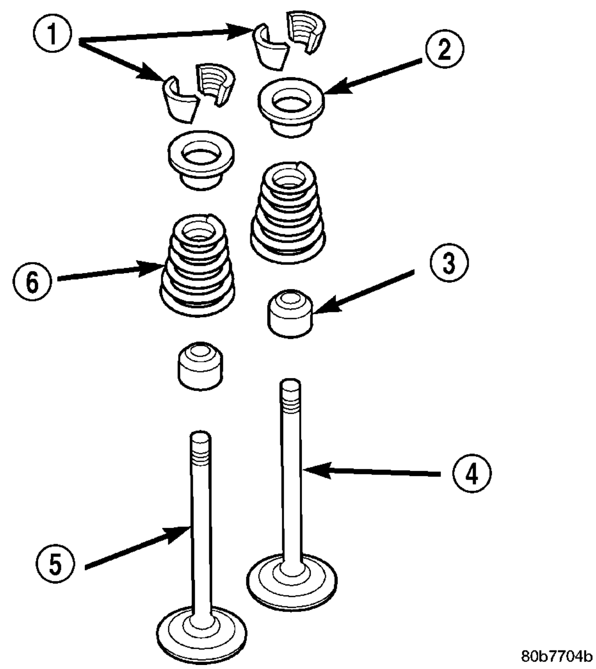


Fig. 21 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

ROCKER ARM / ADJUSTER ASSEMBLY

DESCRIPTION

The rocker arms are made of stamped steel and have a operational ratio of 1.6:1 (Fig. 22).

OPERATION

When the push rods are forced upward by the camshaft lobes the push rod presses upward on the rocker arms, the rocker arms pivot, forcing downward pressure on the valves forcing the valves to move downward and off from their seats.

ROCKER ARM / ADJUSTER ASSEMBLY (Continued)

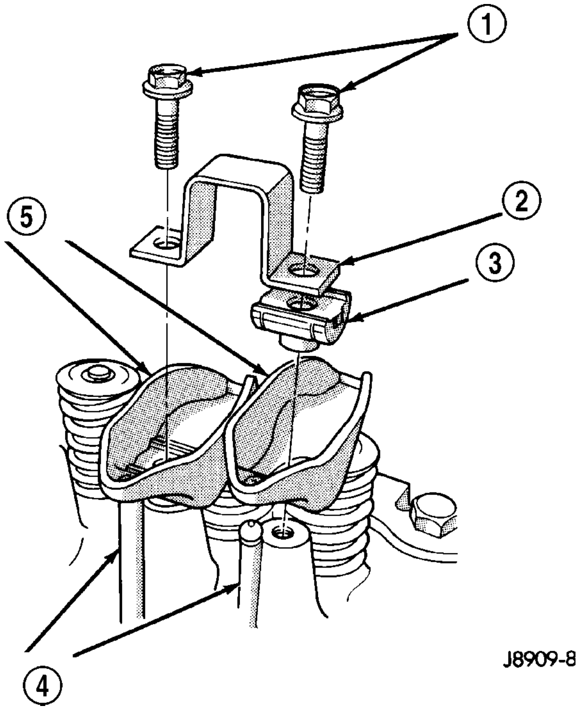


Fig. 22 Rocker Arms—Typical

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

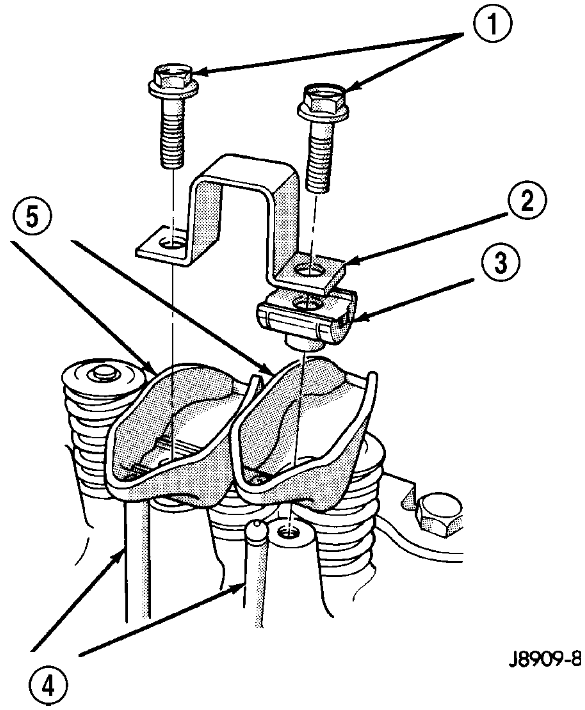


Fig. 23 Rocker Arm

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

REMOVAL

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Check for rocker arm bridges which are causing misalignment of the rocker arm to valve tip area.

(3) Remove the capscrews at each bridge and pivot assembly (Fig. 23). Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.

(4) Remove the bridges, pivots and corresponding pairs of rocker arms (Fig. 23). Place them on a bench in the same order as removed.

(5) Remove the push rods and place them on a bench in the same order as removed.

CLEANING

Clean all the components with cleaning solvent.

Use compressed air to blow out the oil passages in the rocker arms and push rods.

INSPECTION

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted, cracked or excessively worn.

Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.

Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace it and inspect the corresponding hydraulic tappet for excessive wear.

Inspect the push rods for straightness by rolling them on a flat surface or by shining a light between the push rod and the flat surface.

A wear pattern along the length of the push rod is not normal. Inspect the engine cylinder head for obstruction if this condition exists.

INSTALLATION

NOTE: This procedure can be done with the engine in or out of the vehicle.

(1) Lubricate the ball ends of the push rods with Mopar® Engine Oil Supplement, or equivalent and install push rods in their original locations. Ensure

ROCKER ARM / ADJUSTER ASSEMBLY (Continued)

that the bottom end of each push rod is centered in the tappet plunger cap seat.

(2) Using Mopar® Engine Oil Supplement, or equivalent, lubricate the area of the rocker arm that the pivot contacts. Install rocker arms, pivots and bridge above each cylinder in their originally position (Fig. 24).

(3) Loosely install the capscrews through each bridge.

(4) At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(5) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

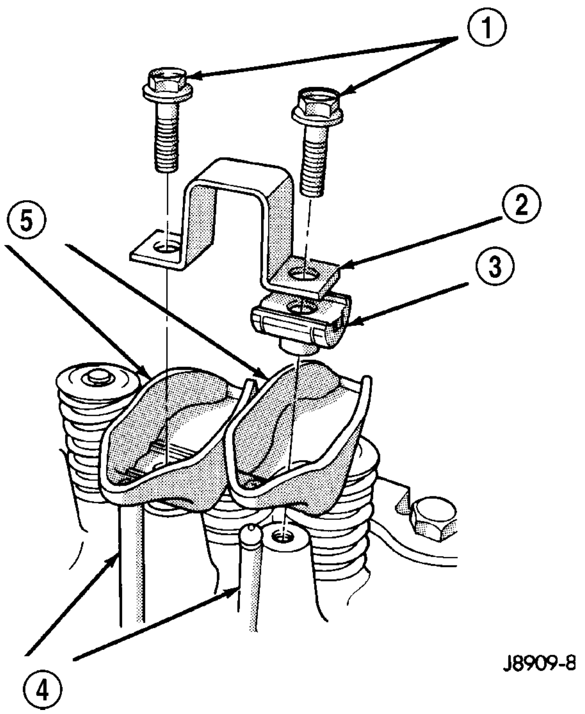


Fig. 24 Rocker Arm

1 - CAPSCREWS
2 - BRIDGE
3 - PIVOT ASSEMBLY
4 - PUSH RODS
5 - ROCKER ARMS

VALVE STEM SEALS

DESCRIPTION

The valve stem seals (Fig. 25) are made of rubber and incorporate a garter spring to maintain consistent lubrication control.

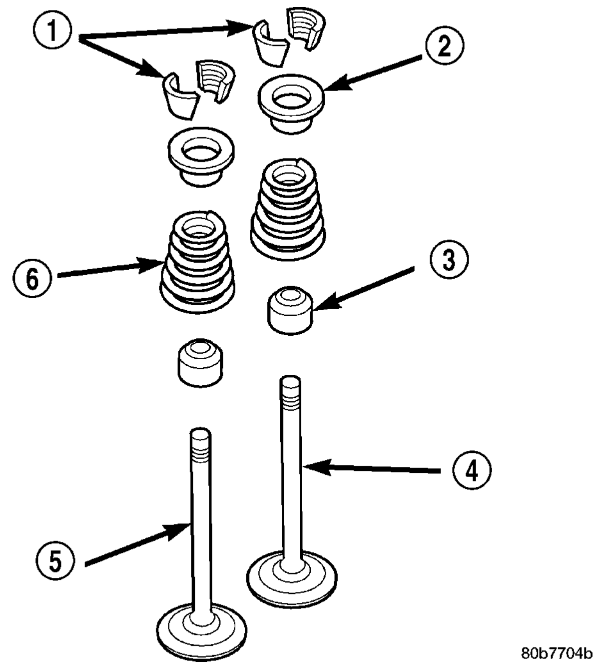


Fig. 25 Valve

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

VALVE SPRINGS

DESCRIPTION

The valve springs (Fig. 26) are made of high strength silicon chrome spring steel. The springs are common for both intake and exhaust valves.

STANDARD PROCEDURE - VALVE SPRING TENSION TEST

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

Use a universal Valve Spring Tester and a torque wrench to test each valve spring for the specified tension value (Fig. 27).

Replace valve springs that are not within specifications.

REMOVAL

NOTE: This procedure can be done with the engine cylinder head installed on the block.

Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

VALVE SPRINGS (Continued)

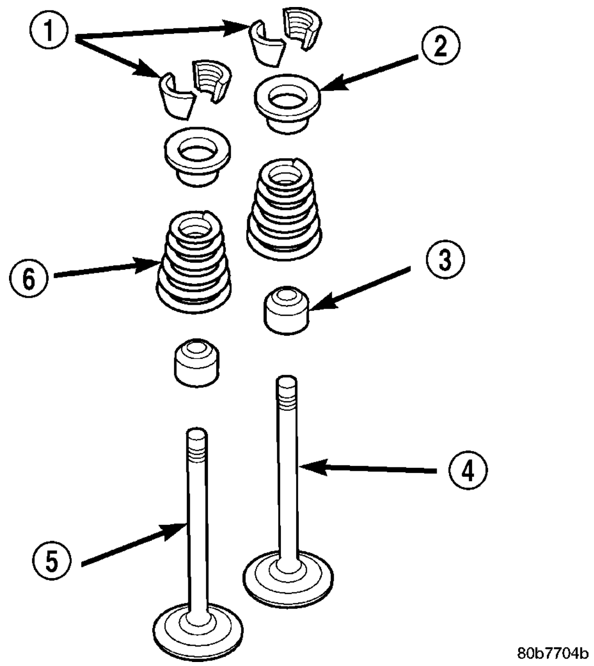


Fig. 26 VALVE AND KEEPER CONFIGURATION 4.0L

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

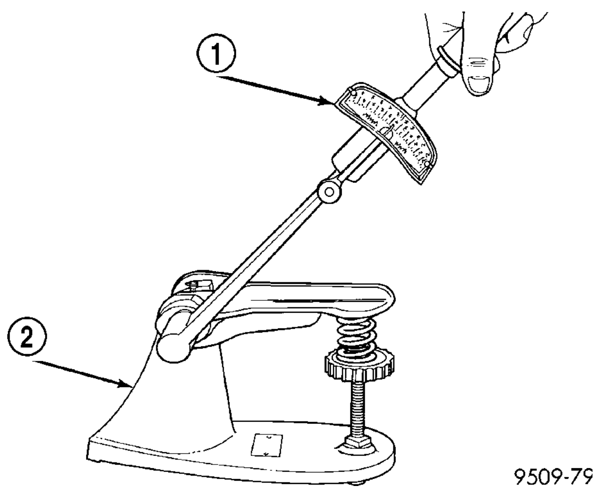


Fig. 27 Valve Spring Tester

1 - TORQUE WRENCH
2 - VALVE SPRING TESTER

Each valve spring is held in place by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

(1) Remove the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Remove cap screws, bridge and pivot assemblies and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL) for access to each valve spring to be removed.

(3) Remove push rods. **Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed.**

(4) Inspect the springs and retainer for cracks and possible signs of weakening.

(5) Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.

(6) Connect an air hose to the adapter and apply air pressure slowly. Maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats. For vehicles equipped with an air conditioner, use a flexible air adaptor when servicing the No.1 cylinder.

(7) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool MD-998772A to compress the spring and remove the locks (Fig. 28).

(8) Remove valve spring and retainer (Fig. 28).

(9) Remove valve stem oil seals (Fig. 28). Note the valve seals are different for intake and exhaust valves. The top of each seal is marked either INT (intake/black in color) or EXH (exhaust/brown in color). DO NOT mix the seals.

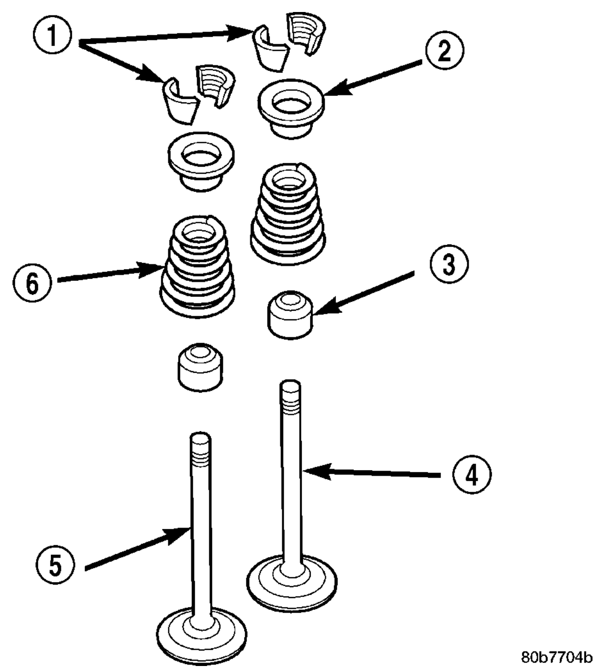


Fig. 28 Valve and Valve Components

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

VALVE SPRINGS (Continued)

INSTALLATION

NOTE: This procedure can be done with the engine cylinder head installed on the block.

CAUTION: Install oil seals carefully to prevent damage from the sharp edges of the valve spring lock grove.

(1) Lightly push the valve seal over the valve stem and valve guide boss. Be sure the seal is completely seated on the valve guide boss.

(2) Install valve spring and retainer (Fig. 29).

(3) Compress the valve spring with Valve Spring Compressor Tool MD-998772A and insert the valve locks. Release the spring tension and remove the tool. Tap the spring from side-to-side to ensure that the spring is seated properly on the engine cylinder head.

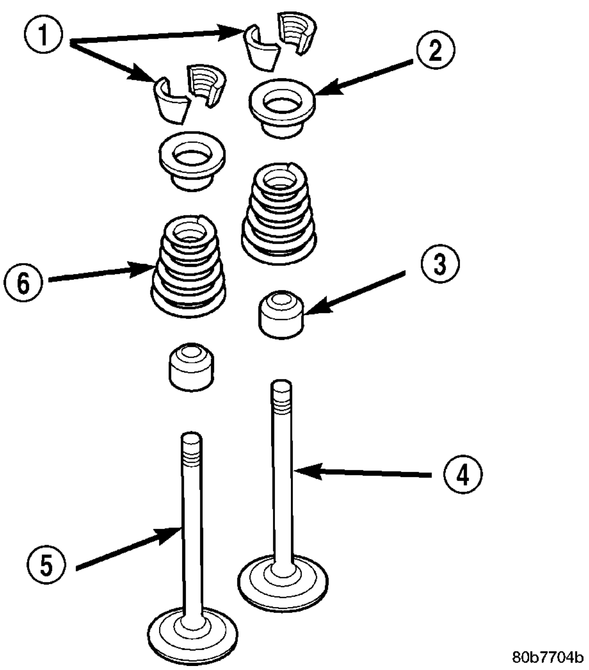


Fig. 29 Valve and Valve

1 - VALVE LOCKS (3–BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING

(4) Release air pressure and disconnect the air hose. Remove the adaptor from the spark plug hole and install the spark plug.

(5) Repeat the procedures for each remaining valve spring to be removed.

(6) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

(7) Install the rocker arms, pivots and bridge (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION) at their original location.

(8) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

ENGINE BLOCK

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

INSPECTION

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter (Fig. 30). To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

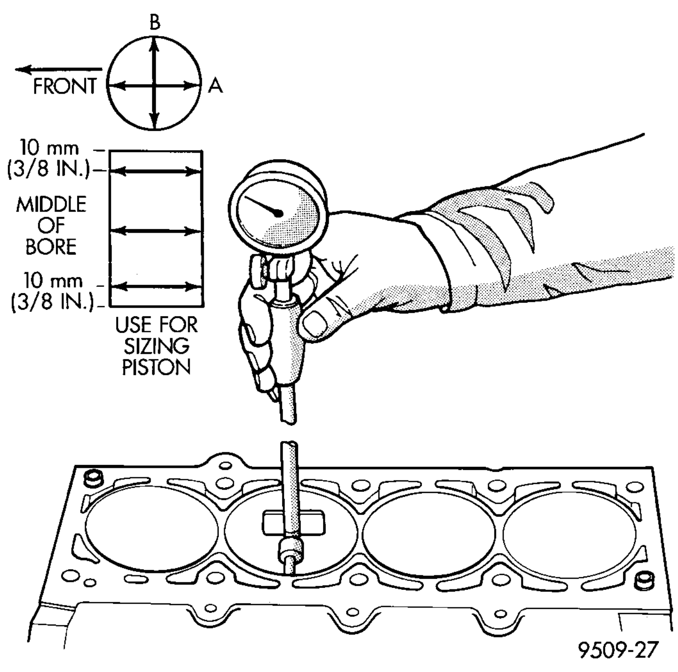


Fig. 30 Cylinder Bore Measurement

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpen-

ENGINE BLOCK (Continued)

dicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

CAMSHAFT & BEARINGS (IN BLOCK)

DESCRIPTION

The camshaft is made of gray cast iron with twelve machined lobes and four bearing journals (Fig. 31). When the camshaft rotates the lobes actuate the tappets and push rods, forcing upward on the rocker arms which applies downward force on the valves.

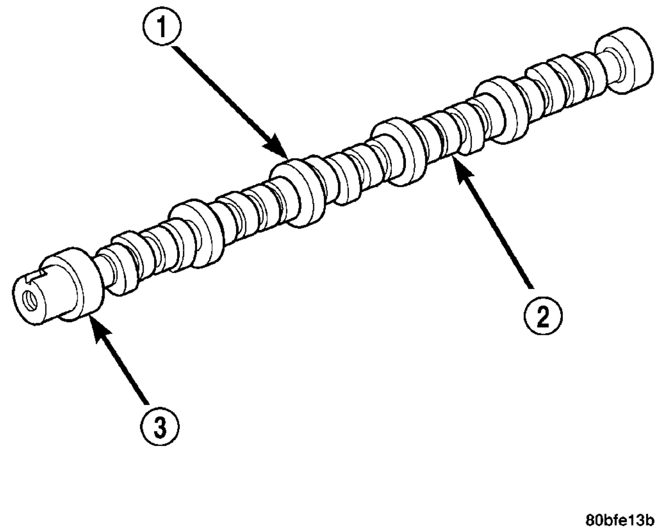


Fig. 31 Camshaft—Typical

1 - CAMSHAFT
2 - LOBES
3 - BEARING JOURNAL

REMOVAL

REMOVAL - CAMSHAFT BEARINGS

The camshaft rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed. The camshaft bearing bores and bearing diameters are not the same size. They are stepped down in 0.254 mm (0.010 inch) increments from the front bearing (largest) to the rear bearing (smallest). This permits easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated. Camshaft end play is maintained by the thrust plate.

(1) Remove the camshaft (Refer to 9 - ENGINE/ ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).

NOTE: It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available, such as recommended tool 8544 Camshaft Bushing Remover Installer.

(2) Using Special tool 8544 Camshaft Bushing Remover Installer, remove the camshaft bearings.

REMOVAL - CAMSHAFT

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. RELEASE THE PRESSURE BEFORE REMOVING THE DRAIN COCK, CAP AND DRAIN PLUGS.

(1) Disconnect negative cable from battery.

(2) Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(3) Remove the radiator (Refer to 7 - COOLING/ ENGINE/RADIATOR - REMOVAL) and condenser (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING/A/C CONDENSER - REMOVAL), if equipped with A/C.

(4) Remove the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Remove the rocker arms, bridges and pivots (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

(6) Remove the push rods.

(7) Remove the engine cylinder head and gasket (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(8) Remove the hydraulic valve tappets from the engine cylinder block (Refer to 9 - ENGINE/ENGINE

CAMSHAFT & BEARINGS (IN BLOCK) (Continued)

BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - REMOVAL).

(9) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(10) Remove the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(11) Rotate the crankshaft until the crankshaft sprocket timing mark is aligned on centerline with the camshaft sprocket timing mark (Fig. 33).

(12) Remove the timing chain and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/ CHAIN AND SPROCKETS - REMOVAL).

(13) Remove the front bumper and/or grille, as required.

(14) Remove the two thrust plate retaining screws, thrust plate and camshaft (Fig. 32).

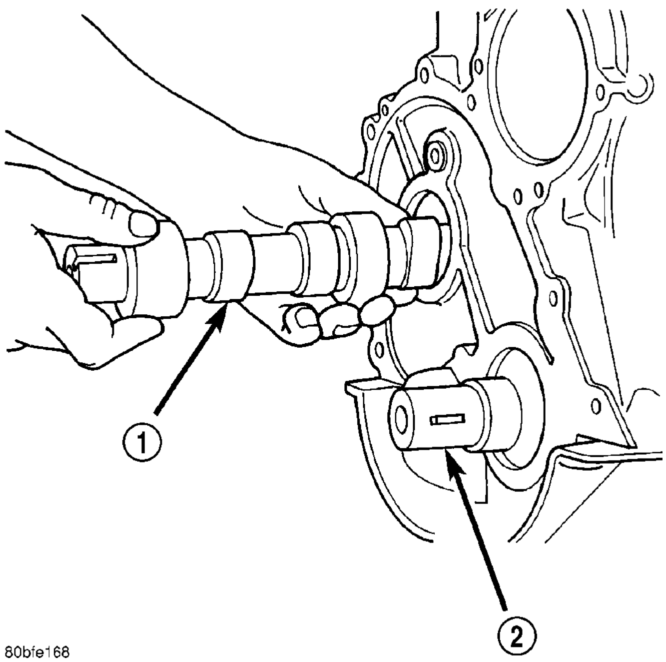


Fig. 32 Camshaft Removal

1 - CAMSHAFT
2 - CRANKSHAFT

INSTALLATION

INSTALLATION - CAMSHAFT BEARINGS

CAUTION: Make sure outside diameter of number 1 bearing is clean. Make sure that the bearing is properly installed in the engine block, align the oil hole in the bearing with the oil gallery in the bearing bore. Failure to do so will cause inadequate oil supply for the sprockets and timing chain.

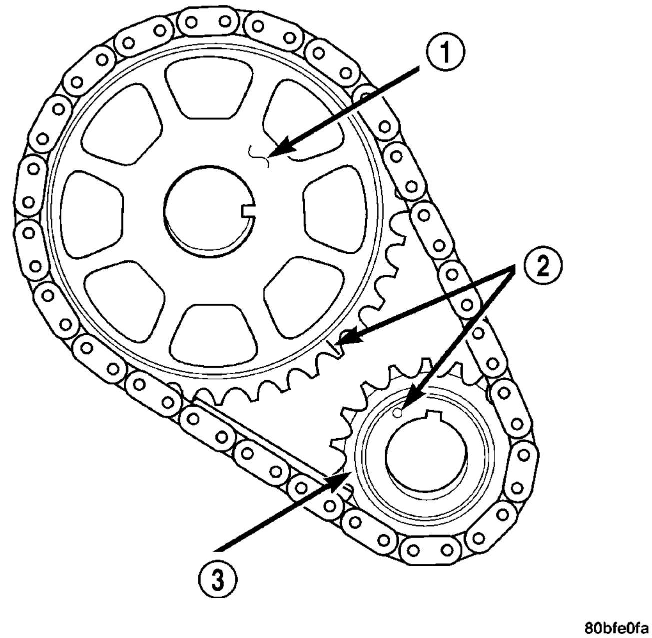


Fig. 33 Crankshaft / Camshaft Sprocket Timing Mark Alignment

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

(1) Using recommended special tool 8544 Camshaft Bearing Remover/Installer, install new camshaft bearings.

INSTALLATION - CAMSHAFT

(1) Lubricate the camshaft with Mopar® Engine Oil Supplement, or equivalent.

(2) Carefully install the camshaft to prevent damage to the camshaft bearings.

(3) Position thrust plate and install retaining screws. Tighten screws to 24 N·m (18 ft. lbs.).

(4) Lubricate the camshaft with Mopar® engine oil supplement, or equivalent.

(5) Install the camshaft sprocket, crankshaft sprocket and timing chain (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Tighten the camshaft sprocket bolt and washer to 68 N·m (50 ft. lbs.).

(7) To verify correct installation of the timing chain, turn the crankshaft two full revolutions then position the camshaft sprocket timing mark as shown in (Fig. 34).

(8) Install the timing case cover with a replacement oil seal (Fig. 35). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

CAMSHAFT & BEARINGS (IN BLOCK) (Continued)

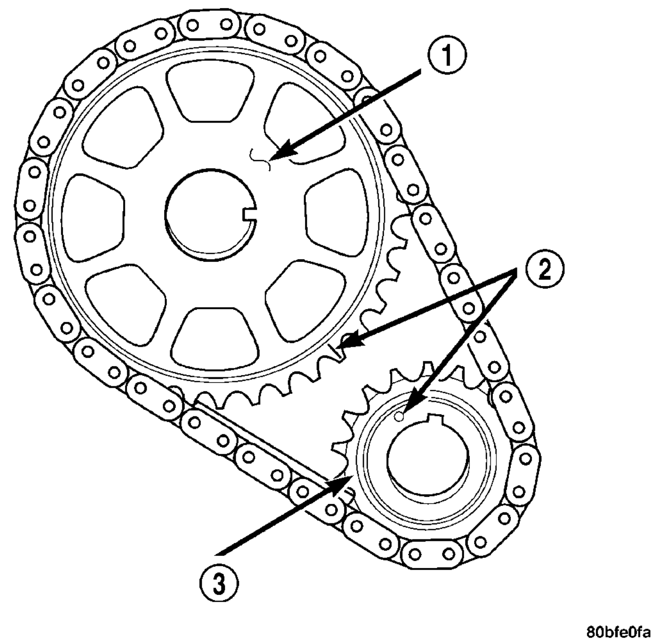


Fig. 34 Crankshaft / Camshaft Chain Drive Installation—Typical

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

(9) Install the vibration damper (Fig. 35) (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

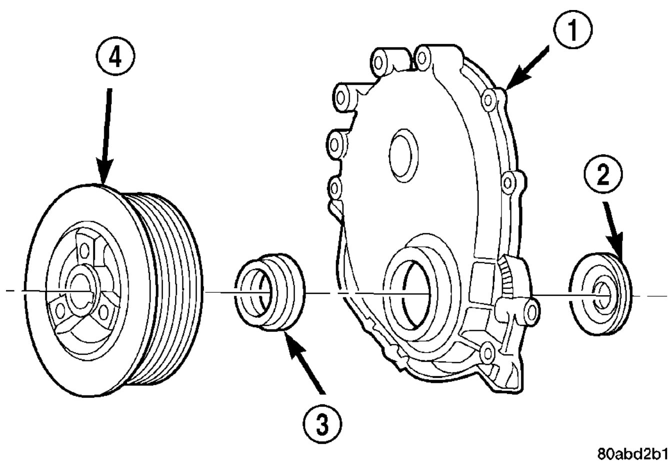


Fig. 35 Timing Case Cover Components

1 - TIMING CASE COVER
2 - OIL SLINGER
3 - CRANKSHAFT OIL SEAL
4 - VIBRATION DAMPER PULLEY

(10) Install the hydraulic valve tappets (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - INSTALLATION).

(11) Install the cylinder head gasket with the numbers facing up.

(12) Install the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(13) Install the push rods.

(14) Install the rocker arms and pivot and bridge assemblies (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - INSTALLATION).

(15) Install the engine cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(16) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

NOTE: During installation, lubricate the hydraulic valve tappets and all valve components with Mopar® Engine Oil Supplement, or equivalent. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(17) Install the radiator (Refer to 7 - COOLING/ ENGINE/RADIATOR - INSTALLATION).

(18) Check the ignition timing and adjust as necessary.

(19) Install the grille and bumper, if removed.

(20) Connect negative cable to battery.

CONNECTING ROD BEARINGS

STANDARD PROCEDURE - FITTING CONNECTING ROD BEARINGS

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 36) (Fig. 37). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 38). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

BEARING-TO-JOURNAL CLEARANCE

(1) Wipe the oil from the connecting rod journal.

(2) Use short rubber hose sections over rod bolts during installation.

(3) Lubricate the upper bearing insert and install in connecting rod.

CONNECTING ROD BEARINGS (Continued)

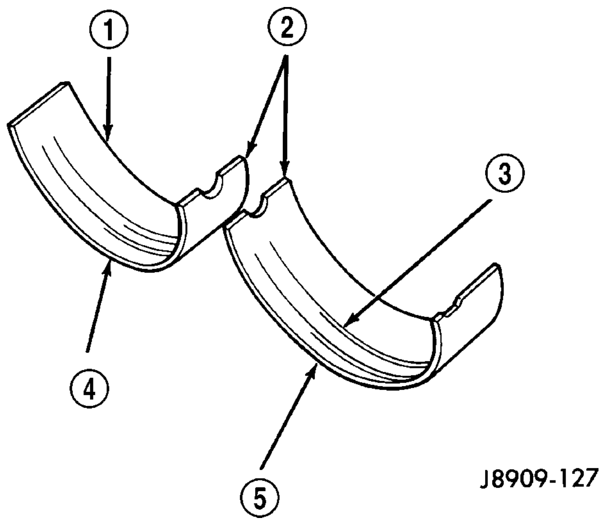


Fig. 36 Connecting Rod Bearing Inspection

1 - UPPER BEARING HALF
2 - MATING EDGES
3 - GROOVES CAUSED BY ROD BOLTS SCRATCHING JOURNAL DURING INSTALLATION
4 - WEAR PATTERN - ALWAYS GREATER ON UPPER BEARING
5 - LOWER BEARING HALF

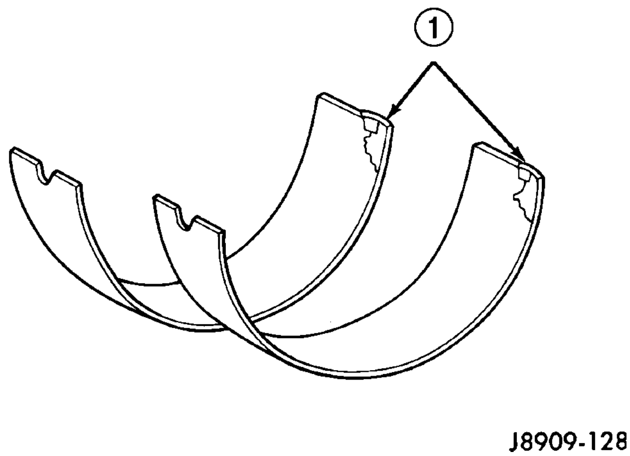


Fig. 37 Locking Tab Inspection

1 - ABNORMAL CONTACT AREA CAUSED BY LOCKING TABS NOT FULLY SEATED OR BEING BENT

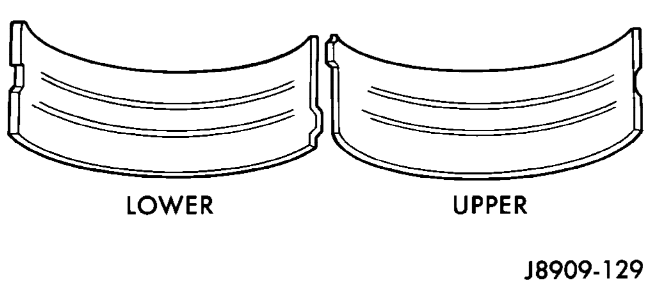


Fig. 38 Scoring Caused by Insufficient Lubrication or Damaged Crankshaft Journal

(4) Use piston ring compressor to install the rod and piston assemblies. The oil squirt holes in the rods must face the camshaft. The arrow on the piston crown should point to the front of the engine (Fig. 39). Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

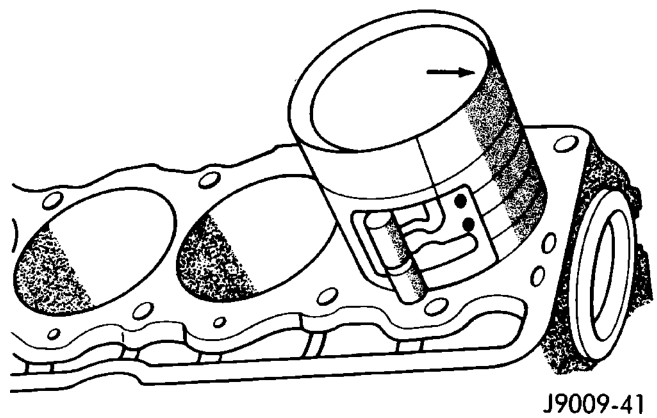


Fig. 39 Rod and Piston Assembly Installation

(5) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

(6) Install bearing cap and connecting rod on the journal and tighten nuts to 45 N·m (33 ft. lbs.) torque. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(7) Remove the bearing cap and determine amount of bearing-to- journal clearance by measuring the width of compressed Plastigage (Fig. 40). **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

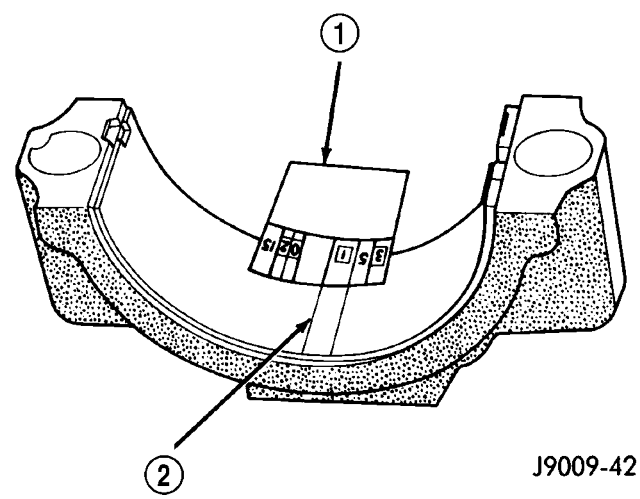


Fig. 40 Measuring Bearing Clearance with Plastigage

1 - PLASTIGAGE SCALE
2 - COMPRESSED PLASTIGAGE

CONNECTING ROD BEARINGS (Continued)

(8) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(9) If bearing-to-journal clearance exceeds the specification, install a pair of 0.0254 mm (0.001 inch) undersize bearing inserts. All the odd size inserts must be on the bottom. The sizes of the service replacement bearing inserts are stamped on the backs of the inserts. Measure the clearance as described in the previous steps.

(10) The clearance is measured with a pair of 0.0254 mm (0.001 inch) undersize bearing inserts installed. This will determine if two 0.0254 mm (0.001 inch) undersize inserts or another combination is needed to provide the correct clearance. Refer to CONNECTING ROD BEARING FITTING CHART.

CONNECTING ROD BEARING FITTING CHART

CRANKSHAFT JOURNAL		CORRESPONDING ROD BEARING INSERT	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	53.2257 - 53.2079 mm (2.0955 - 2.0948 in.)	Yellow - Standard	Yellow - Standard
Orange	53.2079 - 53.1901 mm (2.0948 - 2.0941 in.) 0.0178 mm (0.0007 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	53.1901 - 53.1724 mm (2.0941 - 2.0934 in.) 0.0356 mm (0.0014 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Red	52.9717 - 52.9539 mm (2.0855 - 2.0848 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

(11) **FOR EXAMPLE:** If the initial clearance was 0.0762 mm (0.003 inch), 0.025 mm (0.001 inch) undersize inserts would reduce the clearance by 0.025 mm (0.001 inch). The clearance would be 0.002 inch and within specification. A 0.051 mm (0.002 inch) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 inch). The clearance would then be 0.038 mm (0.0015 inch).

(12) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(13) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 45 N·m (33 ft. lbs.) torque.

SIDE CLEARANCE MEASUREMENT

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange (Fig. 41). (Refer to 9 - ENGINE - SPECIFICATIONS). Replace the connecting rod if the side clearance is not within specification.

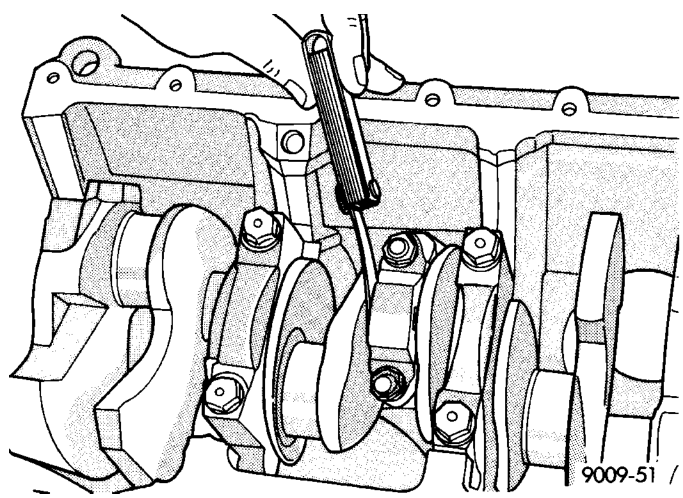


Fig. 41 Checking Connecting Rod Side Clearance - Typical

CRANKSHAFT

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by seven select main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The select fit main bearing markings are located on the crankshaft counter weights. The crankshaft rear oil seal is a two piece design. The front oil seal is a one piece design retained in the timing chain cover (Fig. 42).

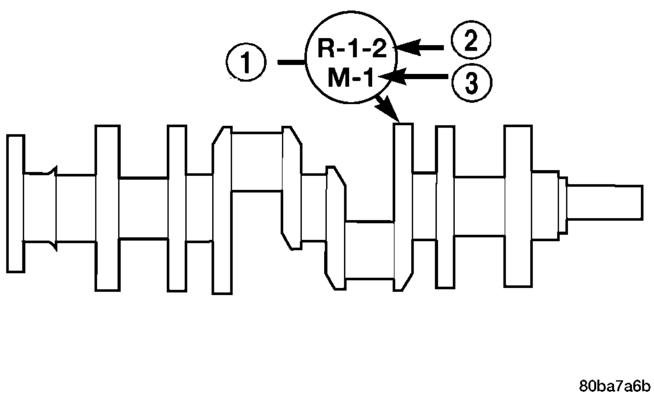


Fig. 42 Crankshaft with Select Fit Marking Location

1 - 1/4" LETTERS
2 - (ROD)
3 - (MAIN)

CRANKSHAFT MAIN BEARINGS

STANDARD PROCEDURE - FITTING CRANKSHAFT MAIN BEARINGS

FITTING BEARINGS (CRANKSHAFT INSTALLED)

The main bearing caps, numbered (front to rear) from 1 through 7 have an arrow to indicate the forward position. The upper main bearing inserts are grooved to provide oil channels while the lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance. In production, the select fit is obtained by using various-sized color-coded bearing insert pairs as listed in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert. **The size is not stamped on bearing inserts used for engine production.**

The main bearing journal size (diameter) is identified by a color-coded paint mark (Fig. 43)on the adjacent cheek or counterweight towards the rear of the crankshaft (flange end). The rear main journal, is identified by a color-coded paint mark on the crankshaft rear flange.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce the clearance by 0.013 mm (0.0005 inch). **Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 inch) difference in size. Refer to the Bearing Insert Pair Chart.**

NOTE: When replacing inserts, the odd size inserts must be either all on the top (in cylinder block) or all on the bottom (in main bearing cap).

Once the bearings have been properly fitted, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - INSTALLATION).

BEARING-TO-JOURNAL CLEARANCE (CRANKSHAFT INSTALLED)

When using Plastigage, check only one bearing clearance at a time.

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten the bolts to 108 N·m (80 ft. lbs.) torque.

NOTE: DO NOT rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate reading. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

Remove the bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope (Fig. 44). (Refer to 9 - ENGINE - SPECIFICATIONS) for the proper clearance.

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replacement of the bearing inserts is not necessary. Remove the Plastigage from the crankshaft journal and bearing insert. Proceed to (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT MAIN BEARINGS - INSTALLATION).

CRANKSHAFT MAIN BEARINGS (Continued)

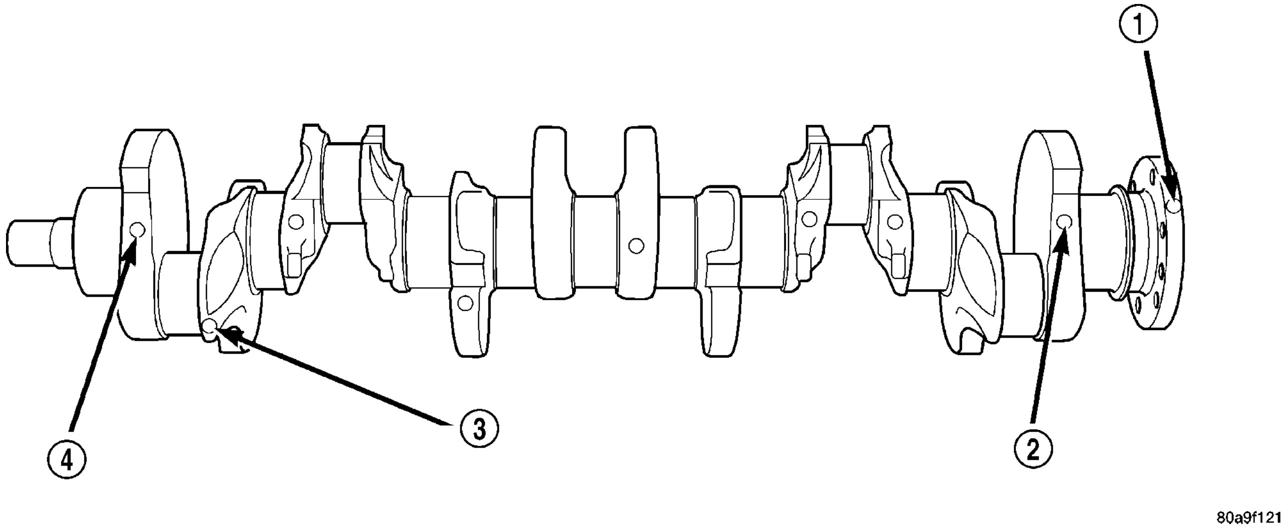


Fig. 43 Crankshaft Journal Size Paint I.D. Location

1 - NO. 7 MAIN JOURNAL SIZE PAINT MARK
2 - NO. 6 CONNECTING ROD JOURNAL SIZE PAINT MARK
3 - NO. 1 CONNECTING ROD JOURNAL SIZE PAINT MARK
4 - NO. 1 MAIN JOURNAL SIZE PAINT MARK

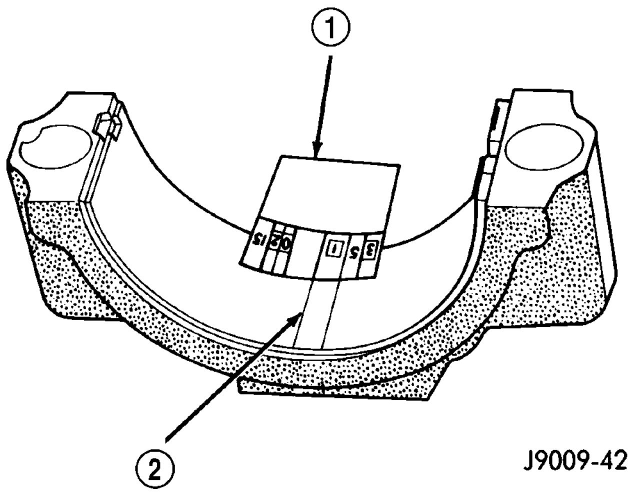


Fig. 44 Measuring Bearing Clearance with Plastigage

1 - PLASTIGAGE SCALE
2 - COMPRESSED PLASTIGAGE

If the clearance exceeds specification, install a pair of 0.025 mm (0.001 inch) undersize bearing inserts and measure the clearance as described in the previous steps.

The clearance indicate with the 0.025 mm (0.001 inch) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance. **FOR EXAMPLE:** If the clearance was 0.0762 mm (0.003 inch) originally, a pair of 0.0254 mm (0.001 inch) undersize inserts would reduce the clearance by 0.0254 mm (0.001 inch). The clearance would then be 0.0508 mm (0.002 inch) and within the specification. A 0.051 mm (0.002 inch) undersize bearing insert and a 0.0254 mm (0.001 inch) undersize insert would reduce the original clearance an additional 0.0127 mm (0.0005 inch). The clearance would then be 0.0381 mm (0.0015 inch).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair.

FOR EXAMPLE: DO NOT use a standard size upper insert and a 0.051 mm (0.002 inch) undersize lower insert.

If the clearance exceeds specification using a pair of 0.051 mm (0.002 inch) undersize bearing inserts, measure crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

Replace the crankshaft or grind to accept the appropriate undersize bearing inserts if:

- Journal diameters 1 through 6 are less than 63.4517 mm (2.4981 inches)
- Journal 7 diameter is less than 63.4365 mm (2.4975 inches).

Once the proper clearances have been obtained, proceed to (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - INSTALLATION).

JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

CRANKSHAFT MAIN BEARINGS (Continued)

The maximum allowable taper and out of round is 0.013 mm (0.0005 inch). Compare the measured diameter with the journal diameter specification MAIN BEARING FITTING CHART. Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block.

MAIN BEARING FITTING CHART

Crankshaft Journals #1-6		**Corresponding Crankshaft Bearing Insert**	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	63.5025 -63.4898 mm (2.5001 - 2.4996 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4898 - 63.4771 mm (2.4996 - 2.4991 in.) 0.0127 mm (0.0005 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	63.4771 - 63.4644 mm (2.4991 - 2.4986 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4644 - 63.4517 mm (2.4986 - 2.4981 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2485 - 63.2358 mm (2.4901 - 2.4896 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

Crankshaft Journal #7 Only		**Corresponding Bearing Insert**	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	63.4873 - 63.4746 mm (2.4995 - 2.4990 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4746 - 63.4619 mm (2.4990 - 2.4985 in.) 0.0127 mm (0.0005 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	63.4619 - 63.4492 mm (2.4985 - 2.4980 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4492 - 63.4365 mm (2.4980 - 2.4975 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2333 - 63.2206 mm (2.4895 - 2.4890 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

(3) Raise the vehicle.

(4) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL) and oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(5) Remove main bearing cap brace (Fig. 45).

CRANKSHAFT MAIN BEARINGS (Continued)

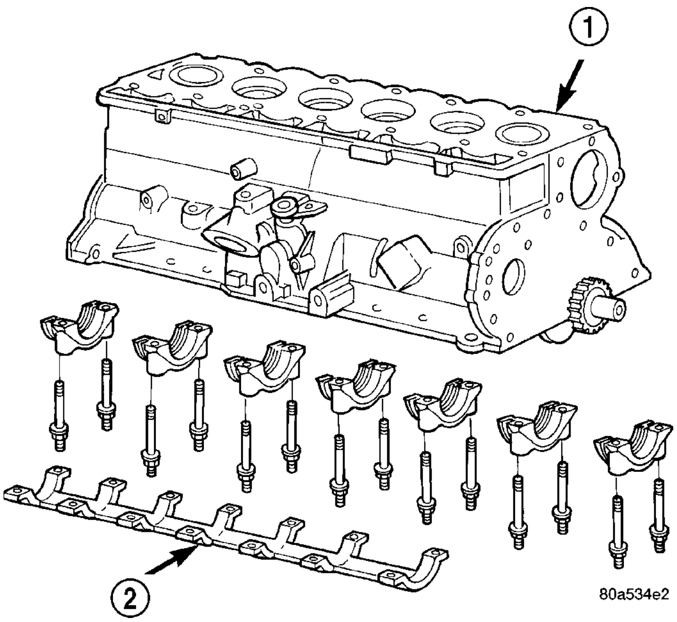


Fig. 45 Main Bearing Caps and Brace.

1 - BLOCK
2 - MAIN BEARING CAP BRACE

(6) Remove only one main bearing cap and lower insert at a time (Fig. 46).

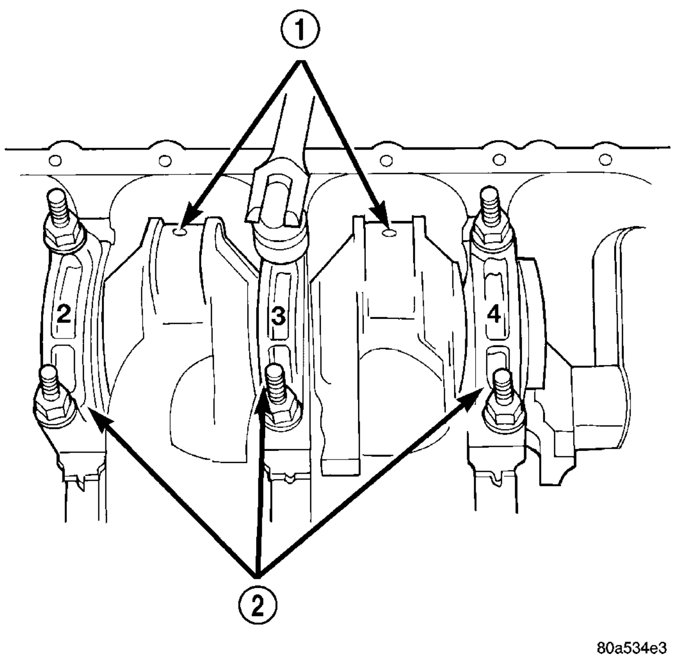


Fig. 46 Removing Main Bearing Caps and Lower Inserts

1 - CONNECTING ROD JOURNAL
2 - MAIN BEARING CAPS

(7) Remove the lower insert from the bearing cap.

(8) Remove the upper insert by LOOSENING (DO NOT REMOVE) all of the other bearing caps. Now insert a small cotter pin tool in the crankshaft journal oil hole. Bend the cotter pin as illustrated to fabricate the tool (Fig. 47). With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab. Because there is no hole in the No.3 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing insert (Fig. 47). After moving the insert approximately 25 mm (1 inch), it can be removed by applying pressure under the tab.

(9) Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

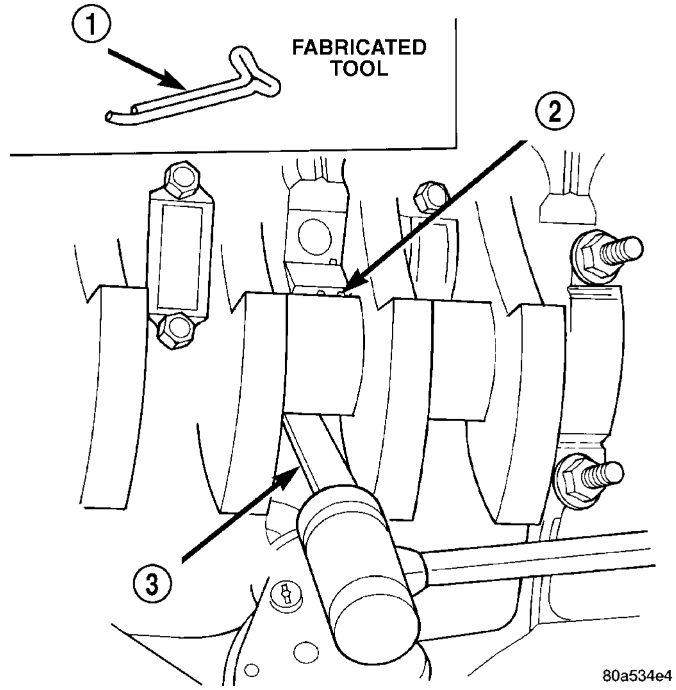


Fig. 47 Removing Upper Inserts

1 - COTTER PIN
2 - BEARING INSERT
3 - TONGUE DEPRESSOR

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 48). In general the lower bearing half will have a heaver wear pattern.

NOTE: If any of the crankshaft journals are scored, remove the engine for crankshaft repair.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

CRANKSHAFT MAIN BEARINGS (Continued)

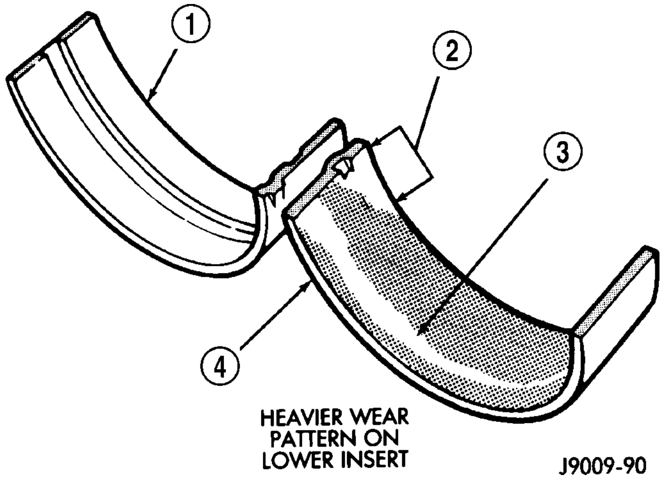


Fig. 48 Main Bearing Wear Patterns

1 - UPPER INSERT
2 - NO WEAR IN THIS AREA
3 - LOW AREA IN BEARING LINING
4 - LOWER INSERT

INSTALLATION

(1) Lubricate the bearing surface of each insert with engine oil.

(2) Loosen all the main bearing caps. Install the main bearing upper inserts.

(3) Install the lower bearing inserts into the main bearing caps.

(4) On the rear main cap, apply Mopar® Gasket Maker sealer on both sides of cylinder block as shown in (Fig. 49). The dab of sealer should be 3 mm (0.125 in.) in diameter.

(5) Apply Mopar® Gasket Maker on the rear bearing cap. The bead should be 2.3 mm (0.09 in.) in diameter. DO NOT apply sealer to the lip of the seal.

(6) Install the main bearing cap(s) and lower insert(s).

(7) Tighten the bolts of caps 1, 2, 4, 5, 6, and 7 to 54 N·m (40 ft. lbs.) torque. Now tighten these bolts to 95 N·m (70 ft. lbs.) torque. Finally, tighten these bolts to 108 N·m (80 ft. lbs.) torque.

(8) Push the crankshaft forward and backward. Load the crankshaft front or rear and tighten cap bolt No.3 to 54 N·m (40 ft. lbs.) torque. Then tighten to 95 N·m (70 ft. lbs.) torque and finally tighten to 108 N·m (80 ft. lbs.) torque.

(9) Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

(10) Check crankshaft end play. Crankshaft end play is controlled by the thrust bearing which is flange and installed at the No.2 main bearing position.

(a) Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

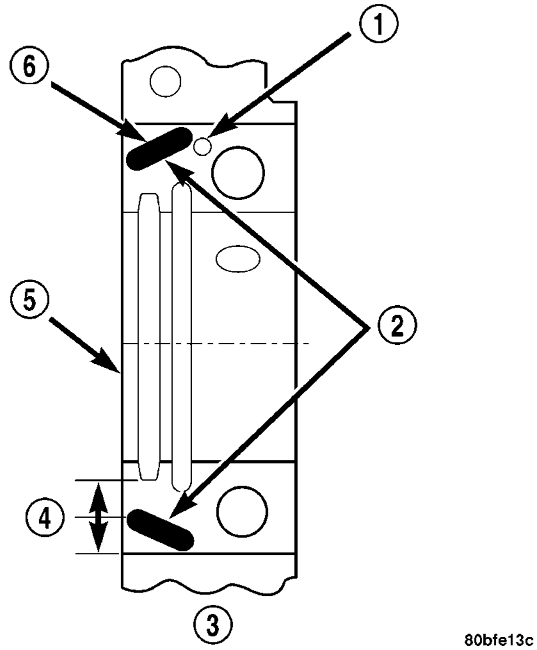


Fig. 49 Location of Sealer

1 - **DOWEL**
2 - **SEALER LOCATIONS**
3 - **CYLINDER BLOCK**
4 - **HALFWAY BETWEEN**
5 - **REAR FACE OF CYLINDER BLOCK**
6 - **3mm (0.125 in.)**

(b) Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

(c) Pry the crankshaft forward, position the dial indicator to zero.

(d) Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements (Fig. 50). Correct end play is 0.038-0.165 mm (0.0015-0.0065 inch). The desired specifications are 0.051-0.064 mm (0.002-0.0025 inch).

(e) If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

(11) If the crankshaft was removed, install the crankshaft into the cylinder block.

(12) Install main bearing cap brace tighten nuts to 47 N·m (35 ft. lbs.) torque.

(13) Install oil pump assy. and tighten attaching bolts to 23 N·m (17 ft. lbs.)

(14) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(15) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(16) Lower the vehicle.

CRANKSHAFT MAIN BEARINGS (Continued)

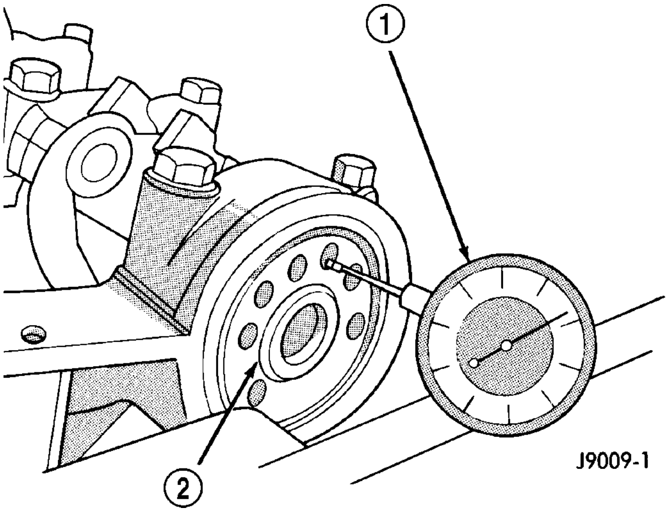


Fig. 50 Crankshaft End Play Measurement

1 - DIAL INDICATOR
2 - CRANKSHAFT

(17) Install the spark plugs. Tighten the plugs to 37 N·m (27 ft. lbs.) torque.

(18) Fill the oil pan with engine oil to the full mark on the dipstick level.

(19) Connect negative cable to battery.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

This procedure is done with the timing case cover installed.

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(4) Remove the radiator shroud.

(5) Carefully remove the oil seal. Make sure seal bore is clean.

INSTALLATION

This procedure is done with the timing case cover installed.

(1) Position the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool 6139 with seal open end facing inward. Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal. Lightly coat the crankshaft with engine oil.

(2) Position the tool and seal over the end of the crankshaft and insert a draw screw tool into Seal Installation Tool 6139 (Fig. 51). Tighten the nut against the tool until it contacts the cover.

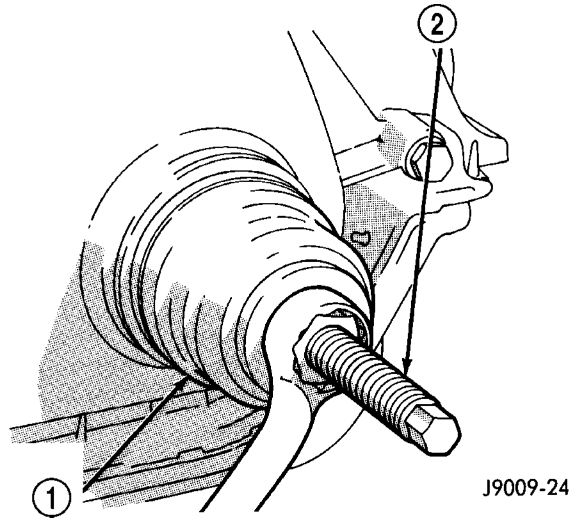


Fig. 51 Timing Case Cover Oil Seal Installation

1 - SEAL INSTALLATION TOOL
2 - DRAW SCREW TOOL

(3) Remove the tools. Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(4) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(5) Install the serpentine belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install the radiator shroud.

(7) Connect negative cable to battery.

CRANKSHAFT OIL SEAL - REAR

REMOVAL

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

(1) Remove transmission inspection cover.

(2) Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)

(3) Remove main bearing cap brace.

(4) Remove rear main bearing cap (No.7).

(5) Push upper seal out of the groove. Ensure that the crankshaft and seal groove are not damaged.

CRANKSHAFT OIL SEAL - REAR (Continued)

(6) Remove lower half of the seal from the bearing cap.

INSTALLATION

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

(1) Wipe the seal surface area of the crankshaft until it is clean.

(2) Apply a thin coat of engine oil.

(3) Coat lip of the seal with engine oil.

(4) Carefully position the upper seal into the groove in the cylinder block. The lip of the seal faces toward the front of the engine.

(5) Apply Mopar® Gasket Maker sealer on both sides of cylinder block as shown in (Fig. 52). The dab of sealer should be 3 mm (0.125 in.) in diameter.

(6) Apply Mopar® Gasket Maker on the rear bearing cap (Fig. 52). The bead should be 2.3 mm (0.09 in.) in diameter. DO NOT apply sealer to the lip of the seal.

(7) Position the lower seal into the bearing cap recess and seat it firmly. Be sure the seal is flush with the cylinder block pan rail.

(8) Coat the outer curved surface of the lower seal with soap and the lip of the seal with engine oil.

(9) Install the rear main bearing cap. DO NOT strike the cap more than twice for proper engagement.

(10) Tighten all main bearing bolts to 108 N·m (80 ft. lbs.) torque.

(11) Install the main bearing cap brace. Tighten nuts to 47 N·m (35 ft. lbs.).

(12) Install the oil pan gasket and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(13) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 53)

(14) Install transmission inspection cover.

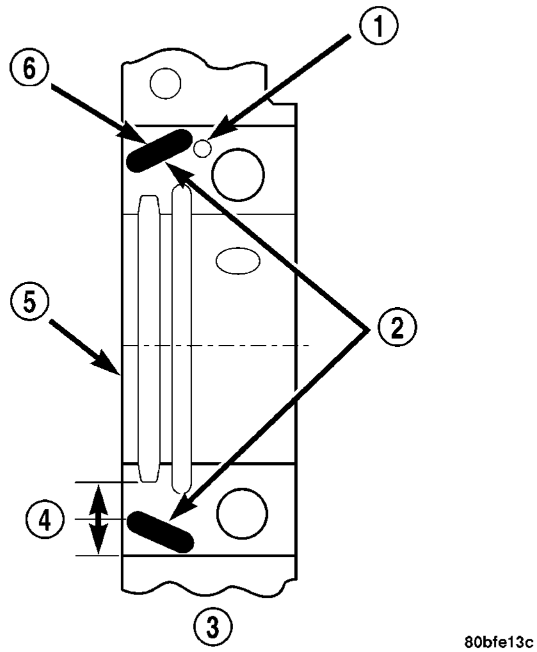


Fig. 52 Location of Sealer

1 - DOWEL
2 - SEALER LOCATIONS
3 - CYLINDER BLOCK
4 - HALFWAY BETWEEN
5 - REAR FACE OF CYLINDER BLOCK
6 - 3mm (0.125 in.)

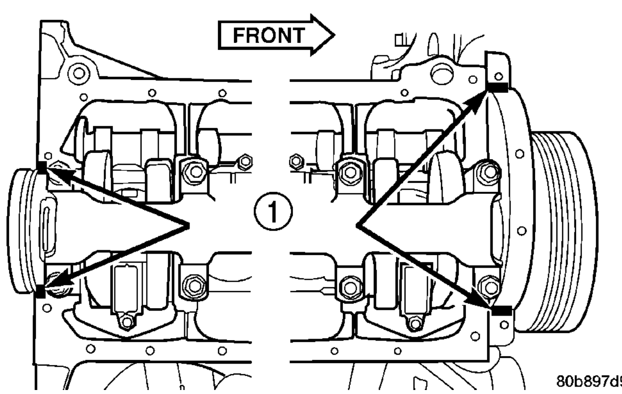


Fig. 53 Oil Pan

1 - SEALER LOCATIONS

HYDRAULIC LIFTERS

DESCRIPTION

Valve lash is controlled by hydraulic tappets located inside the cylinder block, in tappet bores above the camshaft.

REMOVAL

NOTE: Retain all the components in the same order as removed.

(1) Remove the engine cylinder head(Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(2) Remove the push rods.

(3) Remove the tappets through the push rod openings in the cylinder block with a Hydraulic Valve Tappet Removal/Installation Tool (Fig. 54).

CLEANING

Clean each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

HYDRAULIC LIFTERS (Continued)

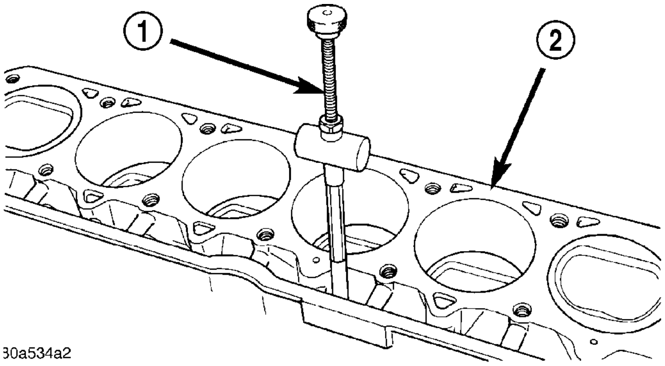


Fig. 54 HYDRAULIC VALVE TAPPET REMOVAL - 4.0L

1 - HYDRAULIC TAPPET REMOVAL TOOL
2 - CYLINDER BLOCK

INSPECTION

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with a straightedge positioned across the base. If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and tappets.

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 55).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Leak-Down Tester.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

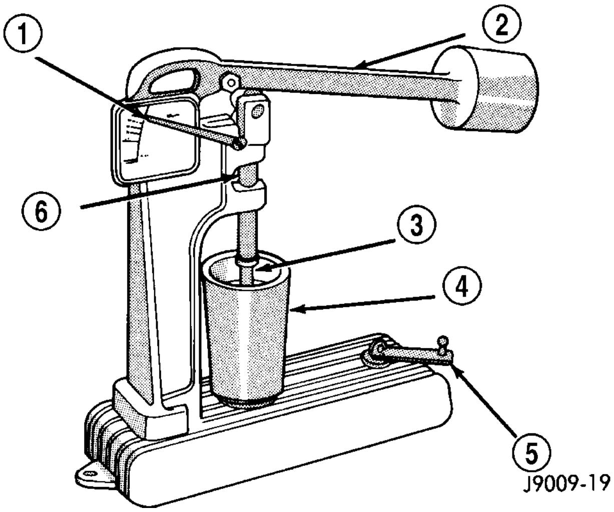


Fig. 55 Leak-Down Tester

1 - POINTER
2 - WEIGHTED ARM
3 - RAM
4 - CUP
5 - HANDLE
6 - PUSH ROD

INSTALLATION

Retain all the components in the same order as removed.

It is not necessary to charge the tappets with engine oil. They will charge themselves within a very short period of engine operation.

(1) Dip each tappet in Mopar® Engine Oil Supplement, or equivalent.

(2) Use Hydraulic Valve Tappet Removal/Installation Tool to install each tappet in the same bore from where it was originally removed.

(3) Install the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(4) Install the push rods in their original locations.

(5) Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

(6) Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(7) Pour the remaining Mopar® Engine Oil Supplement, or equivalent over the entire valve actuating assembly. The Mopar® Engine Oil Supplement, or equivalent must remain with the engine oil for at least 1 609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

HYDRAULIC LIFTERS (Continued)

(8) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

PISTON & CONNECTING ROD

DESCRIPTION

The pistons (Fig. 56) are made of a high strength aluminum alloy, the piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of cast iron.

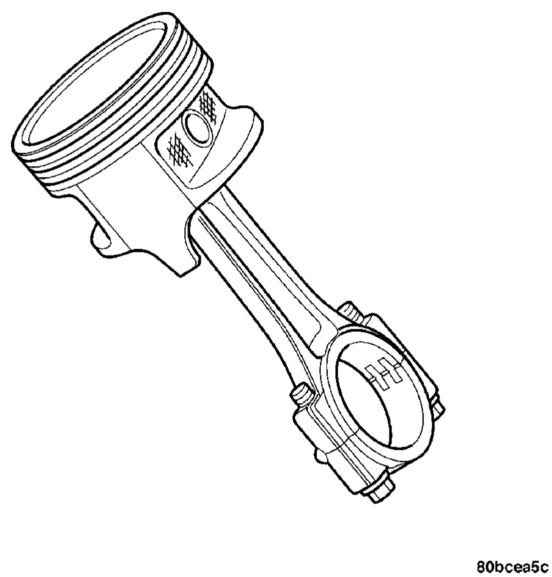


Fig. 56 Piston and Connecting Rod Assembly

STANDARD PROCEDURE - PISTON FITTING

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 58).

(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. **The coated piston connecting rod assembly can be used to service previous built engines and MUST be replaced as complete sets.** Tin coated pistons should not be used as replacements for coated pistons.

(4) The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results (Fig. 57). Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

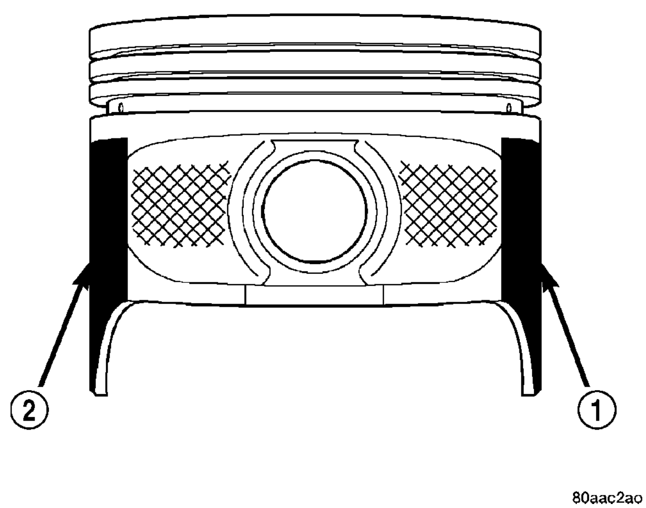


Fig. 57 Moly Coated Piston

1 - MOLY COATED
2 - MOLY COATED

PISTON & CONNECTING ROD (Continued)

PISTON SIZE CHART

CYLINDER BORE SIZE	PISTON LETTER SIZE
98.438 - 98.448 mm (3.8755 - 3.8759 in.)	A
98.448 - 98.458 mm (3.8759 - 3.8763 in.)	B
98.458 - 98.468 mm (3.8763 - 3.8767 in.)	C
98.468 - 98.478 mm (3.8767 - 3.8771 in.)	D
98.478 - 98.488 mm (3.8771 - 3.8775 in.)	E
98.488 - 98.498 mm (3.8775 - 3.8779 in.)	F

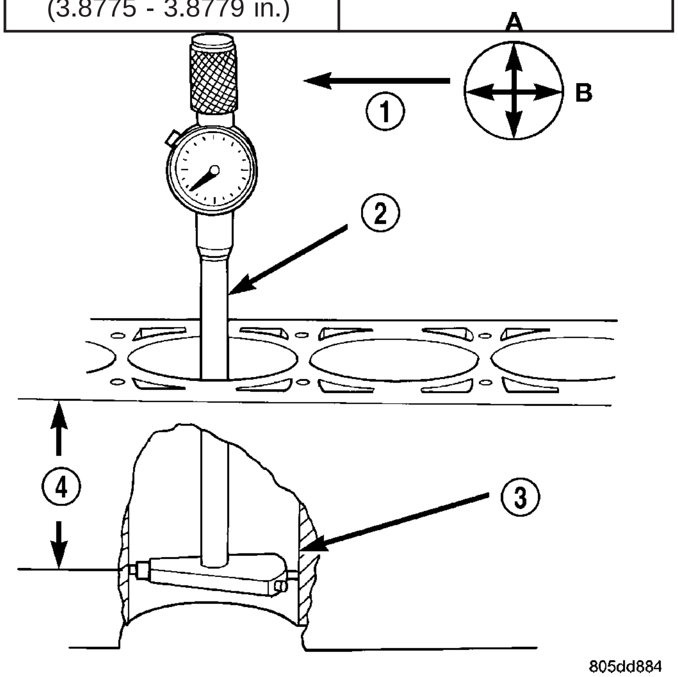


Fig. 58 Bore Gauge

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 49.5 MM (1-15/16 in.)

REMOVAL

(1) Remove the engine cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(2) Remove the rocker arms, bridges and pivots.

(3) Remove the push rods.

(4) Remove the engine cylinder head. (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(5) Position the pistons one at a time near the bottom of the stroke. Use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

(6) Raise the vehicle.

(7) Drain the engine oil.

(8) Remove the oil pan and gasket. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(9) Remove main bearing cap brace (Fig. 59).

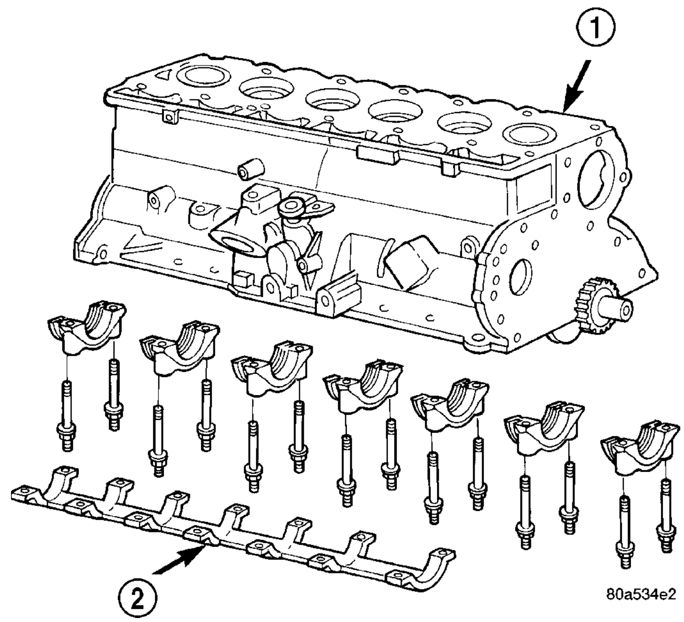


Fig. 59 Main Bearings Caps and Brace

1 - BLOCK
2 - MAIN BEARING CAP BRACE

(10) Remove the connecting rod bearing caps and inserts. Mark the caps and rods with the cylinder bore location. The connecting rods and caps are stamped with a two letter combination (Fig. 60).

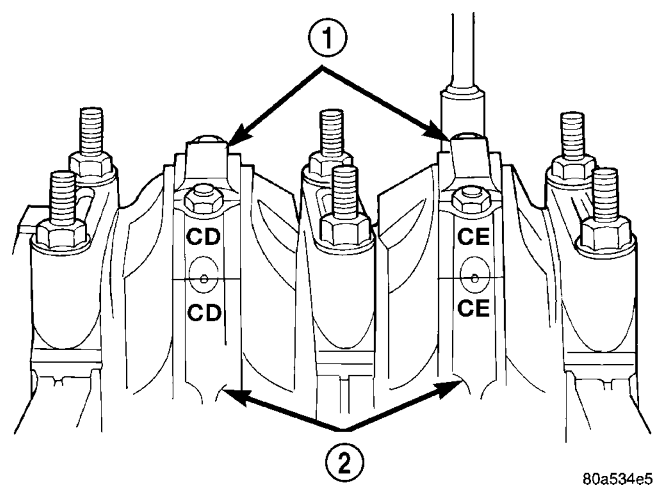


Fig. 60 Stamped Connecting Rods and Caps

1 - CONNECTING ROD CAP
2 - CONNECTING ROD

(11) Lower the vehicle until it is about 2 feet from the floor.

PISTON & CONNECTING ROD (Continued)

CAUTION: Ensure that the connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the rod bolts will provide protection during removal.

(12) Have an assistant push the piston and connecting rod assemblies up and through the top of the cylinder bores (Fig. 61).

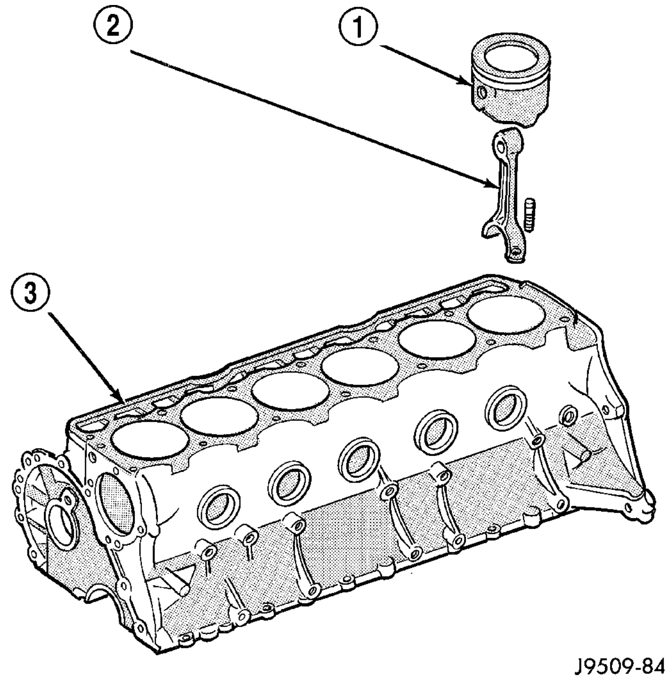


Fig. 61 Removal of Connecting Rod and Piston Assembly

1 - PISTON
2 - CONNECTING ROD
3 - BLOCK

INSTALLATION

(1) Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean lint-free cloth.

(2) Install the piston rings on the pistons if removed (Refer to 9 - ENGINE/ENGINE BLOCK/ PISTON RINGS - STANDARD PROCEDURE).

(3) Lubricate the piston and rings with clean engine oil.

CAUTION: Ensure that connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during installation.

(4) Use a piston ring compressor to install the connecting rod and piston assemblies through the top of the cylinder bores (Fig. 62).

(5) Ensure the arrow on the piston top points to the front of the engine (Fig. 62).

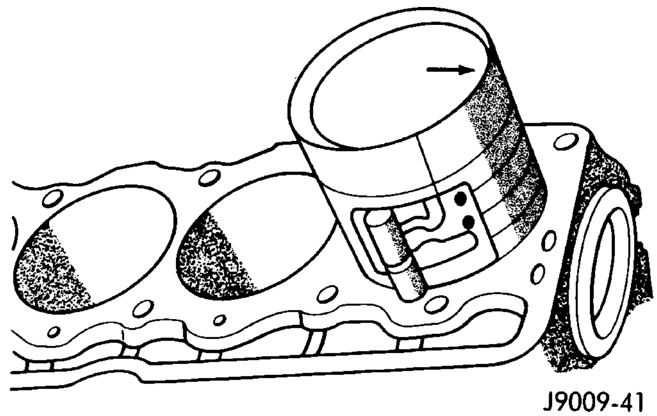


Fig. 62 Rod and Piston Assembly Installation

(6) Raise the vehicle.

(7) Each bearing insert is fitted to its respective journal to obtain the specified clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the Connecting Rod Bearing Fitting Chart. The color code appears on the edge of the bearing insert. The size is not stamped on inserts used for production of engines.

(8) The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flange (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the Connecting Rod Bearing Fitting Chart.

(9) When required, upper and lower bearing inserts of different sizes may be used as a pair (refer to Connecting Rod Bearing Fitting Chart). A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce clearance 0.013 mm (0.0005 inch).

CAUTION: DO NOT intermix bearing caps. Each connecting rod and bearing cap are stamped with the cylinder number. The stamp is located on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

(10) Install the connecting rod bearing caps and inserts in the same positions as removed.

CAUTION: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(11) Install main bearing cap brace (Fig. 59). Tighten nuts to 47 N·m (35 ft. lbs.).

(12) Install the oil pan and gasket (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(13) Lower the vehicle.

PISTON & CONNECTING ROD (Continued)

(14) Install the engine cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION), push rods, rocker arms, bridges, pivots and engine cylinder head cover(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(15) Fill the crankcase with engine oil.

PISTON RINGS

STANDARD PROCEDURE - PISTON RING FITTING

(1) Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring groove and pin boss must be clear. DO NOT remove metal from the grooves or lands. This will change ring-to-groove clearances and will damage the ring-to-land seating.

(2) Be sure the piston ring grooves are free of nicks and burrs.

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 63) (Fig. 64). Rotate the ring in the groove. It must move freely around circumference of the groove.

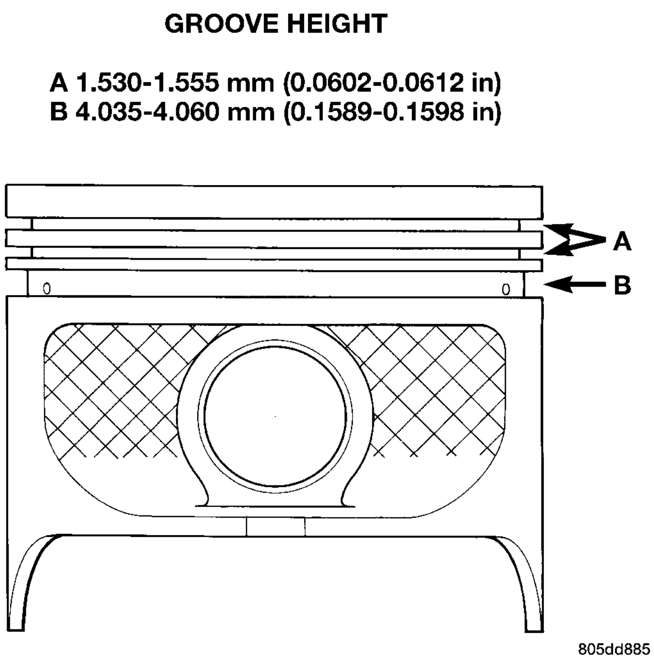


Fig. 63 Piston Dimensions

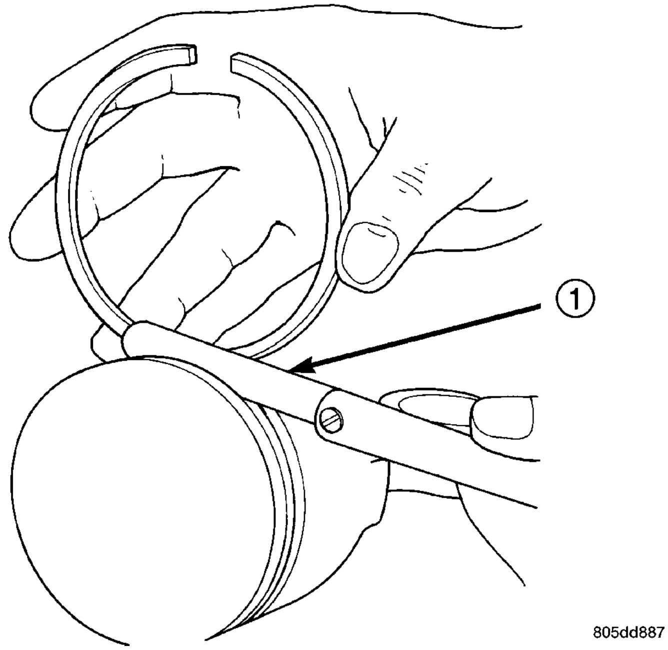


Fig. 64 Ring Side Clearance Measurement

1 - FEELER GAUGE

RING SIDE CLEARANCE CHART

ITEM	SPECIFICATION
Top Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Second Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Oil Control Ring	0.06 - 0.21 mm (0.0024 - 0.0083 in.)

(4) Place ring in the cylinder bore and push down with inverted piston to position near lower end of the ring travel. Measure ring gap with a feeler gauge fitting snugly between ring ends (Fig. 65).

RING GAP MEASUREMENT CHART

ITEM	SPECIFICATION
Top Compression Ring	0.229 - 0.610 mm (0.0090 - 0.0240 in.)
Second Compression Ring	0.483 - 0.965 mm (0.0190 - 0.080 in.)
Oil Control Ring	0.254 - 1.500 mm (0.010 - 0.060 in.)

PISTON RINGS (Continued)

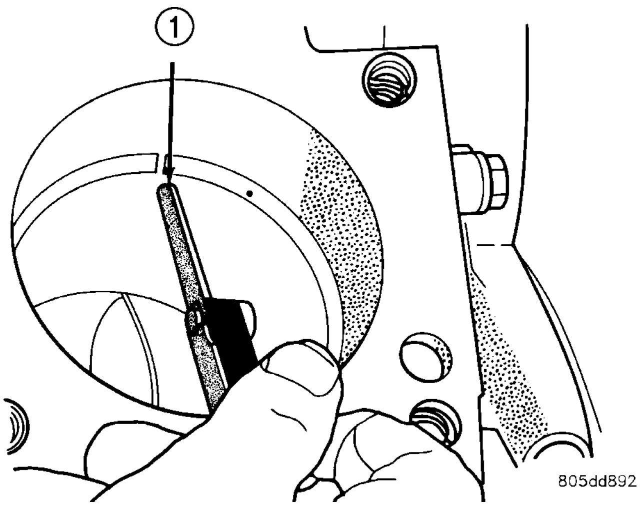


Fig. 65 Gap Measurement

1 - FEELER GAUGE

(5) The oil control rings are symmetrical, and can be installed with either side up. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(6) The two compression rings are different and cannot be interchanged. The top compression ring can be identified by the shiny coating on the outer sealing surface and can be installed with either side up. (Fig. 66).

(7) The second compression ring has a slight chamfer on the bottom of the inside edge and a dot on the top for correct installation (Fig. 67) and (Fig. 68).

(8) Using a ring installer, install the second compression ring with the dot facing up (Fig. 67) (Fig. 69).

(9) Using a ring installer, install the top compression ring (either side up).

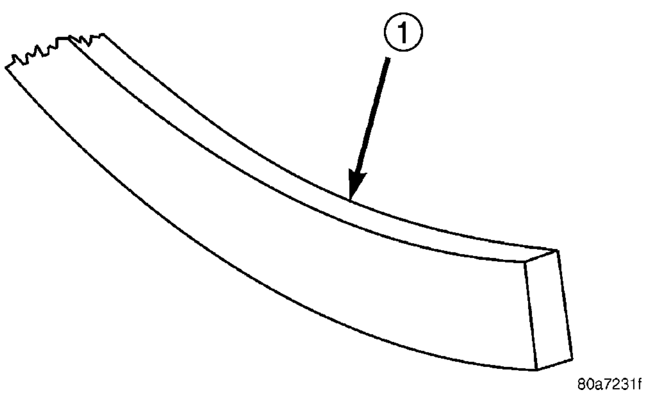


Fig. 66 Top Compression ring identification

1 - TOP COMPRESSION RING

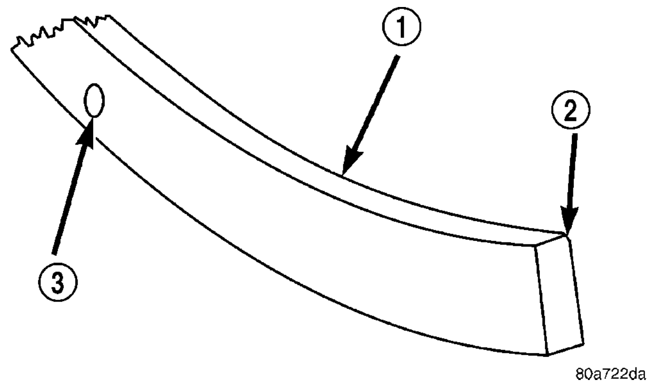


Fig. 67 Second Compression Ring Identification

1 - SECOND COMPRESSION RING
2 - CHAMFER
3 - ONE DOT

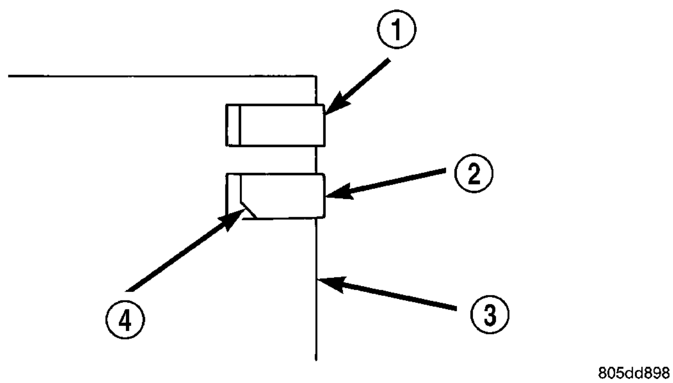


Fig. 68 Compression Ring Chamfer Location

1 - TOP COMPRESSION RING
2 - SECOND COMPRESSION RING
3 - PISTON
4 - CHAMFER

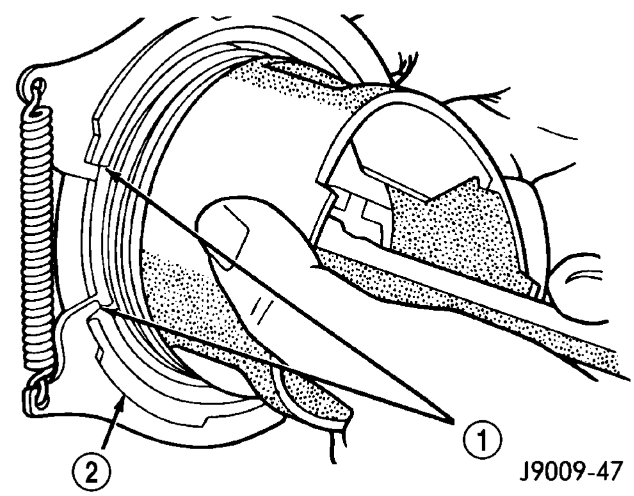


Fig. 69 Compression Ring Installation

1 - COMPRESSION RING
2 - RING EXPANDER RECOMMENDED

PISTON RINGS (Continued)

Ring Gap Orientation

- Position the gaps on the piston as shown (Fig. 70).
- Oil spacer - Gap on center line of piston skirt.
- Oil rails - gap 180° apart on centerline of piston pin bore.
- No. 2 Compression ring - Gap 180° from top oil rail gap.
- No. 1 Compression ring - Gap 180° from No. 2 compression ring gap.

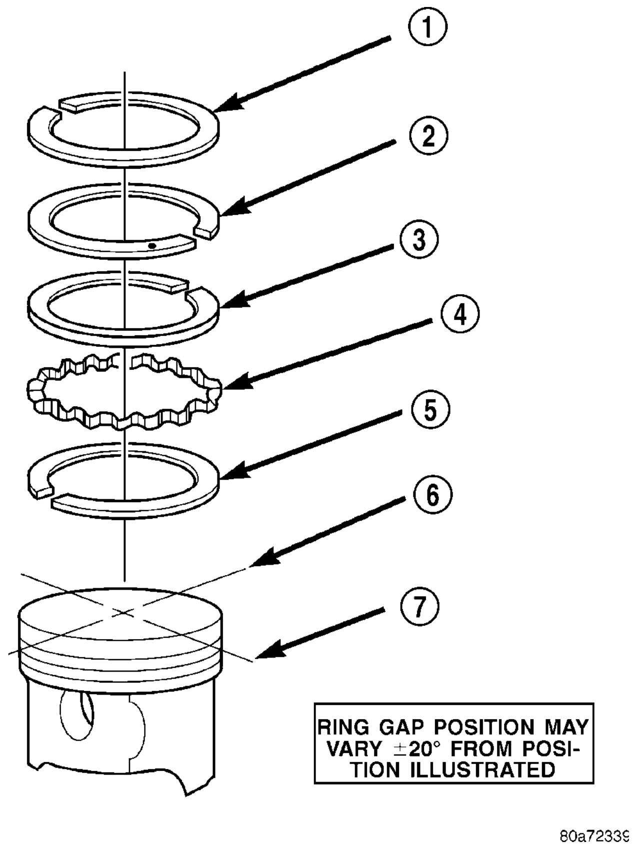


Fig. 70 Ring Gap Orientation

1 - TOP COMPRESSION RING
2 - BOTTOM COMPRESSION RING
3 - TOP OIL CONTROL RAIL
4 - OIL RAIL SPACER
5 - BOTTOM OIL CONTROL RAIL
6 - IMAGINARY LINE PARALLEL TO PISTON PIN
7 - IMAGINARY LINE THROUGH CENTER OF PISTON SKIRT

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) and fan shroud.

(3) Remove the vibration damper retaining bolt and washer.

(4) Use Vibration Damper Removal Tool 7697 to remove the damper from the crankshaft (Fig. 71).

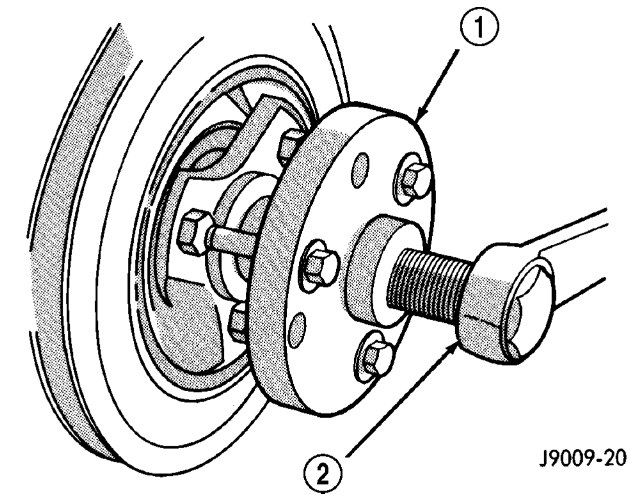


Fig. 71 Vibration Damper Removal Tool 7697

1 - VIBRATION DAMPER REMOVAL TOOL
2 - WRENCH

INSTALLATION

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in position, align the keyway on the vibration damper hub with the crankshaft key and tap the damper onto the crankshaft.

(2) Install the vibration damper retaining bolt and washer.

(3) Tighten the damper retaining bolt to 108 N·m (80 ft. lbs.) torque.

(4) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) and fan shroud.

(5) Connect negative cable to battery.

STRUCTURAL SUPPORT

REMOVAL

The engine bending braces are used to add strength to the powertrain and to address some minor NVH concerns.

NOTE: Before the engine or the transmission can be removed the engine bending braces must be removed.

(1) Raise and support vehicle.

NOTE: Both left and right side bending braces are removed the sameway. Only the right side is shown.

NOTE: The exhaust does not require removal to preform this procedure.

STRUCTURAL SUPPORT (Continued)

(2) Remove the exhaust hanger bracket retaining bolt.

(3) Remove locknut and transmission bending brace bar.

(4) Remove engine-to-bending brace retaining bolt, bending brace bar and cross bar.

INSTALLATION

NOTE: DO NOT tighten the retaining hardware until all bending braces are in place.

(1) Position the cross brace into the engine-to-transmission brace, then position the engine-to-transmission brace and install retaining bolt.

(2) Position the transmission bending brace onto through brace and install new locknut.

(3) Position exhaust hanger and transmission brace, install retaining bolt (Fig. 73).

(4) Tighten engine-to-transmission brace retaining bolt (Fig. 72)to 40 N·m (30 ft. lbs.).

(5) Tighten transmission brace retaining bolts (Fig. 73)to 40 N·m (30 ft. lbs.), then tighten transmission brace retaining lock nuts (Fig. 73) to 108 N·m (80 ft. lbs.).

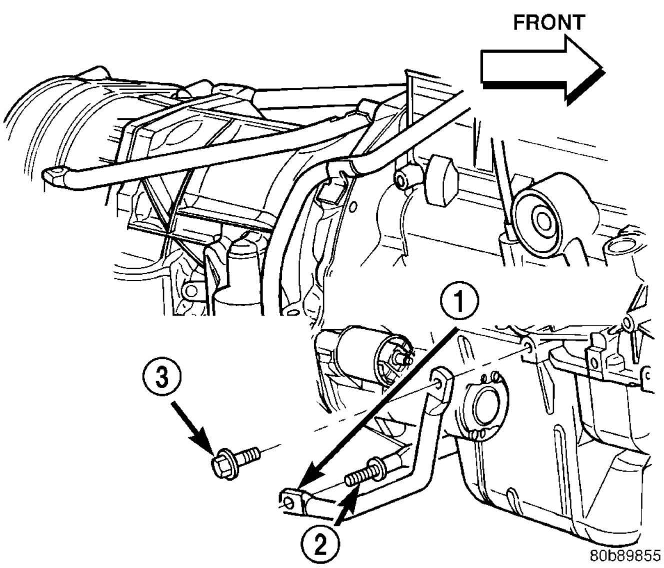


Fig. 72 Engine-to-Transmission Bending Braces

1 - ENGINE-TO-TRANSMISSION BENDING BRACE
2 - CROSS BRACE
3 - ENGINE-TO-TRANSMISSION BENDING BRACE RETAINING BOLT

FRONT MOUNT

REMOVAL

The front mounts support the engine at each side. These supports are made of resilient rubber.

(1) Disconnect negative cable from battery.

(2) Raise the vehicle.

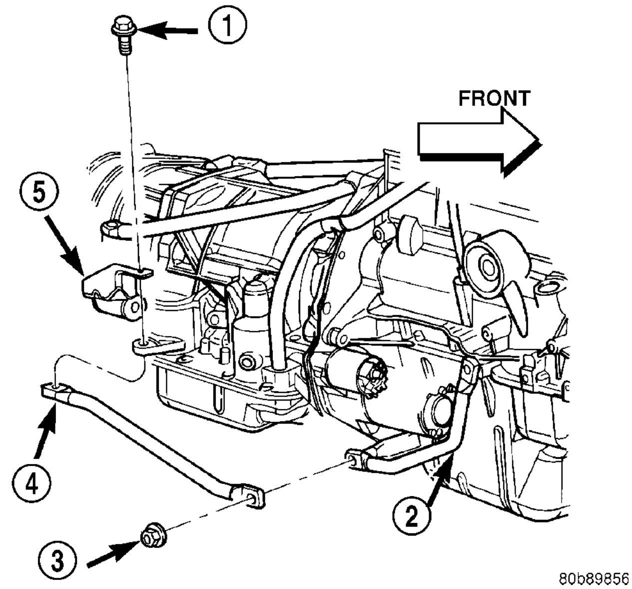


Fig. 73 Transmission Bending Braces and Exhaust Hanger

1 - TRANSMISSION BENDING BRACE RETAINING BOLT
2 - ENGINE-TO-TRANSMISSION BENDING BRACE
3 - LOCKNUT
4 - TRANSMISSION BRACE
5 - EXHAUST HANGER

(3) Support the engine.

(4) Remove the nut from the through bolt (Fig. 74) (Fig. 75). DO NOT remove the through bolt.

(5) Remove the retaining bolts and nuts from the insulator.

(6) Remove the through bolt.

(7) Remove the insulator.

INSTALLATION

The front mounts support the engine at each side. These supports are made of resilient rubber.

(1) If the engine support bracket was removed, position the bracket onto the block and install the attaching bolts (Fig. 74) (Fig. 75). Tighten the bolts to 50 N·m (37 ft. lbs.) torque.

(2) Place the insulator on the support bracket. Install the insulator retaining bolts and nuts. Tighten the bolts and nuts to 40 N·m (30 ft. lbs) torque.

(3) Install the through bolt and the retaining nut. Tighten the through bolt nut to 48 N·m (35 ft. lbs.) torque.

(4) Remove the engine support.

(5) Lower the vehicle.

(6) Connect negative cable to battery.

FRONT MOUNT (Continued)

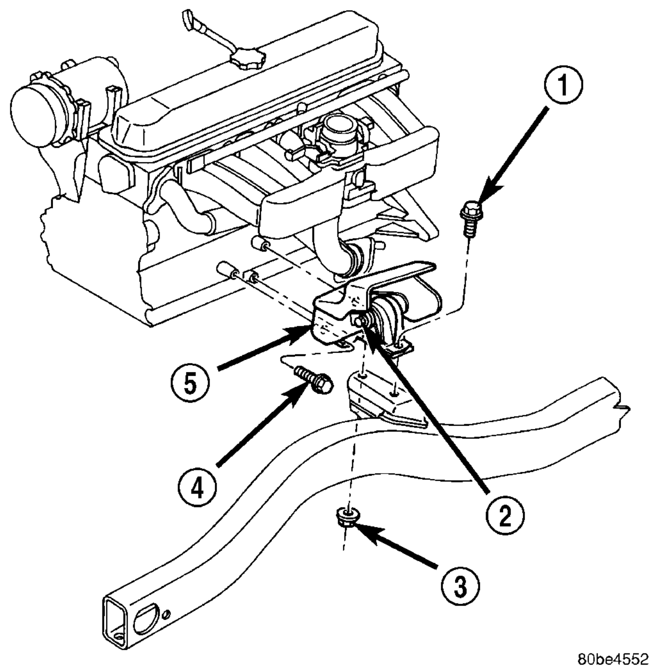


Fig. 74 Left Front Engine Mount

1 - **BOLT (2)**
2 - **THROUGH BOLT**
3 - **NUT (2)**
4 - **BOLT (3)**
5 - **LEFT HAND ENGINE MOUNT ASSEMBLY**

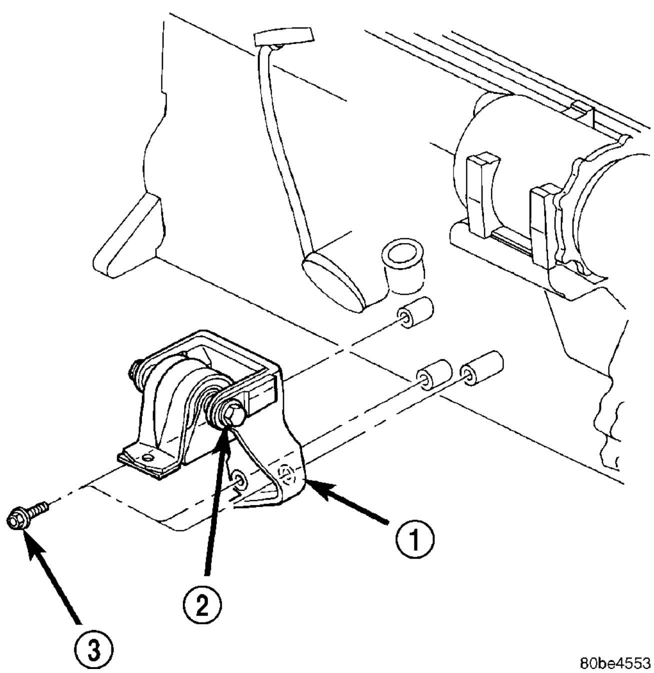


Fig. 75 Right Front Engine Mount

1 - RIGHT HAND ENGINE MOUNT ASSEMBLY
2 - THROUGH BOLT
3 - BOLT (3)

REAR MOUNT

REMOVAL

A resilient rubber cushion supports the transmission at the rear between the transmission extension housing and the rear support crossmember or skid plate.

ALL TRANSMISSIONS

(1) Disconnect negative cable from battery.
(2) Raise the vehicle and support the transmission.
(3) Remove the nuts holding the support cushion to the skid plate (Fig. 76) (Fig. 77).

MANUAL TRANSMISSIONS

(1) Remove nuts holding support cushion to transmission support bracket.
(2) Remove the support cushion.
(3) Remove bolts holding transmission support bracket to transmission.
(4) Remove the transmission support bracket.

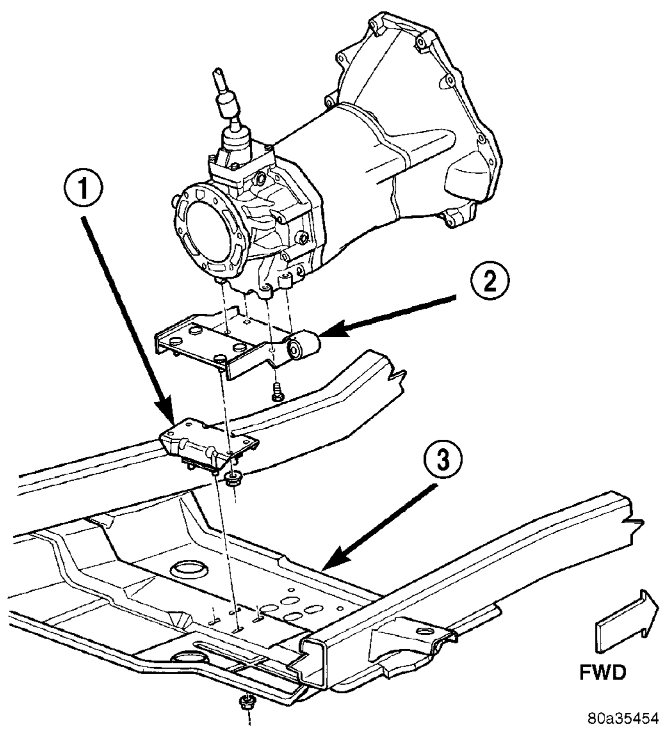


Fig. 76 Rear Mount (Manual Transmission)

1 - CUSHION
2 - BRACKET
3 - SKID PLATE

AUTOMATIC TRANSMISSIONS

(1) Remove nuts holding support cushion to transmission support bracket (Fig. 77). Remove the support cushion.
(2) Remove the bolts holding the transmission support bracket to transmission.

REAR MOUNT (Continued)

(3) Remove the transmission support bracket.

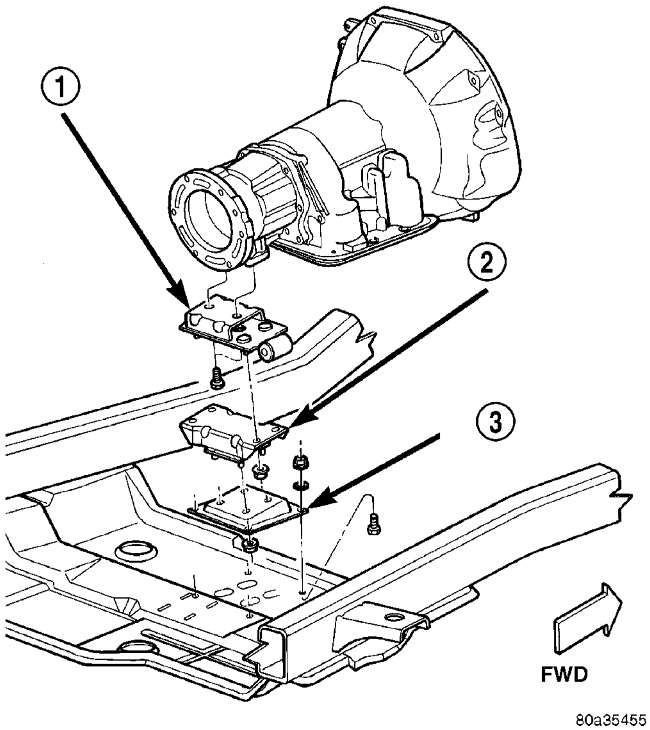


Fig. 77 Rear Mount (AutomaticTransmission)

1 - BRACKET
2 - CUSHION
3 - BRACKET

INSTALLATION

MANUAL TRANSMISSION

(1) Position the transmission mount bracket to the transmission and install the bolts (Fig. 76).

(2) Tighten the bolts to 54 N·m (40 ft. lbs.) torque.

(3) Position the support cushion to the transmission mount bracket and install nuts (Fig. 76).

AUTOMATIC TRANSMISSION

(1) Position the transmission mount bracket to the transmission and install the bolts. Tighten the bolts to 54 N·m (40 ft. lbs.) torque.

(2) Position the support cushion to the transmission mount bracket and install nuts. Tighten the nuts to 41 N·m (30 ft. lbs.) torque (Fig. 77).

(3) If the support cushion bracket was removed from the skid plate, position the bracket on the skid plate and install the nuts and bolts. Tighten the nuts to 28 N·m (21 ft. lbs.) torque.

ALL TRANSMISSIONS

(1) Position the skid plate to the studs of the support cushion and install the nuts (Fig. 76) (Fig. 77). Tighten the nuts to 28 N·m (21 ft. lbs.) torque.

(2) Install the skid plate bolts to the sill and tighten to 75 N·m (55 ft. lbs.) torque.

(3) Remove the transmission support.

(4) Lower the vehicle.

(5) Connect negative cable to battery.

LUBRICATION

DESCRIPTION

A gear—type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing.

OPERATION

The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals (except number 4 main bearing journal) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole, oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. Oil is provided to the camshaft bearing through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan (Fig. 78).

LUBRICATION (Continued)

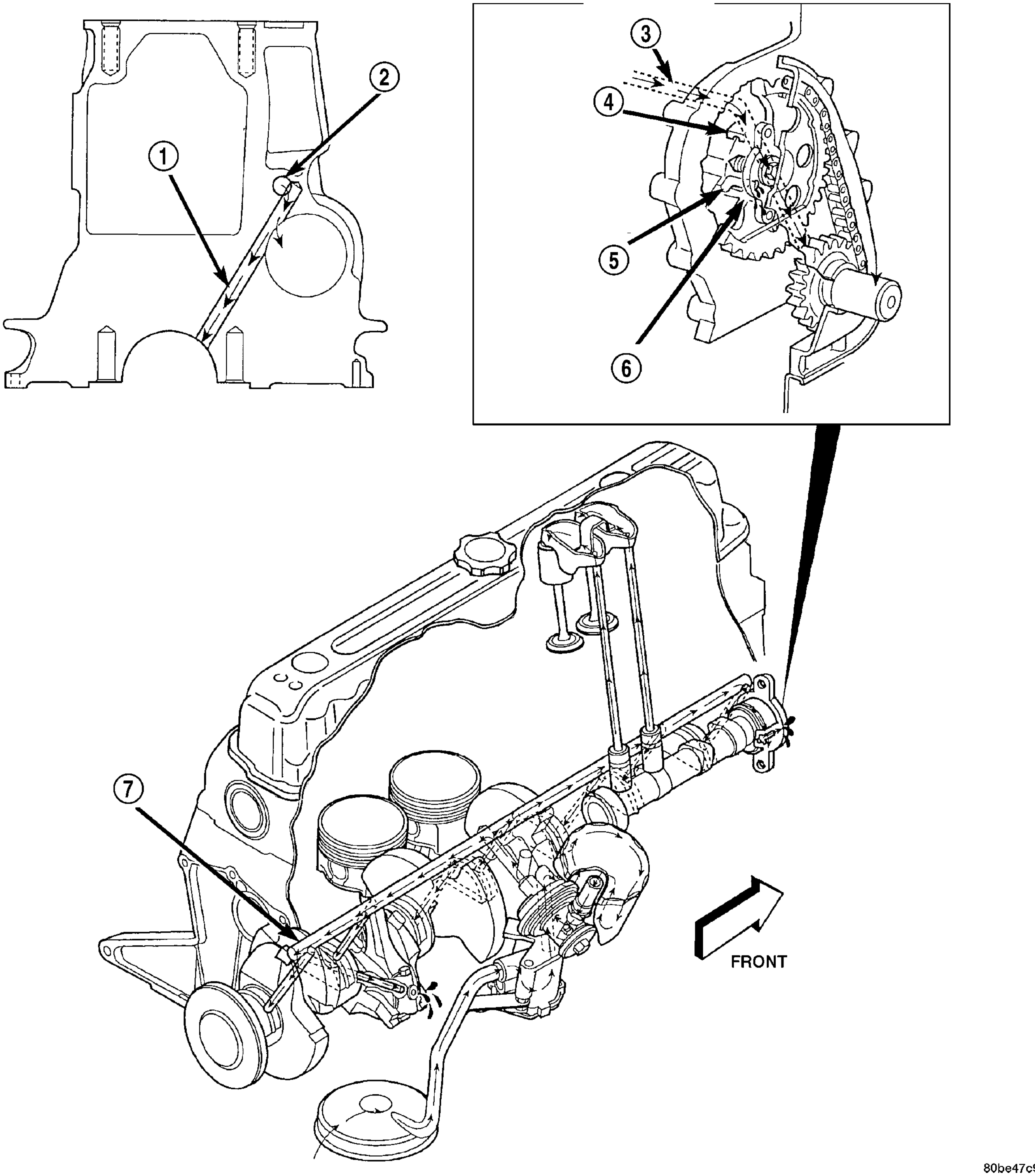


Fig. 78 Oil Lubrication System—4.0L Engine

1 - CAM/CRANK MAIN GALLERY (7)
2 - TAPPET GALLERY
3 - TAPPET GALLERY
4 - CAMSHAFT BEARING
5 - NUMBER 1 CAMSHFT BEARING JOURNAL
6 - CAMSHAFT SPROCKET
7 - TAPPET GALLERY

LUBRICATION (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE

(1) Disconnect connector and remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292 or equivalent. Start engine and record pressure. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct pressures.

DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the CCV valve from the cylinder head cover. Cap or plug the CCV valve grommet.

(3) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(4) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service information procedures.

(5) If the leakage occurs at the rear oil seal area, INSPECTION FOR REAR SEAL AREA LEAKS.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the CCV valve and breather cap hose.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE - ENGINE OIL SERVICE

ENGINE OIL CHANGE

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

CAUTION: Do not use oil filter with metric threads. The proper oil filter has SAE type 3/4 X 16 threads. An oil filter with metric threads can result in oil leaks and engine failure.

All Jeep engines are equipped with a high quality full-flow, throw-away type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

(6) Install drain plug in crankcase.

(7) Position a drain pan under the oil filter.

(8) Using a suitable oil filter wrench loosen filter.

(9) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss or filter adapter housing.

(10) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(11) Make sure old gasket comes off with oil filter. With a wiping cloth, clean the gasket sealing surface (Fig. 79) of oil and grime.

(12) Lightly lubricate oil filter gasket with engine oil or chassis grease.

(13) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 79)hand tighten filter one full turn, do not over tighten.

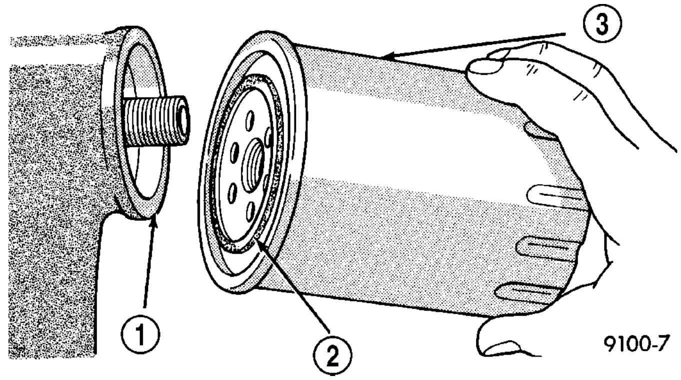


Fig. 79 Oil Filter Sealing Surface—Typical

1 - SEALING SURFACE
2 - RUBBER GASKET
3 - OIL FILTER

(14) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(15) Install oil fill cap.

(16) Start engine and inspect for leaks.

(17) Stop engine and inspect oil level.

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

The engine oil level indicator (Dipstick) is located at the right rear of the 4.0L engine. Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

OIL (Continued)

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this procedure.

OIL FILTER

REMOVAL

CAUTION: Do not use oil filter with metric threads. The proper oil filter has SAE type 3/4 X 16 threads. An oil filter with metric threads can result in oil leaks and engine failure.

All Jeep engines are equipped with a high quality full-flow, throw-away type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss or filter adapter housing.

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) Make sure old gasket comes off with oil filter. With a wiping cloth, clean the gasket sealing surface of oil and grime.

INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil or chassis grease.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 80) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

OIL PAN

DESCRIPTION

The oil pan is made of stamped steel. The oil pan gasket is a one piece steel backbone silicone coated gasket (Fig. 81).

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise the vehicle.

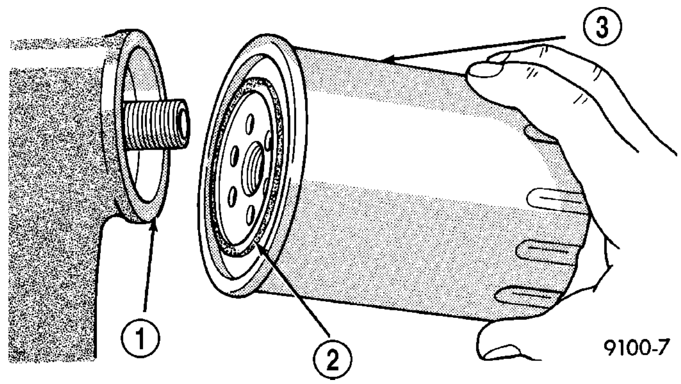


Fig. 80 Oil Filter Sealing Surface—Typical

1 - SEALING SURFACE
2 - RUBBER GASKET
3 - OIL FILTER

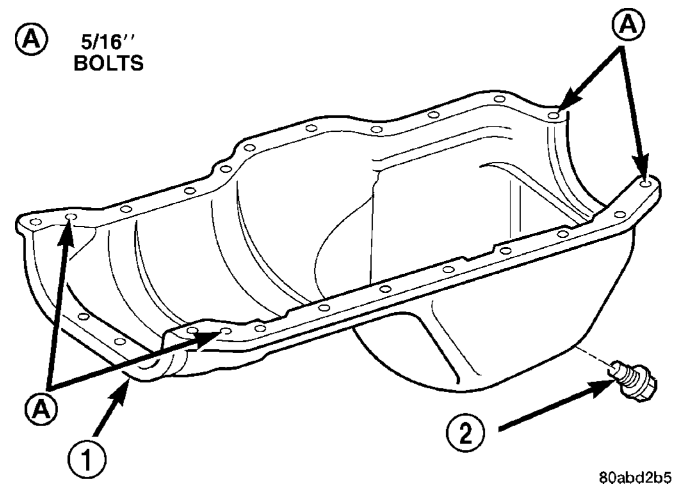


Fig. 81 Oil Pan

1 - OIL PAN
2 - OIL PAN DRAIN PLUG

(3) Remove the oil pan drain plug and drain the engine oil.

(4) Disconnect the exhaust pipe at the exhaust manifold.

(5) Disconnect the exhaust hanger at the catalytic converter and lower the pipe.

(6) Remove the starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

(7) Remove the engine flywheel and transmission torque converter housing access cover.

(8) If equipped with an oil level sensor, disconnect the sensor.

(9) Position a jack stand directly under the engine vibration damper.

(10) Place a piece of wood (2 x 2) between the jack stand and the engine vibration damper.

(11) Remove the engine mount through bolts.

(12) Using the jack stand, raise the engine until adequate clearance is obtained to remove the oil pan.

OIL PAN (Continued)

(13) Remove transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that are attached to the oil pan studs.

(14) Remove the oil pan bolts and studs. Carefully slide the oil pan and gasket to the rear. If equipped with an oil level sensor, take care not to damage the sensor.

INSTALLATION

(1) Clean the block and pan gasket surfaces.

(2) Fabricate 4 alignment dowels from 1 1/2 x 1/4 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 82).

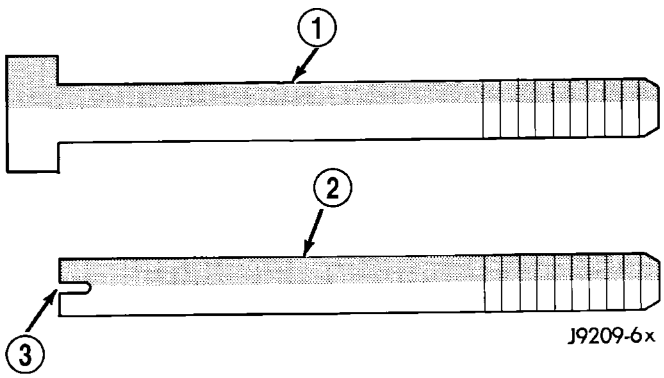


Fig. 82 Fabrication of Alignment Dowels

1 - 1/4′′ × 1 1/2′′ BOLT
2 - DOWEL
3 - SLOT

(3) Install two dowels in the timing case cover. Install the other two dowels in the cylinder block (Fig. 83).

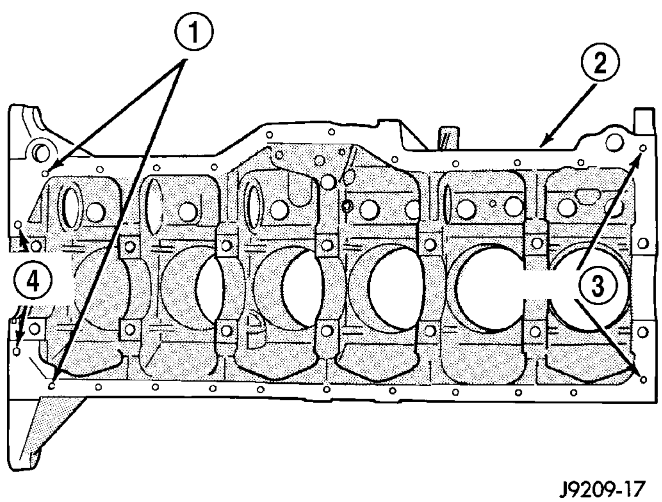


Fig. 83 Position of Dowels in Cylinder Block

1 - DOWEL HOLES
2 - CYLINDER BLOCK
3 - 5/16′′ HOLES
4 - 5/16′′ HOLES

(4) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 84).

(5) Slide the one-piece gasket over the dowels and onto the block and timing case cover.

(6) Position the oil pan over the dowels and onto the gasket. If equipped with an oil level sensor, take care not to damage the sensor.

(7) Install the 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque. Install the 5/16 inch oil pan bolts (Fig. 85). Tighten these bolts to 15 N·m (132 in. lbs.) torque.

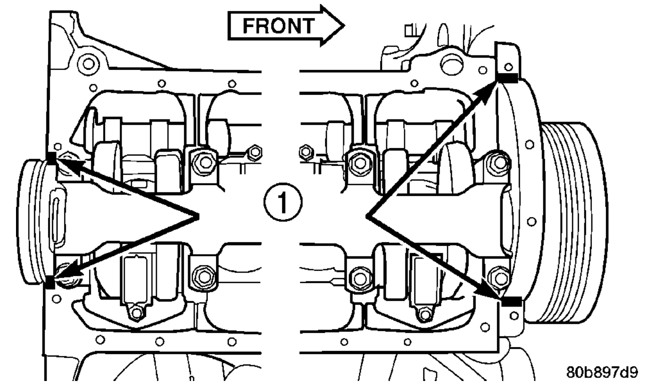


Fig. 84 Oil Pan Sealer Location

1 - SEALER LOCATIONS

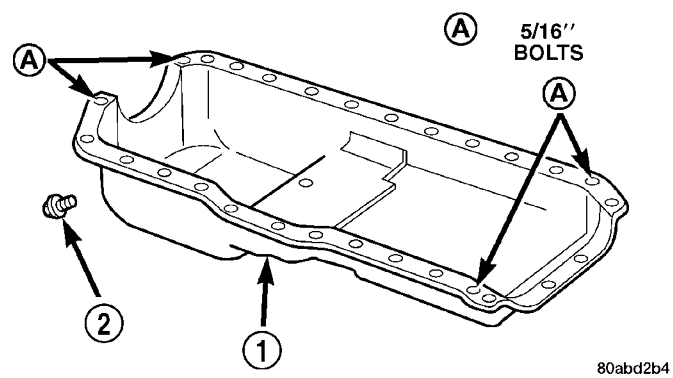


Fig. 85 Position of 5/16 inch Oil Pan Bolts

1 - OIL PAN
2 - OIL PAN DRAIN PLUG

(8) Remove the dowels. Install the remaining 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque.

(9) Lower the engine until it is properly located on the engine mounts.

(10) Install the through bolts and tighten the nuts.

(11) Lower the jack stand and remove the piece of wood.

(12) Install the engine flywheel and transmission torque converter housing access cover.

OIL PAN (Continued)

(13) Install the engine starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(14) Connect the exhaust pipe to the hanger and to the engine exhaust manifold.

(15) Install transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that attach to the oil pan studs.

(16) Install the oil pan drain plug (Fig. 85). Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(17) Lower the vehicle.

(18) Connect negative cable to battery.

(19) Fill the oil pan with engine oil to the specified level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(20) Start the engine and inspect for leaks.

ENGINE OIL PRESSURE SENSOR

DESCRIPTION

The 3 wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

OIL PUMP

REMOVAL

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No.4 main bearing.

(1) Drain the engine oil.

(2) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) Remove the pump-to-cylinder block attaching bolts. Remove the pump assembly with gasket (Fig. 86).

CAUTION: If the oil pump is not to be serviced, DO NOT disturb position of oil inlet tube and strainer assembly in pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

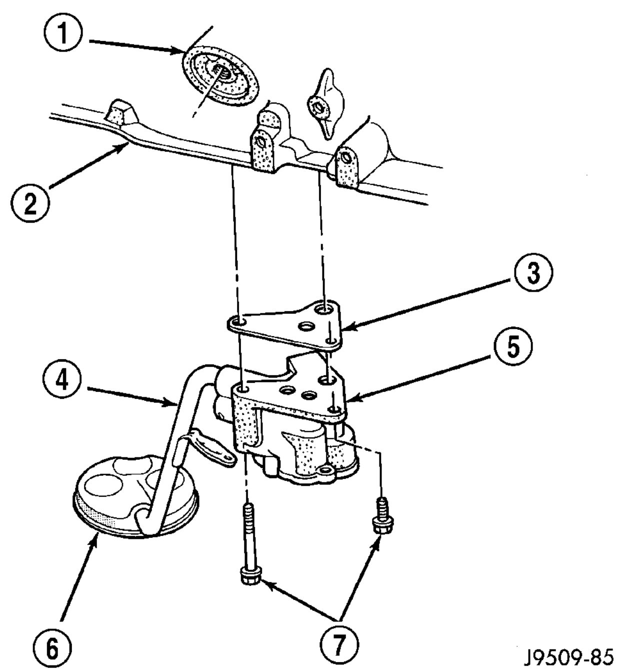


Fig. 86 Oil Pump Assembly

1 - OIL FILTER ADAPTOR
2 - BLOCK
3 - GASKET
4 - OIL INLET TUBE
5 - OIL PUMP
6 - STRAINER ASSEMBLY
7 - ATTACHING BOLTS

INSTALLATION

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No.4 main bearing.

(1) Install the oil pump on the cylinder block using a replacement gasket. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(2) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

OIL PUMP (Continued)

(3) Fill the oil pan with oil to the specified level.

VALVE TIMING

STANDARD PROCEDURE - VALVE TIMING

(1) Disconnect the spark plug wires and remove the spark plugs.

(2) Remove the engine cylinder head cover .

(3) Remove the capscrews, bridge and pivot assembly, and rocker arms from above the No.1 cylinder.

(4) Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

(5) Rotate the crankshaft until the No.6 piston is at top dead center (TDC) on the compression stroke.

(6) Rotate the crankshaft counterclockwise (viewed from the front of the engine) 90°.

(7) Install a dial indicator on the end of the No.1 cylinder intake valve push rod. Use rubber tubing to secure the indicator stem on the push rod.

(8) Set the dial indicator pointer at zero.

(9) Rotate the crankshaft clockwise (viewed from the front of the engine) until the dial indicator pointer indicates 0.305 mm (0.012 inch) travel distance (lift).

(10) The timing notch index on the vibration damper should be aligned with the TDC mark on the timing degree scale.

(11) If the timing notch is more than 13 mm (1/2 inch) away from the TDC mark in either direction, the valve timing is incorrect.

NOTE: If the valve timing is incorrect, the cause may be a broken camshaft pin. It is not necessary to replace the camshaft because of pin failure. A spring pin is available for service replacement.

TIMING BELT / CHAIN COVER(S)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(3) Remove the fan, hub assembly and fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(4) Remove the accessory drive brackets that are attached to the timing case cover.

(5) Remove the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL) (if equipped) and generator bracket assembly from the engine cylinder head and move to one side.

(6) Remove the oil pan-to-timing case cover bolts and timing case cover-to-cylinder block bolts.

(7) Remove the timing case cover and gasket from the engine.

(8) Pry the crankshaft oil seal from the front of the timing case cover (Fig. 87).

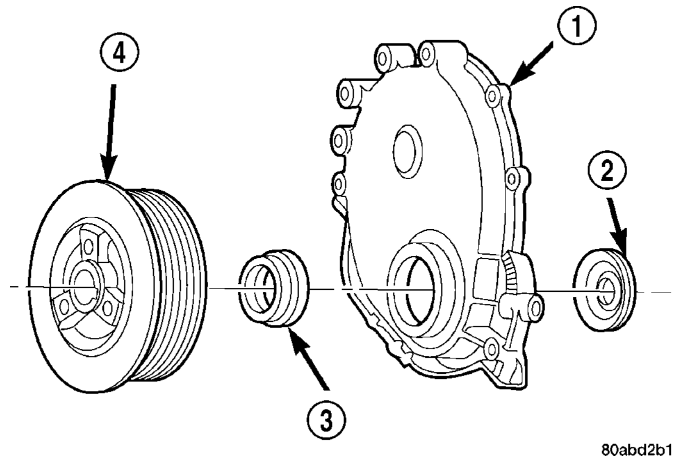


Fig. 87 Timing Case Cover Components

1 - TIMING CASE COVER
2 - OIL SLINGER
3 - CRANKSHAFT OIL SEAL
4 - VIBRATION DAMPER PULLEY

INSTALLATION

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

(1) Install a new crankshaft oil seal in the timing case cover. The open end of the seal should be toward the inside of the cover. Support the cover at the seal area while installing the seal. Force it into position with Seal Installation Tool 6139.

(2) Position the gasket on the cylinder block.

(3) Position the timing case cover on the oil pan gasket and the cylinder block.

(4) Insert Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 88).

(5) Install the timing case cover-to-cylinder block and the oil pan-to-timing case cover bolts.

(6) Tighten the 1/4 inch cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque. Tighten the oil pan-to-cover 1/4 inch bolts to 9.5 N·m (84 in. lbs.) torque.

(7) Remove the cover alignment tool.

(8) Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the

TIMING BELT / CHAIN COVER(S) (Continued)

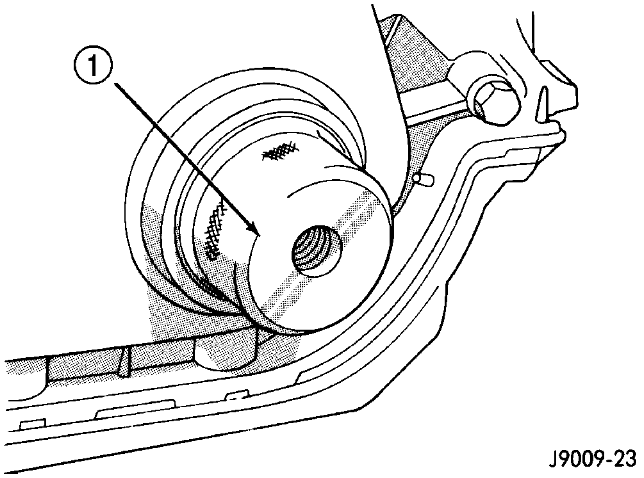


Fig. 88 Timing Case Cover Alignment

1 - TIMING CASE COVER ALIGNMENT AND SEAL INSTALLATION TOOL

crankshaft, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(10) Install the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION) (if equipped) and generator bracket assembly.

(11) Install the engine fan, hub assembly and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(12) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Connect negative cable to battery.

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(3) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(4) Remove the crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(5) Remove the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(6) Rotate crankshaft until the “0” timing mark is closest to and on the center line with camshaft sprocket timing mark (Fig. 89).

(7) Remove the oil slinger from the crankshaft.

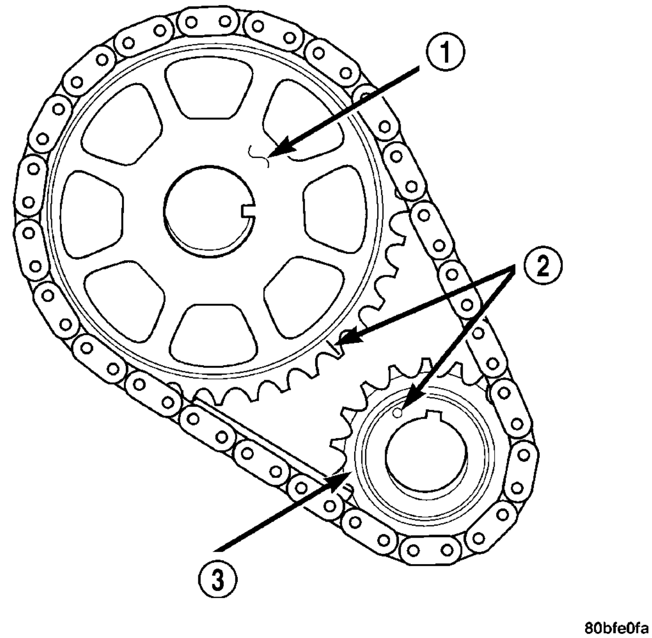


Fig. 89 Crankshaft—Camshaft Alignment

1 - CAMSHAFT SPROCKET
2 - TIMING MARKS
3 - CRANKSHAFT SPROCKET

(8) Remove the camshaft sprocket bolt and washer (Fig. 90).

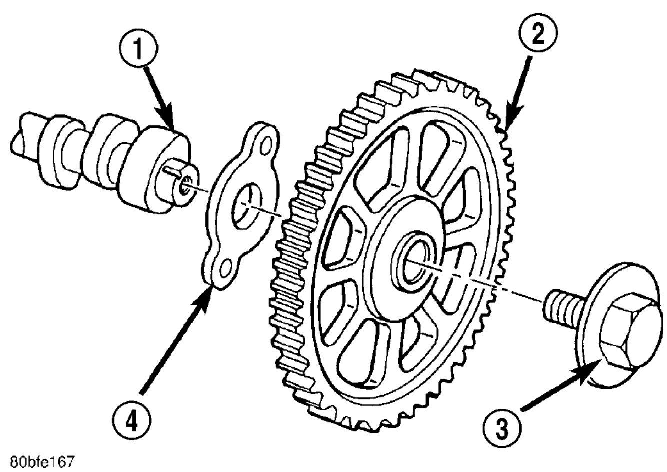


Fig. 90 Camshaft Sprocket and Thrust Plate

1 - CAMSHAFT
2 - CAMSHAFT SPROCKET W/INTEGRAL KEY
3 - BOLT AND WASHER
4 - THRUST PLATE

(9) Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

(10) Installation of the timing chain with the timing marks on the crankshaft and camshaft sprockets properly aligned ensures correct valve timing. A worn or stretched timing chain will adversely affect valve

TIMING BELT/CHAIN AND SPROCKETS (Continued)

timing. If the timing chain deflects more than 12.7 mm (1/2 inch) replace it.

INSTALLATION

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned (Fig. 89).

(1) Apply Mopar® Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in the keyway on the crankshaft, install the assembly on the crankshaft and camshaft.

(2) Install the camshaft sprocket bolt and washer (Fig. 90). Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(3) To verify correct installation of the timing chain, rotate the crankshaft 2 revolutions. The camshaft and crankshaft sprocket timing mark should align (Fig. 89).

(4) Install the crankshaft oil slinger.

(5) Replace the oil seal in the timing case cover (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - REMOVAL).

(6) Install the timing case cover and gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) With the key installed in the crankshaft keyway, install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(8) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(9) Install the fan, hub assembly and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(10) Connect negative cable to battery.

INTAKE MANIFOLD

DESCRIPTION

The intake manifold (Fig. 91) is made of cast aluminum and uses eleven bolts to mount to the cylinder head. This mounting style improves sealing and reduces the chance of leaks.

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

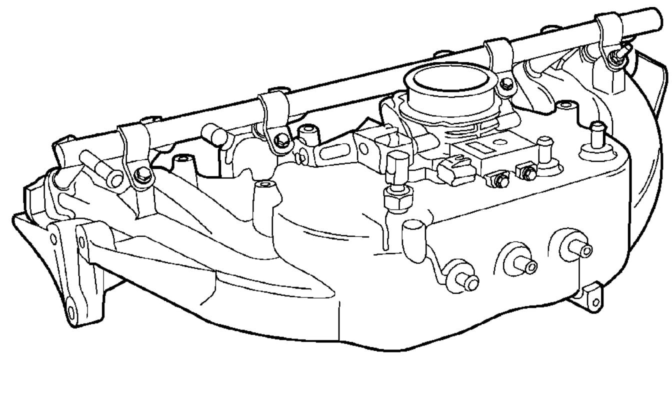


Fig. 91 Intake Manifold 4.0L Engine

(1) Start the engine.

(2) Spray a small stream of water at the suspected leak area.

(3) If a change in RPM is observed the area of the suspected leak has been found.

(4) Repair as required.

REMOVAL

NOTE: THE ENGINE INTAKE AND EXHAUST MANIFOLD MUST BE REMOVED AND INSTALLED TOGETHER. THE MANIFOLDS USE A COMMON GASKET AT THE CYLINDER HEAD.

(1) Disconnect the battery negative cable.

(2) Remove air cleaner inlet hose from the resonator assembly.

(3) Remove the air cleaner assembly.

(4) Remove the throttle cable, vehicle speed control cable (if equipped) and the transmission line pressure cable (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - AW4/THROTTLE VALVE CABLE - REMOVAL).

(5) Disconnect the following electrical connections and secure their harness out of the way:

- Throttle Position Sensor
- Idle Air Control Motor
- Coolant Temperature Sensor (at thermostat housing)
- Intake Air Temperature Sensor
- Oxygen Sensor
- Crank Position Sensor
- Six (6) Fuel Injector Connectors
- Manifold Absolute Pressure (MAP) Sensor.

(6) Disconnect HVAC, and Brake Booster vacuum supply hoses at the intake manifold.

(7) Perform the fuel pressure release procedure. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

INTAKE MANIFOLD (Continued)

(8) Disconnect and remove the fuel system supply line from the fuel rail assembly.

(9) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(10) Remove the power steering pump from the intake manifold and set aside.

(11) Raise the vehicle.

(12) Disconnect the exhaust pipes from the engine exhaust manifolds.

(13) Lower the vehicle.

(14) Remove the intake manifold and exhaust manifold bolts and manifolds (Fig. 92).

INSTALLATION

If the manifold is being replaced, ensure all the fitting, etc. are transferred to the replacement manifold.

(1) Install a new engine exhaust/intake manifold gasket over the alignment dowels on the cylinder head.

(2) Position the engine exhaust manifolds to the cylinder head. Install fastener Number 3 and finger tighten at this time (Fig. 92).

(3) Install intake manifold on the cylinder head dowels.

(4) Install washer and fastener Numbers 1, 2, 4, 5, 8, 9, 10 and 11 (Fig. 92).

(5) Install washer and fastener Numbers 6 and 7 (Fig. 92).

(6) Tighten the fasteners in sequence and to the specified torque (Fig. 92).

- Fastener Numbers 1 through 5—Tighten to 33 N·m (24 ft. lbs.) torque.
- Fastener Numbers 6 and 7—Tighten to 31 N·m (23 ft. lbs.) torque.
- Fastener Numbers 8 through 11—Tighten to 33 N·m (24 ft. lbs.) torque.

(7) Install the power steering pump to the intake manifold.

(8) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

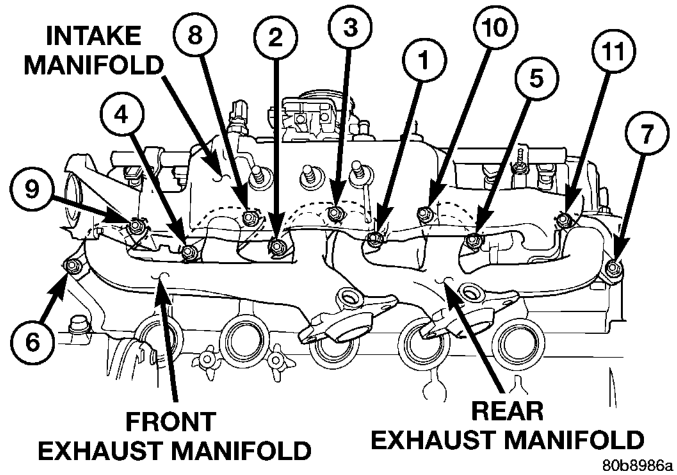


Fig. 92 Intake and Exhaust Manifolds Installation

(9) Install the fuel system supply line to the fuel rail assembly.

(10) Connect all electrical connections on the intake manifold.

(11) Connect the vacuum hoses previously removed.

(12) Install throttle cable, vehicle speed control cable (if equipped).

(13) Install the transmission line pressure cable (if equipped) (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - AW4/THROTTLE VALVE CABLE - INSTALLATION).

(14) Install air cleaner assembly.

(15) Connect air inlet hose to the resonator assembly.

(16) Raise the vehicle.

(17) Connect the exhaust pipes to the engine exhaust manifolds. Tighten the bolts to 31 N·m (23 ft. lbs.)

(18) Lower the vehicle.

(19) Connect the battery negative cable.

(20) Start the engine and check for leaks.

EXHAUST MANIFOLD

DESCRIPTION

The two exhaust manifolds (Fig. 93) are log style and are made of high silicon molybdenum cast iron. The exhaust manifolds share a common gasket with the intake manifold. The exhaust manifolds also incorporate ball flange outlets for improved sealing and strain free connections.

REMOVAL

The intake and engine exhaust manifolds on the 4.0L engine must be removed together. The manifolds use a common gasket at the cylinder head.

(Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

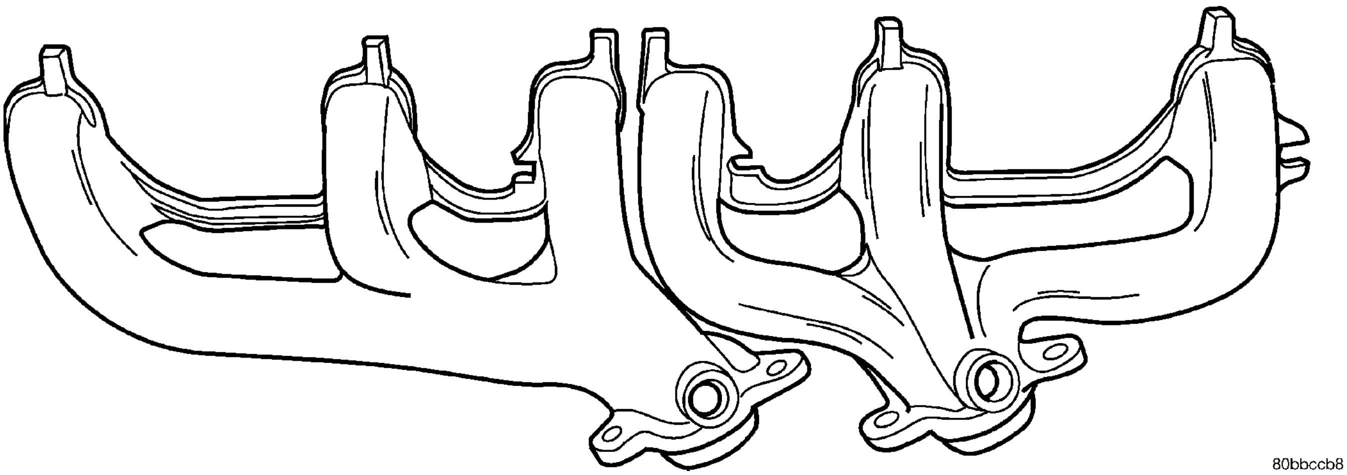


Fig. 93 EXHAUST MANIFOLDS 4.0L ENGINE

EXHAUST SYSTEM

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EXHAUST SYSTEM

DESCRIPTION

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

The basic exhaust system consists of exhaust manifold(s), exhaust pipe with oxygen sensors, catalytic converter(s), heat shield(s), muffler and tailpipe (Fig. 1) and (Fig. 2)

EXHAUST SYSTEM (Continued)

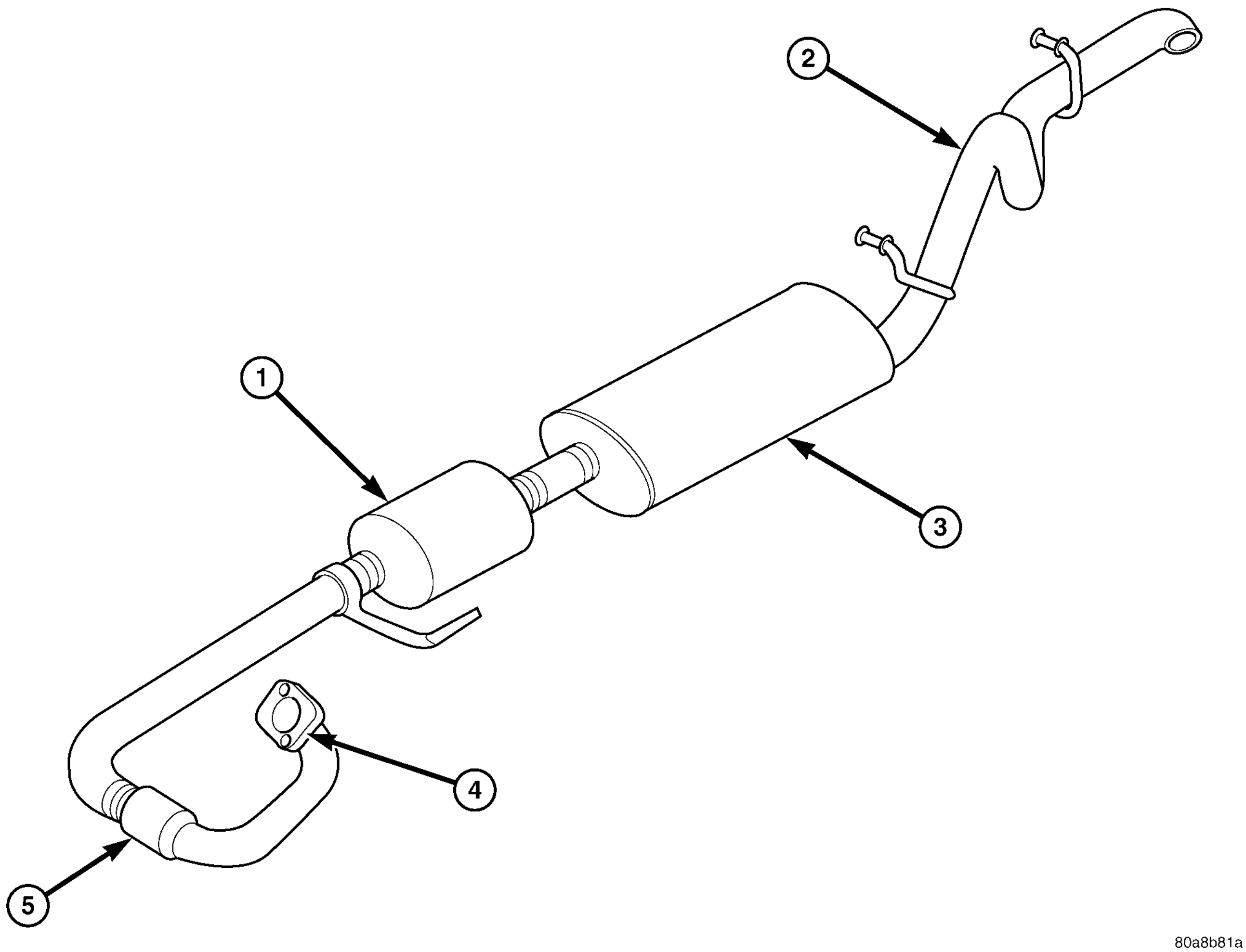


Fig. 1 Exhaust system - 2.4L Engine

1 - CATALYTIC CONVERTER
2 - TAILPIPE
3 - MUFFLER
4 - EXHAUST PIPE TO EXHAUST MANIFOLD FLANGE
5 - MINI CATALYTIC CONVERTER

EXHAUST SYSTEM (Continued)

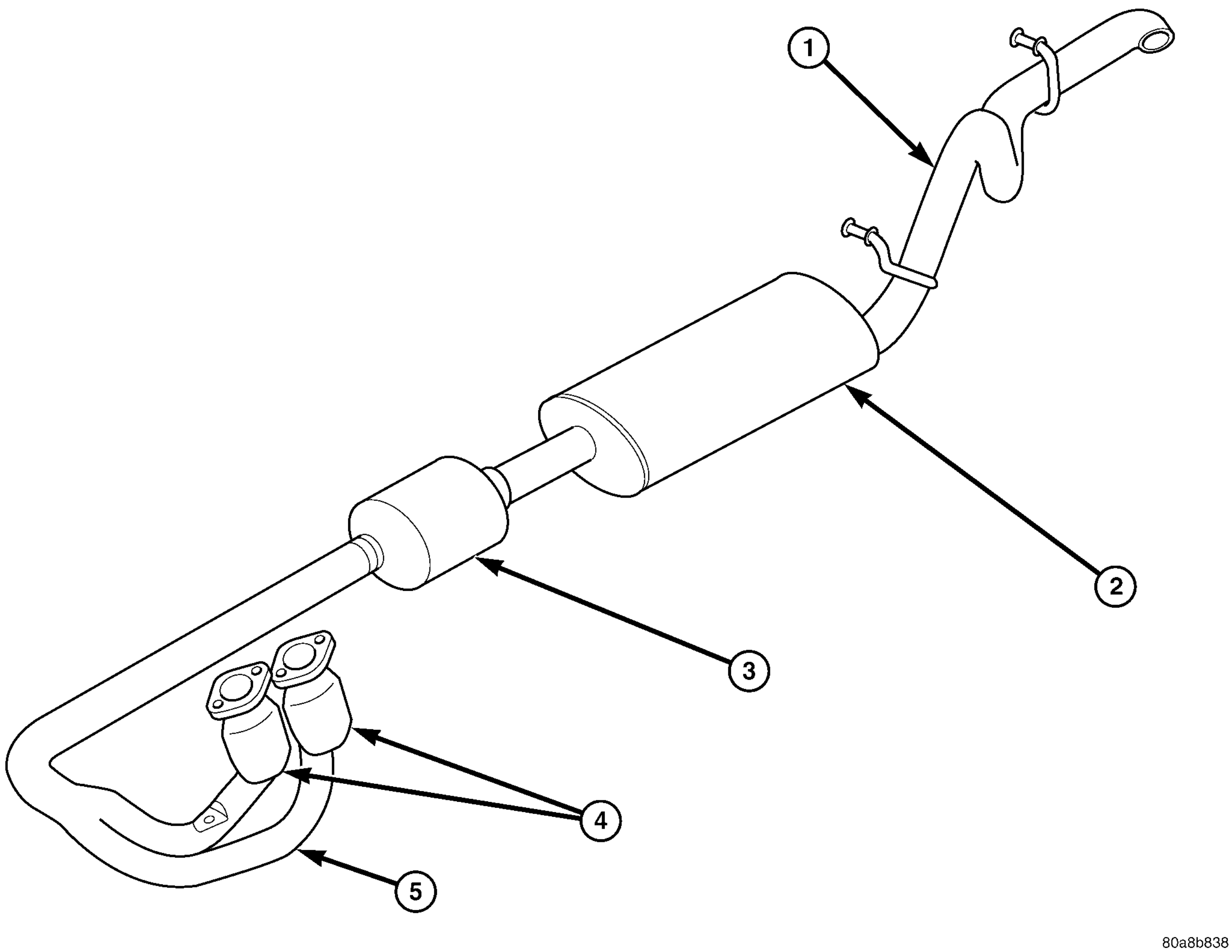


Fig. 2 Exhaust System - 4.0L

1 - TAILPIPE
2 - MUFFLER
3 - CATALYTIC CONVERTER
4 - MINI CATALYTIC CONVERTER
5 - EXHAUST PIPE

EXHAUST SYSTEM (Continued)

DIAGNOSIS AND TESTING - EXHAUST SYSTEM

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten clamps/bolts to specified torque at leaking joints.
	2. Rusted or blown out muffler.	2. Replace muffler. Inspect exhaust system.
	3. Broken or rusted out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten/replace flange attaching nuts/bolts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head bolts.
	7. Catalytic converter rusted or blown out.	7. Replace catalytic converter assy.
	8. Restriction in exhaust system.	8. Remove restriction, if possible. Replace restricted part if necessary.
CAUTION: When servicing and replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.		

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolts, Crossmember to Sill	42	31	-
Nuts, Crossmember to Transmission Mount	22	16	-
Nuts, Exhaust Pipe to Manifold	31	23	-
Nuts/Bolt, Exhaust Manifold to Engine			
#6&7	31	23	-
#1,2,3,4,5,8,9,10&11	33	24	-
Nuts, Exhaust Pipe to Catalytic Converter Flange	28.5	21	-
Clamp, Tailpipe to Rear Tailpipe Hanger	27	20	-
Oxygen Sensors	27	20	-
Heat Shields	45	33	-

CATALYTIC CONVERTER

DESCRIPTION

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: DO NOT remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. If unburned fuel enters the converter, overheating may occur. If a converter is heat-damaged, correct the

CATALYTIC CONVERTER (Continued)

cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

The catalytic converter and muffler are serviced as an assembly.

Unleaded gasoline must be used to avoid contaminating the catalyst core.

REMOVAL

REMOVAL - 2.4L

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

(1) Disconnect the oxygen sensors.

(2) Remove the two bolts and flanged nuts at the manifold (Fig. 3).

(3) Remove the two bolts and flanged nuts at the flange.

(4) Remove the mini catalyst assembly from the vehicle.

(5) Slide exhaust pipe forward until exhaust pipe hanger disengages from transmission support. Remove exhaust pipe and catalytic converter from vehicle.

REMOVAL - 4.0L

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

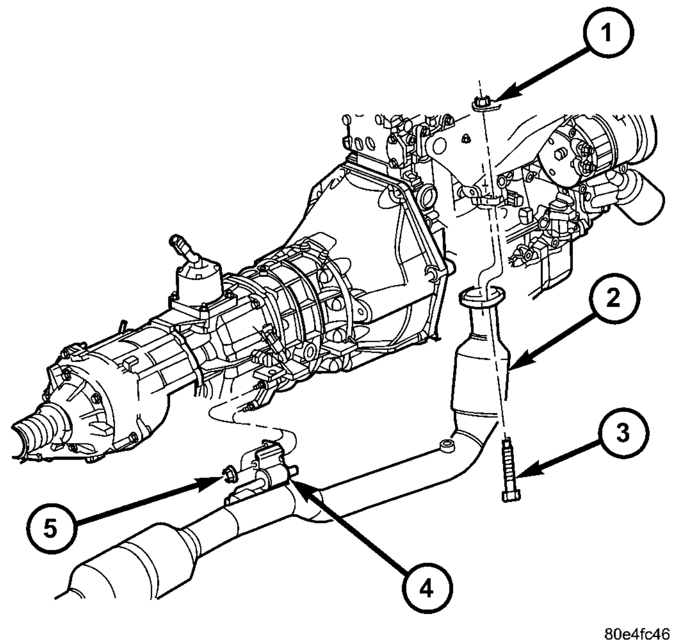


Fig. 3 2.4L Exhaust Pipe and Catalytic Converter - 4x4

1- FLANGED NUT
2- MINI CATALYST ASSEMBLY
3- BOLT
4- HANGER
5- NUT

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

(1) Raise and support the vehicle.

(2) Saturate the studs and nuts with a Mopar® rust penetrant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensors from the exhaust pipe and the catalytic converter.

(4) Disconnect the exhaust pipe from the engine exhaust manifold (Fig. 4).

(5) Remove mini catalytic converter flange retaining nuts (Fig. 4).

(6) Slide exhaust pipe forward until exhaust pipe hanger disengages from transmission support. Remove exhaust pipe and catalytic converter from vehicle.

CATALYTIC CONVERTER (Continued)

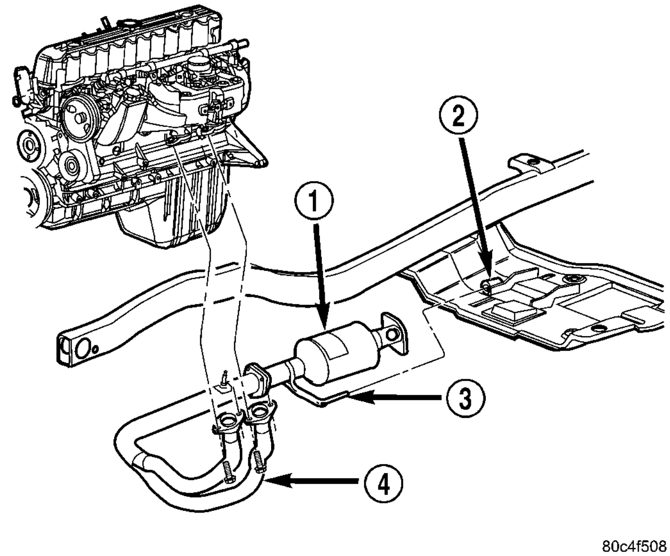


Fig. 4 Exhaust Pipe and Catalytic Converter - 4.0L

1 - CATALYTIC CONVERTER
2 - TRANSMISSION SUPPORT
3 - EXHAUST HANGER
4 - EXHAUST PIPE

INSTALLATION

INSTALLATION - 2.4L

(1) Position the mini catalytic converter assembly onto the exhaust pipe flange and the exhaust manifold. Tighten the nuts to 31 N·m (23 ft.lbs.) torque. Tighten the flange nuts to 28 N·m (21 ft. lbs.).

(2) Connect oxygen sensor wiring.

(3) Lower the vehicle.

(4) Start engine and inspect for leaks. Repair exhaust leaks as necessary.

(5) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

INSTALLATION - 4.0L

(1) Position exhaust pipe and catalytic converter into vehicle.

(2) Insert exhaust pipe hanger into transmission support (Fig. 4).

(3) Install exhaust pipe onto exhaust manifold **DO NOT** tighten bolts at this time.

(4) Position muffler flange onto catalytic converter flange and install retaining bolts and nuts (Fig. 4). **DO NOT** tighten nuts at this time.

(5) Make sure the exhaust system is aligned and has the proper clearance. The minimum clearance is 25mm (1 inch).

(6) Tighten muffler to catalytic converter flange retaining nuts to 28.5 N·m (21 ft. lbs.).

(7) Tighten exhaust pipe to exhaust manifold mounting bolts to 31 N·m (23 ft. lbs.).

(8) Install the oxygen sensors in the exhaust pipe and catalytic converter.

(9) Lower vehicle.

(10) Start engine and inspect for leaks. Repair exhaust leaks as necessary.

(11) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

EXHAUST PIPE

REMOVAL

REMOVAL - 2.4L

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

(1) Raise and support the vehicle.

(2) Saturate the studs and nuts with a Mopar® rust penetrant. Allow 5 minutes for penetration.

(3) Remove the oxygen sensors from the exhaust pipe and the catalytic converter.

(4) Disconnect the exhaust pipe from the engine exhaust manifold (Fig. 5).

(5) Remove catalytic converter to muffler flange retaining nuts (Fig. 5).

(6) Slide exhaust pipe forward until exhaust pipe hanger disengages from transmission support. Remove exhaust pipe and catalytic converter from vehicle.

EXHAUST PIPE (Continued)

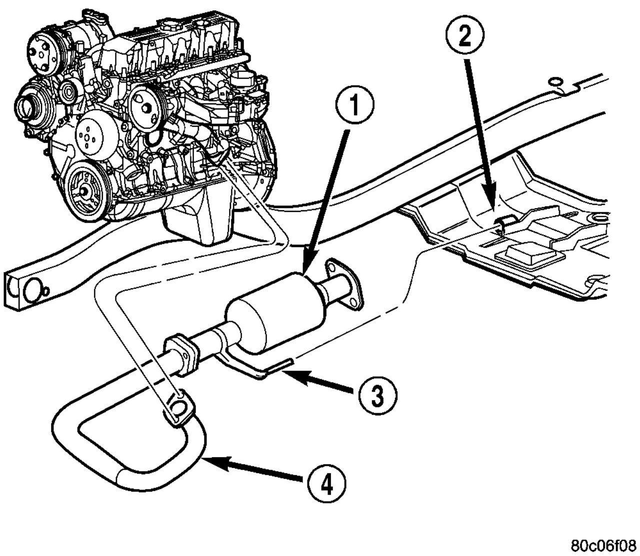


Fig. 5 Exhaust Pipe and Calalytic Converter - 2.4L

1 - CATALYTIC CONVERTER
2 - TRANSMISSION SUPPORT
3 - EXHAUST HANGER
4 - EXHAUST PIPE

REMOVAL - 4.0L

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

(1) Raise and support the vehicle.
(2) Saturate the studs and nuts with a Mopar® rust penetrant. Allow 5 minutes for penetration.
(3) Remove the oxygen sensors from the exhaust pipe and the catalytic converter.
(4) Disconnect the exhaust pipe from the engine exhaust manifold (Fig. 6).
(5) Remove catalytic converter to muffler flange retaining nuts (Fig. 6).
(6) Slide exhaust pipe foward until exhaust pipe hanger disengages from transmission support. Remove exhaust pipe and catalytic converter from vehicle.

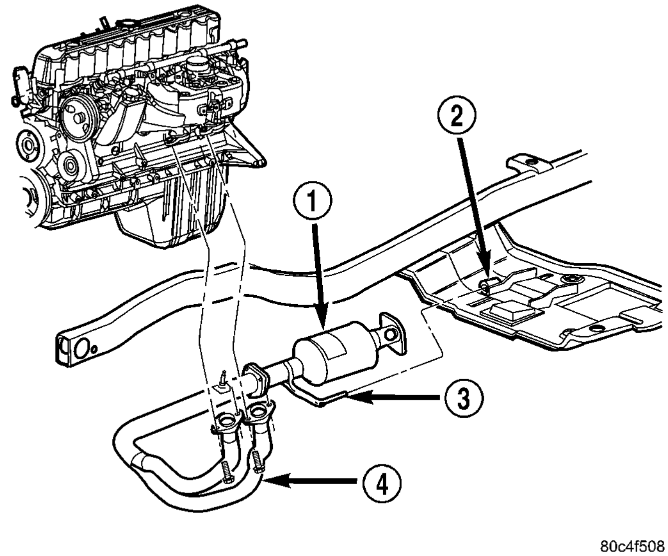


Fig. 6 Exhaust Pipe and Catalytic Converter - 4.0L

1 - CATALYTIC CONVERTER
2 - TRANSMISSION SUPPORT
3 - EXHAUST HANGER
4 - EXHAUST PIPE

INSTALLATION

INSTALLATION - 2.4L

(1) Position exhaust pipe and catalytic converter into vehicle.
(2) Insert exhaust pipe hanger into transmission support (Fig. 5).
(3) Install exhaust pipe onto exhaust manifold **DO NOT** tighten bolts at this time.
(4) Position muffler flange onto catalytic converter flange and install retaining bolts and nuts (Fig. 5). **DO NOT** tighten nuts at this time.
(5) Make sure the exhaust system is aligned and has the proper clearance. The minimum clearance is 25mm (1 inch).
(6) Tighten muffler to catalytic converter flange retaining nuts to 28.5 N·m (21 ft. lbs.).
(7) Tighten exhaust pipe to exhaust manifold mounting bolts to 31 N·m (23 ft. lbs.).
(8) Install the oxygen sensors in the exhaust pipe and catalytic converter.
(9) Lower vehicle.
(10) Start engine and inspect for leaks. Repair exhaust leaks as necessary.
(11) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

EXHAUST PIPE (Continued)

INSTALLATION - 4.0L

(1) Position exhaust pipe and catalytic converter into vehicle.

(2) Insert exhaust pipe hanger into transmission support (Fig. 6).

(3) Install exhaust pipe onto exhaust manifold **DO NOT** tighten bolts at this time.

(4) Position muffler flange onto catalytic converter flange and install retaining bolts and nuts (Fig. 6). **DO NOT** tighten nuts at this time.

(5) Make sure the exhaust system is aligned and has the proper clearance. The minimum clearance is 25mm (1 inch).

(6) Tighten muffler to catalytic converter flange retaining nuts to 28.5 N·m (21 ft. lbs.).

(7) Tighten exhaust pipe to exhaust manifold mounting bolts to 31 N·m (23 ft. lbs.).

(8) Install the oxygen sensors in the exhaust pipe and catalytic converter.

(9) Lower vehicle.

(10) Start engine and inspect for leaks. Repair exhaust leaks as necessary.

(11) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

HEAT SHIELDS

DESCRIPTION

Heat shields (Fig. 7) are made of stamped/formed steel, or metal foil.

Exhaust heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. The catalytic converter releases additional heat into the exhaust system. Under severe operating conditions, the temperature increases in the area of the converter. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the screws and/or nuts holding the heat shields to the frame and/or floor pan (Fig. 8) and (Fig. 9).

(3) When removing muffler heat shield, the muffler front support bracket must be removed first.

(4) Slide the shields out around the exhaust system.

INSTALLATION

(1) Position the heat shields to the floor pan or the frame and install the screws and/or nuts (Fig. 8) and (Fig. 9).

(2) Tighten the nuts and/or screws to 45 N·m (33 ft. lbs.).

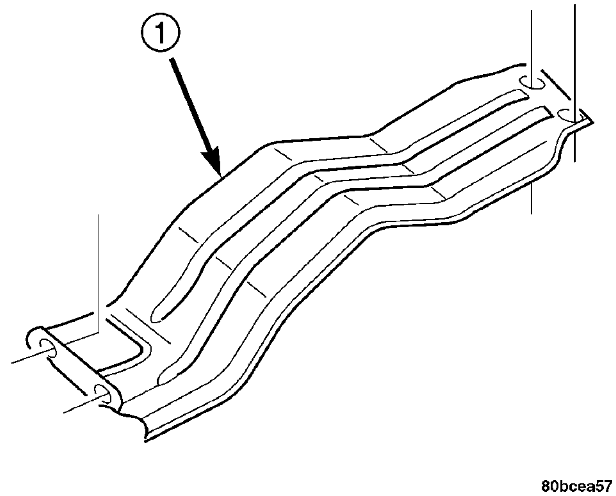


Fig. 7 Exhaust Heat Shield - Typical

1 - HEAT SHIELD

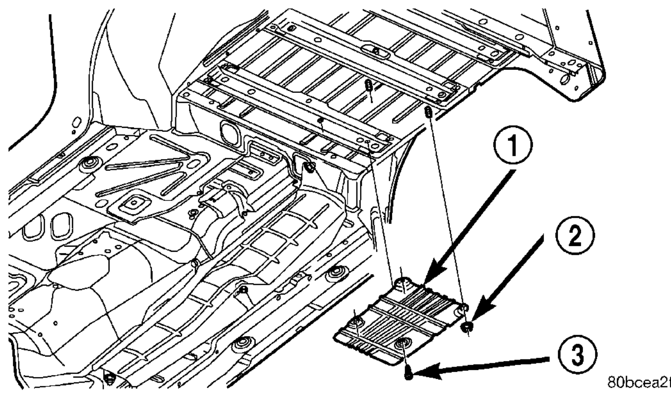


Fig. 8 Muffler Heat Shield - Rear

1 - MUFFLER HEAT SHIELD - REAR
2 - NUTS
3 - SELF TAPPING SCREWS

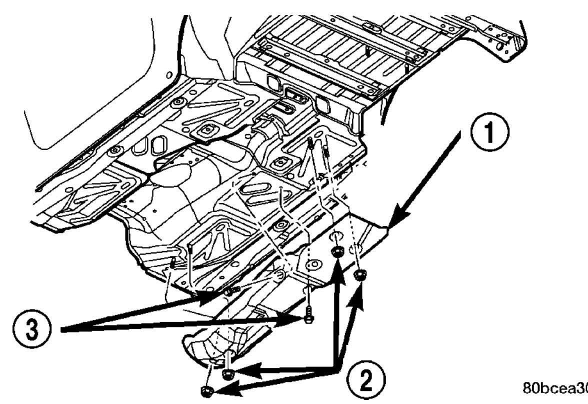


Fig. 9 Muffler Heat Shield - Middle

1 - MUFFLER HEAT SHIELD - MIDDLE
2 - NUTS
3 - SELF TAPPING SCREWS

(3) Lower the vehicle.

MUFFLER

DESCRIPTION

Both the 2.4L and 4.0L engines use a galvanized steel muffler (Fig. 10) to control exhaust noise levels and exhaust back pressure.

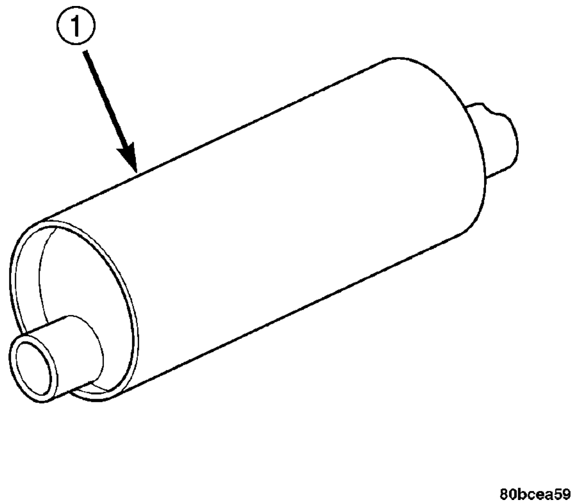


Fig. 10 Muffler

1 - MUFFLER

REMOVAL

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE FUEL LINES.

CAUTION: When servicing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust system to hang by the oxygen sensor harness will damage the wiring and/or sensor.

All original equipment exhaust systems are manufactured with the exhaust tailpipe welded to the muffler. Service replacement mufflers and exhaust tailpipes are either clamped together or welded together.

(1) Raise the vehicle and support the rear of the vehicle by the side rails and allow the axle to hang free.

(2) Remove the tailpipe hangers from the insulators (Fig. 11).

(3) Remove muffler to catalytic converter flange retaining nuts (Fig. 11).

(4) Remove muffler and tailpipe assembly from vehicle.

MUFFLER (Continued)

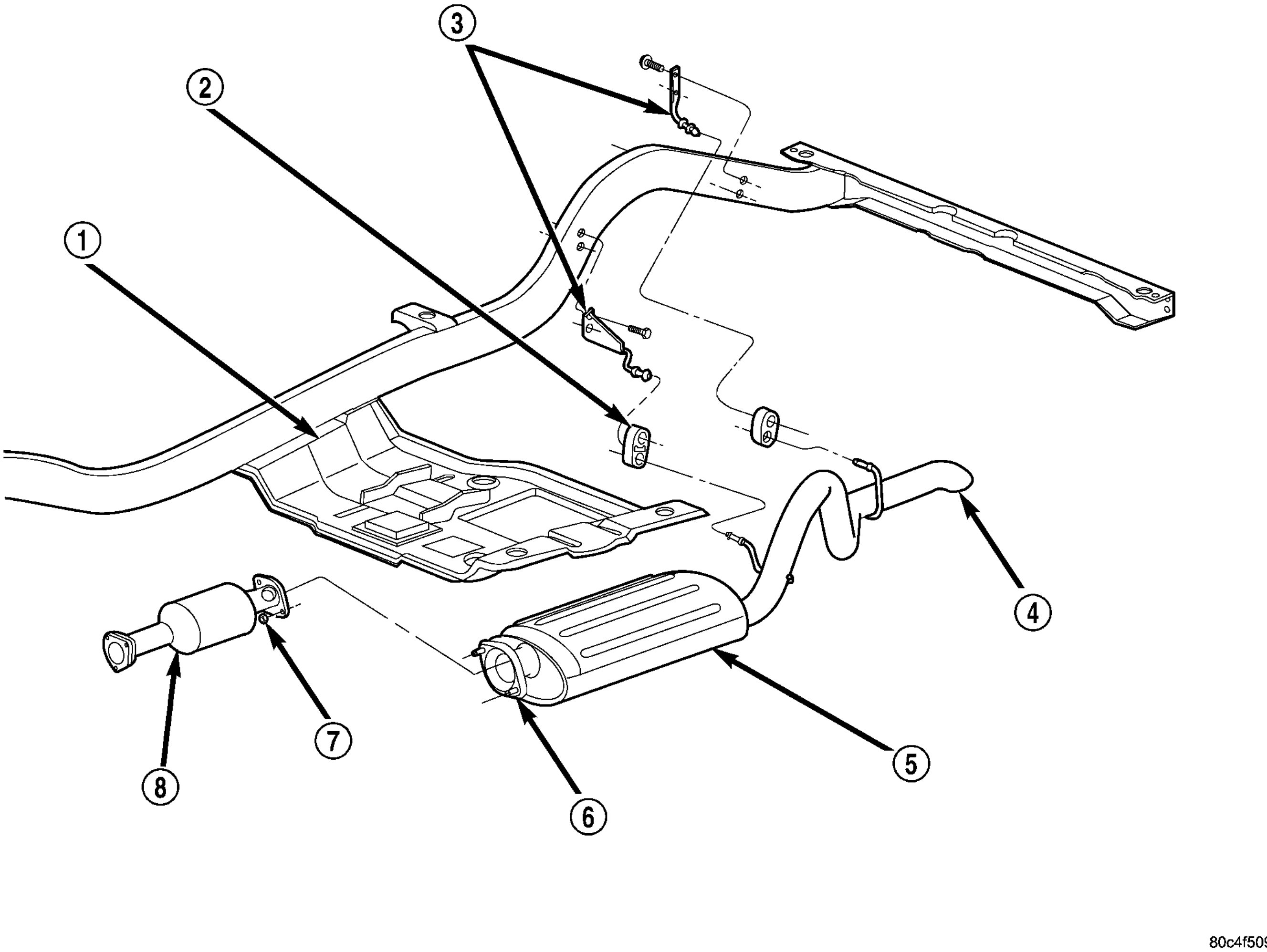


Fig. 11 Muffler and Tailpipe

1 - TRANSMISSION SUPPORT
2 - TAILPIPE HANGER INSULATORS
3 - TAILPIPE HANGERS
4 - TAILPIPE
5 - MUFFLER
6 - MUFFLER TO CATALYTIC CONVERTER FLANGE
7 - NUTS
8 - CATALYTIC CONVERTER

INSTALLATION

(1) Position muffler and tailpipe assembly into vehicle.

(2) Position muffler and catalytic converter flanges together and install nuts (Fig. 11). **DO NOT** tighten nuts at this time.

(3) Install tailpipe hangers into the insulators (Fig. 11).

(4) Make sure the muffler and tailpipe are correctly positioned and the proper alignment. The minimum clearance between components is 25mm (1 inch).

(5) Tighten muffler to catalytic converter flange nuts to 28.5 N·m (21 ft. lbs.).

(6) Lower vehicle.

(7) Start engine and inspect for leaks. Repair exhaust leaks as necessary.

(8) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

TAILPIPE

DESCRIPTION

TAILPIPE

DESCRIPTION

The tailpipe (Fig. 12) is made of galvanized steel

OPERATION

The tailpipe channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment.

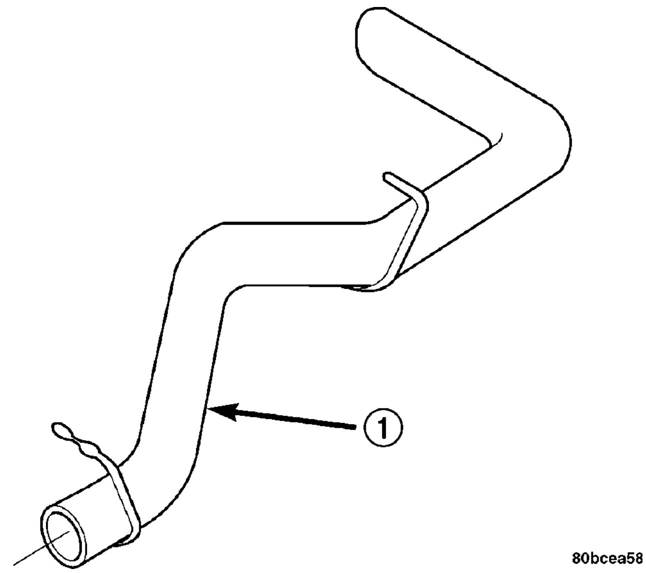


Fig. 12 Tailpipe - Typical

1 - TAILPIPE

FRAME & BUMPERS

TABLE OF CONTENTS

FRAME & BUMPERS

SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
FRONT BUMPER SCREW	108	80	—
FRONT TOW HOOK SCREW	108	80	—
FUEL TANK SKID PLATE NUTS	16	12	138
FUEL TANK STRAP NUTS	5	—	40
MAIN FLOOR TO HOLD DOWN BOLT	68	50	—
RADIATOR TO FRAME HOLD DOWN BOLT	60	45	—
REAR BUMPER BOLT	77	57	—
REAR FLOOR TO FRAME BOLT	47	35	—
REAR TOE HOOK SCREW	77	57	—
TRANFER CASE SKID PLATE BOLTS	45	33	—
TRANSMISSION MOUNT NUTS	35	26	—
TRANSMISSION SKID PLATE TO FRAME BOLTS	45	33	—
TRANSMISSION SKID PLATE TO TRANSFER CASE SKID PLATE BOLTS	28	21	—

FRONT EXTENSION

REMOVAL

(1) Remove the bolts attaching the bumper extension to the bumper (Fig. 1).

(2) Separate the extension from the bumper.

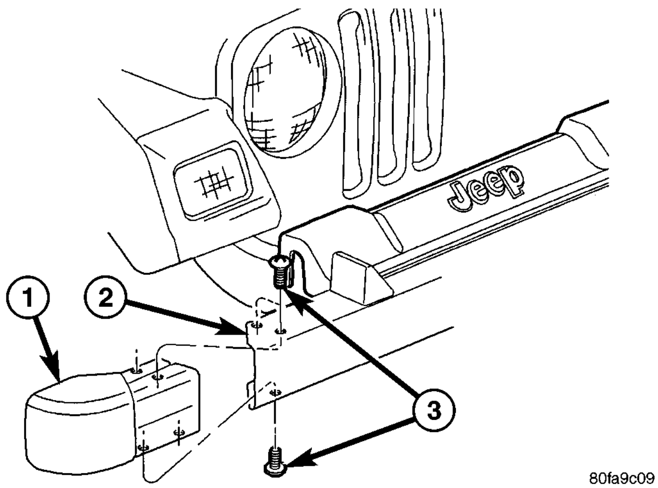


Fig. 1 BUMPER EXTENSION

1 - BUMPER EXTENSION
2 - FRONT BUMPER
3 - BOLTS (2 ON TOP AND 1 ON BOTTOM)

INSTALLATION

(1) Position the extension to the bumper

(2) Install the screws retaining the front bumper extension. (Fig. 1)

FRONT BUMPER

REMOVAL

(1) If equipped, disconnect the fog lamp harness connector.

(2) Remove the screws that attach the bumper to the frame rail (Fig. 2).

(3) If equipped, remove the tow hook. (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT TOW HOOK - REMOVAL)

(4) Separate the bumper from the vehicle.

INSTALLATION

(1) Position the bumper on the vehicle.

(2) If equipped, install the tow hook. (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT TOW HOOK - INSTALLATION)

(3) Install the screws that attach the bumper to the frame rail and tighten to 108 N·m (80 ft. lbs.).

(4) If equipped, Connect the fog lamp harness connector.

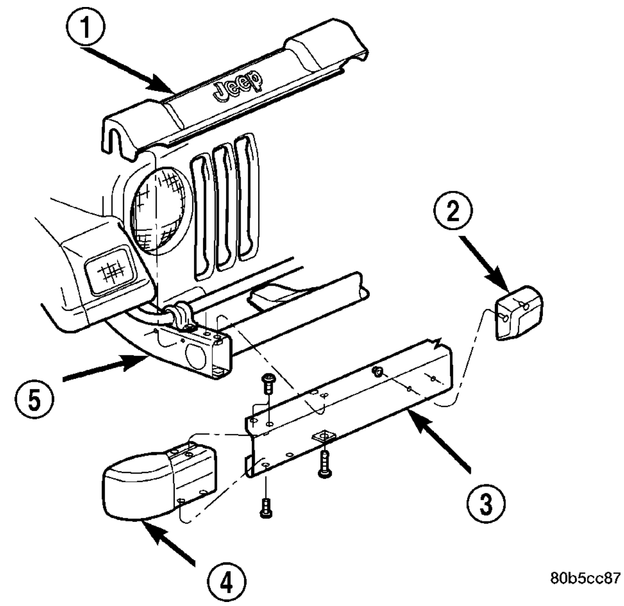


Fig. 2 FRONT BUMPER COMPONENTS

1 - VALANCE
2 - BUMPER GUARD
3 - FRONT BUMPER
4 - BUMPER EXTENSION
5 - FRAME

REAR EXTENSION

REMOVAL

(1) Remove the screws attaching the bumper extension to the bumper (Fig. 3).

(2) Separate the extension from the bumper.

INSTALLATION

(1) Position the extension on the bumper.

(2) Install the screws attaching the bumper extension to the bumper.

REAR BUMPER

REMOVAL

(1) Remove the bolt attaching the bumper to frame rail. (Fig. 3)

(2) If equipped, remove the rear tow eye/hook. (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - REMOVAL)

(3) Disconnect the rear fog lamp electrical connector, if equipped.

(4) Remove the nuts attaching the bumper to the rear frame crossmember.

(5) Separate the bumper from the vehicle.

REAR BUMPER (Continued)

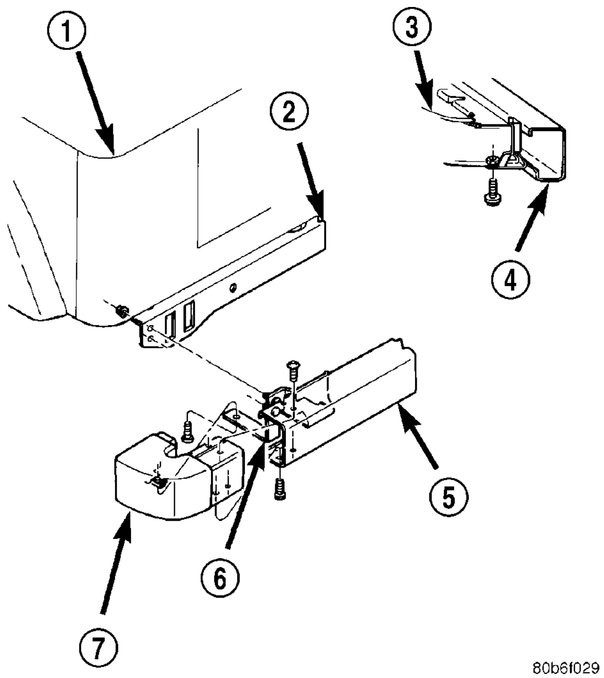


Fig. 3 REAR BUMPER COMPONENTS

1 - BODY
2 - CROSSMEMBER
3 - FRAME
4 - REAR BUMPER
5 - REAR BUMPER
6 - BRACE
7 - REAR BUMPER EXTENSION

INSTALLATION

(1) Position the bumper on the vehicle.

(2) Install the nuts attaching the bumper to the rear frame crossmember and tighten to 77 N·m (57 ft. lbs.).

(3) If equipped, install the rear tow eye/hook. (Refer to 13 - FRAME & BUMPERS/FRAME/REAR TOW HOOK - INSTALLATION)

(4) Install the bolt attaching the bumper to frame rail and tighten to 77 N·m (57 ft. lbs.).

(5) Connect the rear fog lamp electrical connectors, if equipped.

FRAME

STANDARD PROCEDURE - FRAME SERVICE

SAFETY PRECAUTIONS AND WARNINGS

WARNING: USE EYE PROTECTION WHEN GRINDING OR WELDING METAL, SERIOUS EYE INJURY CAN RESULT. BEFORE PROCEEDING WITH FRAME REPAIR INVOLVING GRINDING OR WELDING, VERIFY THAT VEHICLE FUEL SYSTEM IS NOT LEAKING OR IN CONTACT WITH REPAIR AREA, PERSONAL INJURY CAN RESULT. DO NOT ALLOW OPEN FLAME TO CONTACT PLASTIC BODY PANELS. FIRE OR EXPLOSION CAN RESULT. WHEN WELDED FRAME COMPONENTS ARE REPLACED, 100% PENETRATION WELD MUST BE ACHIEVED DURING INSTALLATION. IF NOT, DANGEROUS OPERATING CONDITIONS CAN RESULT. STAND CLEAR OF CABLES OR CHAINS ON PULLING EQUIPMENT DURING FRAME STRAIGHTENING OPERATIONS, PERSONAL INJURY CAN RESULT. DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT SUPPORTED ON SAFETY STANDS, PERSONAL INJURY CAN RESULT.

CAUTION: Do not reuse damaged fasteners, quality of repair would be suspect. Do not drill holes in top or bottom frame rail flanges, frame rail failure can result. Do Not use softer than Grade 3 bolts to replace production fasteners, loosening or failure can result. When using heat to straighten frame components do not exceed 566°C (1050°F), metal fatigue can result. Welding the joints around riveted cross members and frame side rails can weaken frame.

FRAME STRAIGHTENING

When necessary, a conventional frame that is bent or twisted can be straightened by application of heat. The temperature must not exceed 566°C (1050°F). The metal will have a dull red glow at the desired temperature. Excessive heat will decrease the strength of the metal and result in a weakened frame.

Welding the joints around riveted cross members and frame side rails is not recommended.

A straightening repair process should be limited to frame members that are not severely damaged. The replacement bolts, nuts and rivets that are used to join the frame members should conform to the same specifications as the original bolts, nuts and rivets.

FRAME REPAIRS

DRILLING HOLES

Do not drill holes in the top and bottom of frame rail, metal fatigue can result causing frame failure. Holes drilled in the side of the frame rail must be at least 38 mm (1.5 in.) from the top and bottom flanges.

Additional drill holes should be located away from existing holes.

WELDING

Use MIG, TIG or arc welding equipment to repair welded frame components.

FRAME (Continued)

Frame components that have been damaged should be inspected for cracks before returning the vehicle to use. If cracks are found in accessible frame components perform the following procedures.

(1) Drill a hole at each end of the crack with a 3 mm (O.125 in.) diameter drill bit.

(2) Using a suitable die grinder with 3 inch cut off wheel, V-groove the crack to allow 100% weld penetration.

(3) Weld the crack.

(4) If necessary when a side rail is repaired, grind the weld smooth and install a reinforcement channel (Fig. 4) over the repaired area.

CAUTION: A reinforcement should never be used on the front section of the frame. The frame section forward of the suspension mounts contains energy management holes (Fig. 5). Reinforcing this area may effect energy management.

NOTE: If a reinforcement is required, it should completely cover the repaired area. The reinforcement should also overlap the top and bottom of the frame by more than 50% of its width. Weld as indicated (Fig. 4).

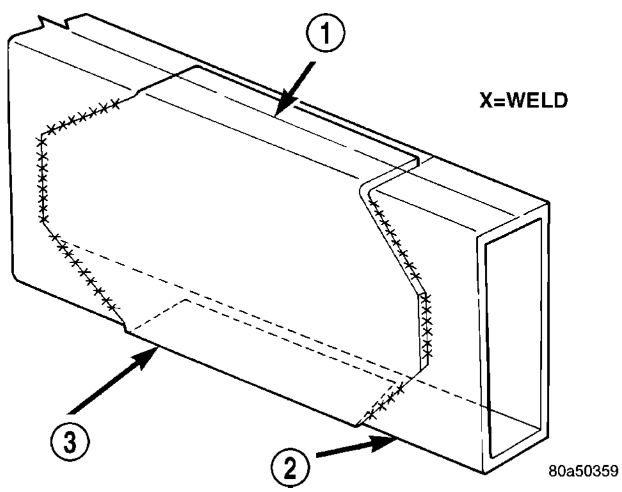


Fig. 4 FRAME REINFORCEMENT

1 - FRAME CENTER LINE
2 - FRAME
3 - FRAME REPAIR REINFORCEMENT

FRAME FASTENERS

Bolts and nuts can be used to repair frames or to install a reinforcement section on the frame.

Conical-type washers are preferred over the split-ring type lock washers. Normally, grade-5 bolts are adequate for frame repair. **Grade-3 bolts or softer should not be used.** Tightening bolts/nuts with the correct torque, refer to the Introduction Group at the front of this manual for tightening information.

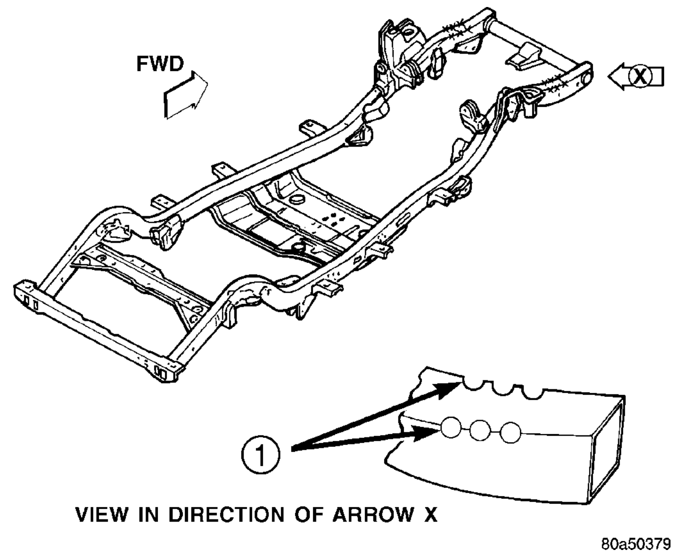


Fig. 5 ENERGY MANAGEMENT HOLES

1 - ENERGY MANAGEMENT HOLES

SPECIFICATIONS

FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principle Locating Point (PLP), or from center to center of PLP and fastener location.

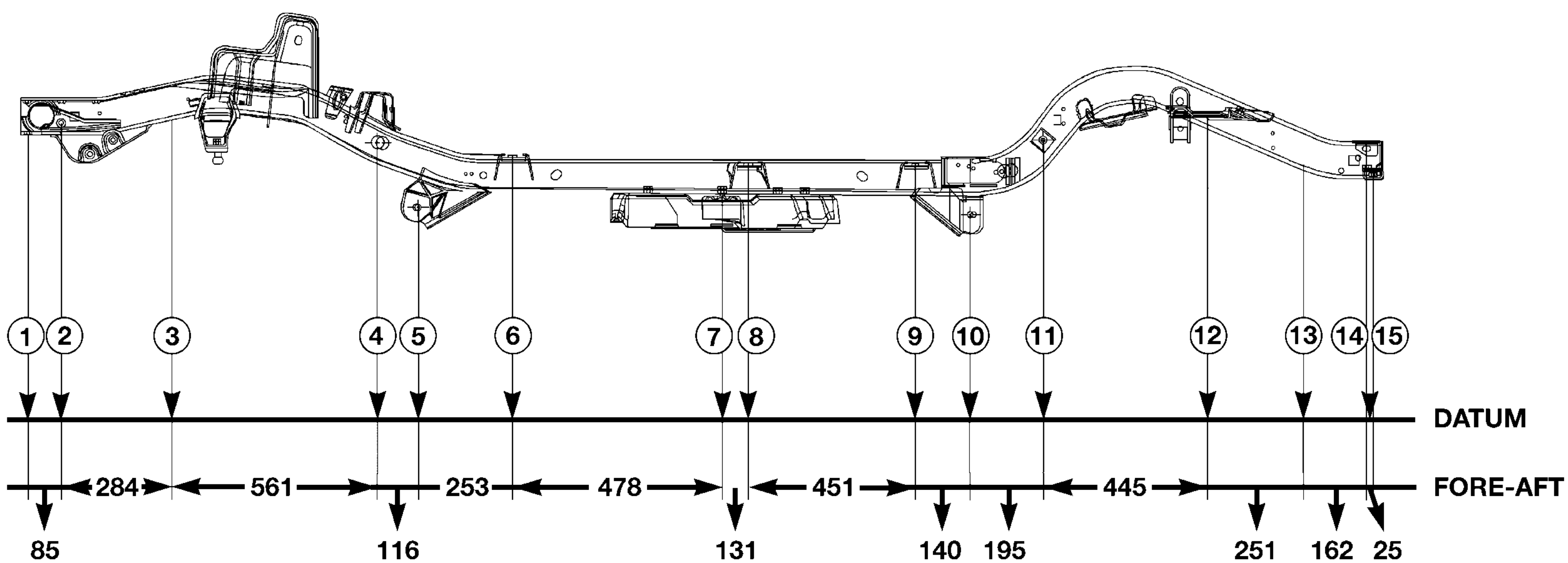
VEHICLE PREPARATION

Position the vehicle on a level work surface. Using screw or bottle jacks, adjust the vehicle PLP heights to the specified dimension above a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable.

INDEX

DESCRIPTION	FIGURE
FRAME SIDE VIEW	6
FRAME TOP VIEW	7
FRAME SIDE VIEW LWB	8
FRAME TOP VIEW LWB	9

FRAME (Continued)



POINT #	DISTANCE TO DATUM (mm)	
1.	500	BOTTOM OF SIDERAIL
2.	534	CENTER OF HOLE
3.	543	BOTTOM OF SIDERAIL, CENTER OF SLOT
4.	494	CENTER OF HOLE, OUTBOARD
5.	317	CENTER OF HOLE, OUTBOARD
6.	460	BOTTOM OF BRACKET
7.	359	BOTTOM OF SIDERAIL

POINT #	DISTANCE TO DATUM (mm)	
8.	445	BOTTOM OF BRACKET
9.	445	BOTTOM OF BRACKET
10.	309	CENTER OF HOLE, OUTBOARD
11.	512	CENTER OF HOLE, INBOARD
12.	577	BOTTOM OF CROSSMEMBER
13.	474	CENTER OF HOLE, OUTBOARD
14.	505	BOTTOM OF BRACKET
15.	406	BOTTOM OF FRAME

805fe562

Fig. 6 FRAME SIDE VIEW

FRAME (Continued)

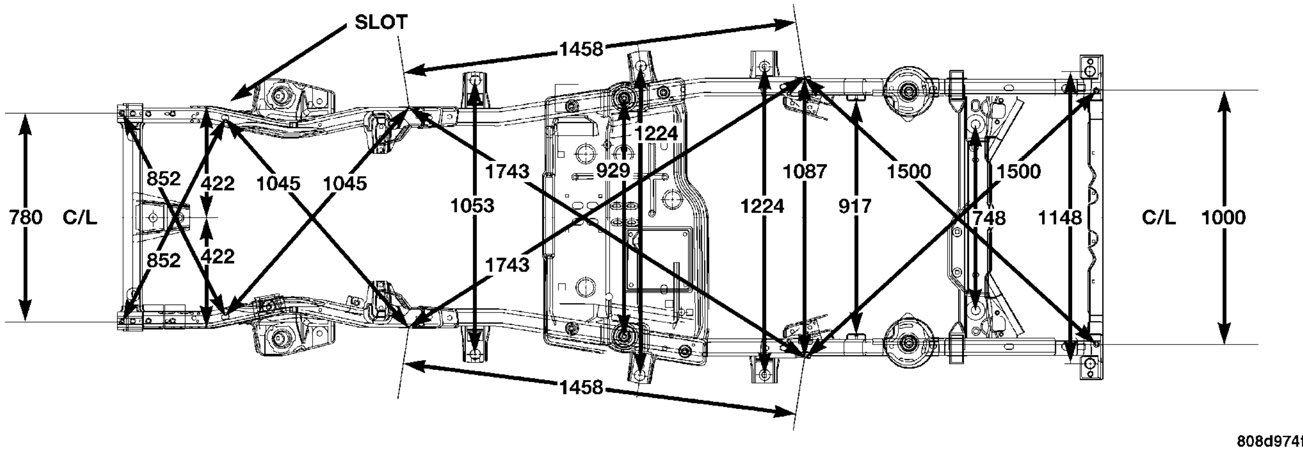


Fig. 7 FRAME TOP VIEW

FRAME (Continued)

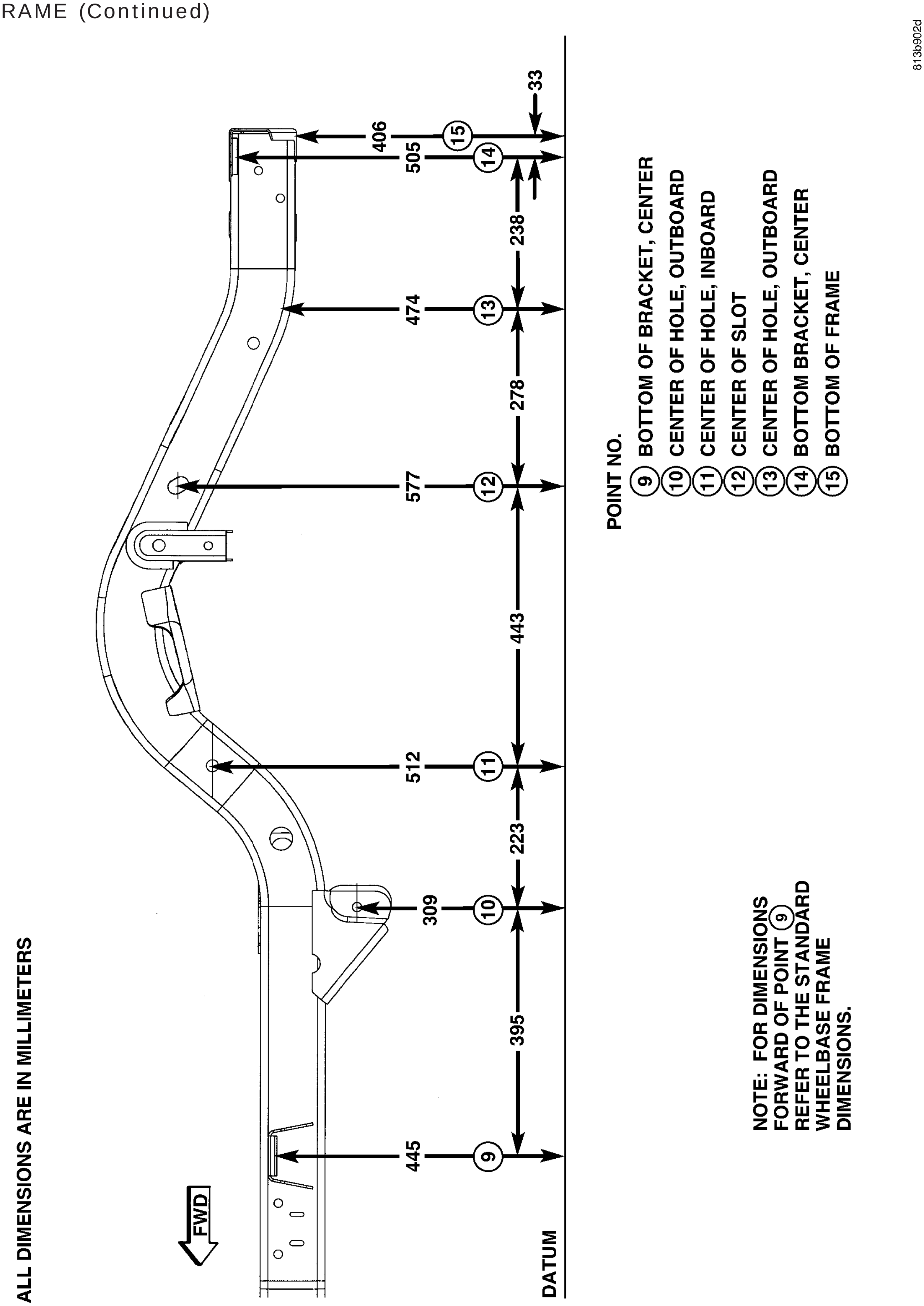


Fig. 8 FRAME SIDE VIEW LWB

FRAME (Continued)

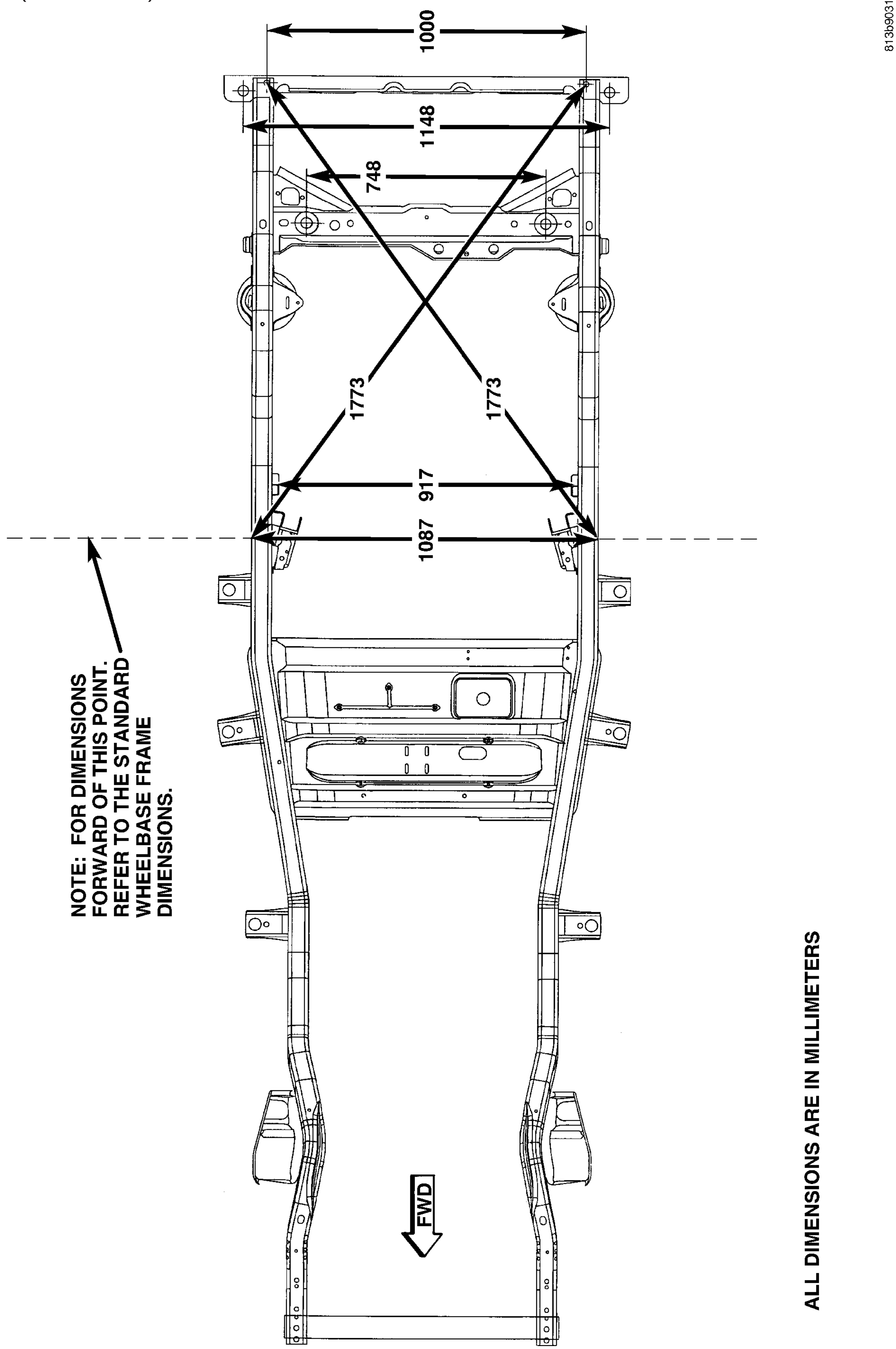


Fig. 9 FRAME TOP VIEW LWB

TRANSFER CASE SKID PLATE

REMOVAL

NOTE: The transmission and transfer case cross-member is integrated with the transfer case skid plate.

WARNING: THE TRANSFER CASE AND TRANSMISSION ARE SUPPORTED BY THE TRANSFER CASE SKID PLATE. BEFORE REMOVING THE TRANSFER CASE SKID PLATE, ENSURE THAT THE TRANSMISSION IS PROPERLY SUPPORTED.

(1) Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
(2) Remove the transmission skid plate, if equipped. (Refer to 13 - FRAME & BUMPERS/ FRAME/FRONT SKID PLATE - REMOVAL)
(3) Support the transmission with a suitable lifting device.
(4) Remove the nuts attaching the transmission mount to the skid plate. (Fig. 10)
(5) Remove the bolts attaching the skid plate to the frame and remove the skid plate. (Fig. 11)

INSTALLATION

(1) Position the skid plate on the vehicle.
(2) Install the bolts attaching the skid plate to the frame and tighten to 74 N·m (55 ft. lbs.).
(3) Install the nuts attaching the transmission mount to the skid plate and tighten to 35 N·m (26 ft. lbs.).
(4) Install the transmission skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT SKID PLATE - INSTALLATION)

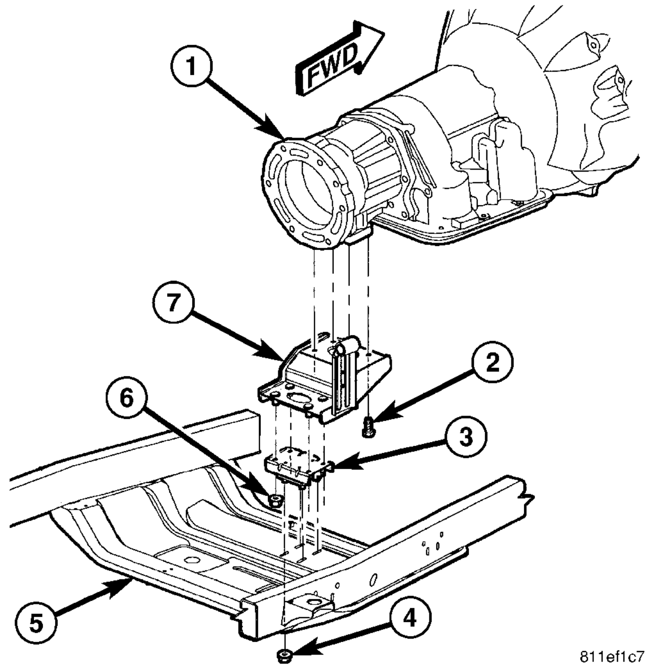


Fig. 10 TRANSMISSION MOUNT (Auto shown, manual similar)

1 - TRANSMISSION ASSEMBLY
2 - SUPPORT BRACKET BOLTS (4)
3 - TRANSMISSION MOUNT
4 - SKID PLATE/CROSSMEMBER NUTS (4)
5 - SKID PLATE/CROSSMEMBER
6 - MOUNT NUTS (4)
7 - SUPPORT BRACKET

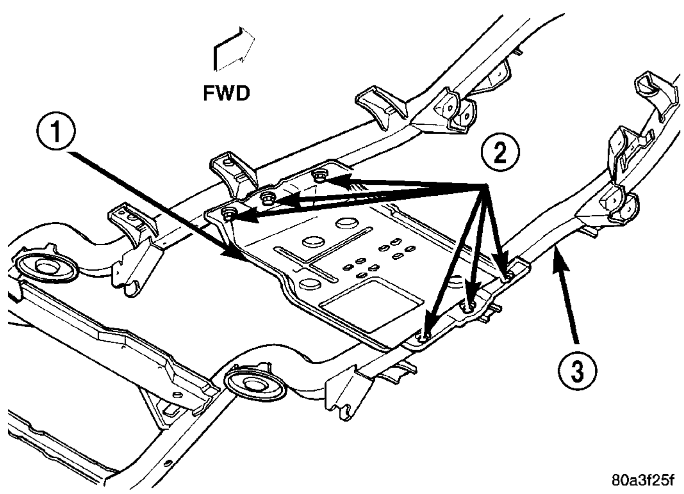


Fig. 11 TRANSFER CASE SKID PLATE

1 - SKID PLATE
2 - BOLTS
3 - FRAME

FUEL TANK SKID PLATE

REMOVAL

(1) Position a support under the fuel tank skid plate.

(2) Remove the protective caps from the end of the strap studs.

(3) Remove the nuts that attach the skid plate to the straps and to the crossmembers (Fig. 12).

(4) Separate the fuel tank strap from the skid plate.

(5) Support the fuel tank and remove the skid plate from the vehicle.

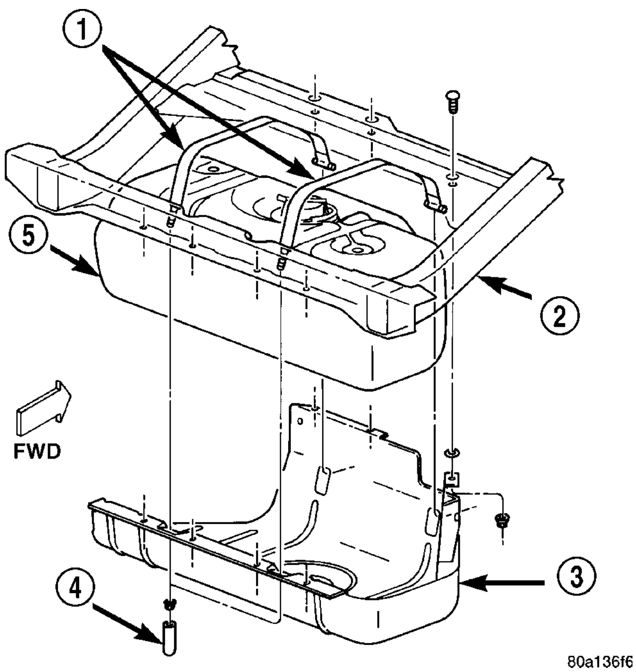


Fig. 12 FUEL TANK SKID PLATE

1 - STRAP
2 - FRAME
3 - SKID PLATE
4 - PROTECTIVE CAP
5 - FUEL TANK

INSTALLATION

(1) Attach the skid plate to the fuel tank strap.

(2) Position and support the skid plate under the fuel tank.

(3) Install the nuts to attach the skid plate to the straps and to the frame crossmembers. Tighten the fuel tank strap nuts to 5 N·m (40 in. lbs.). Tighten the skid plate-to-crossmember nuts with 16 N·m (138 in. lbs.).

(4) Install the protective caps on the end of the strap studs.

(5) Remove the support from under the skid plate.

FRONT TOW HOOK

REMOVAL

(1) Remove the torx bolts that attach the tow hook to the bumper (Fig. 13).

(2) Separate the tow hook from the bumper.

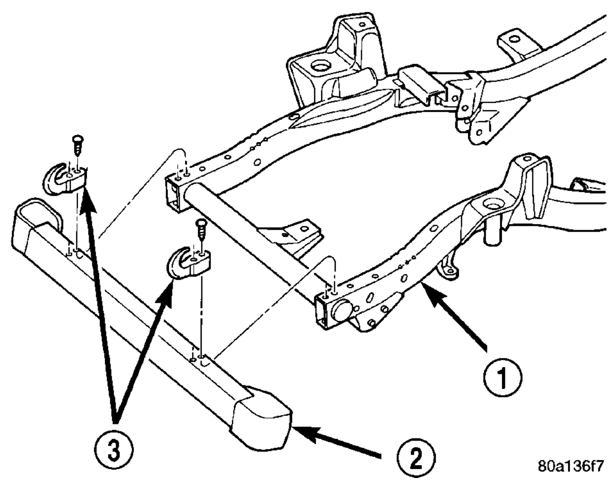


Fig. 13 FRONT TOW HOOK

1 - FRAME
2 - BUMPER
3 - TOW HOOK

INSTALLATION

(1) Position the tow hook on the bumper.

(2) Install the torx bolts that attach the tow hook to the bumper and tighten to 108 N·m (80 ft. lbs.).

REAR TOW HOOK

REMOVAL

(1) Remove the fasteners that attach the rear tow hook to the frame (Fig. 14).

(2) Separate the tow hook from the frame.

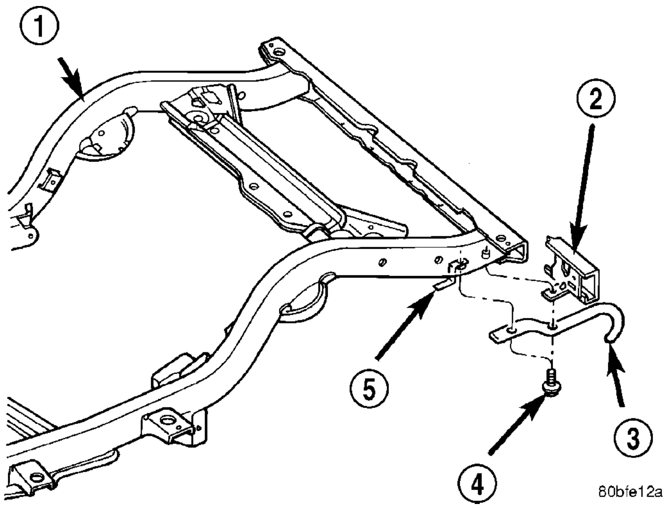


Fig. 14 REAR TOW HOOK

1 - FRAME
2 - REAR BUMPER
3 - TOW HOOK
4 - BOLT
5 - NUT

INSTALLATION

(1) Position the tow hook on the frame.

(2) Install the bolts and tighten to 77 N·m (57 ft. lbs.).

TRANSMISSION SKID PLATE

REMOVAL

(1) Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

(2) Support the skid plate.

(3) Remove the bolts and remove the skid plate. (Fig. 15)

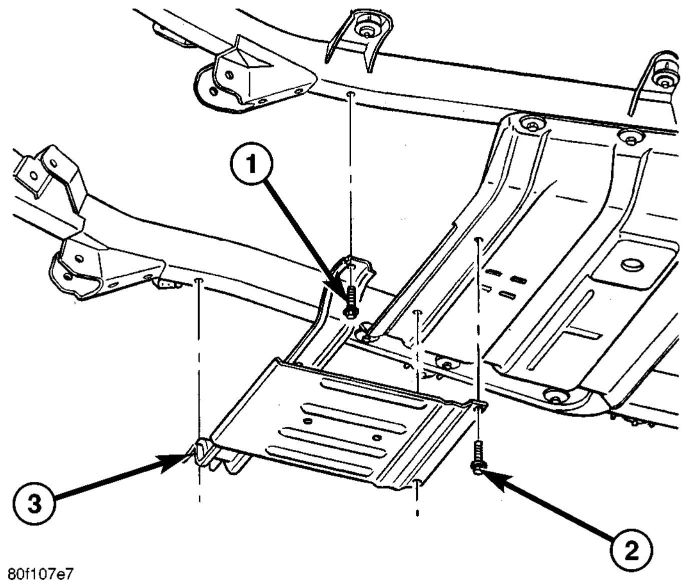


Fig. 15 TRANSMISSION SKID PLATE

1 - FRONT BOLTS (2)
2 - REAR BOLTS (2)
3 - SKID PLATE

INSTALLATION

(1) Position the skid plate in place and support.

(2) Install the bolts and tighten the plate to frame bolts to 45 N·m (33 ft. lbs.).

(3) Tighten the plate to transfer case skid plate bolts to 35 N·m (26 ft. lbs.).

FUEL SYSTEM

TABLE OF CONTENTS

FUEL DELIVERY

TABLE OF CONTENTS

FUEL DELIVERY

DESCRIPTION

The fuel delivery system consists of:

• the fuel pump module containing the electric fuel pump, fuel filter/fuel pressure regulator, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module

- fuel tubes/lines/hoses
- quick-connect fittings
- fuel injector rail
- fuel injectors
- fuel tank
- fuel tank filler/vent tube assembly

FUEL DELIVERY (Continued)

- fuel tank filler tube cap
- check valve(s)
- accelerator pedal
- throttle cable

OPERATION

Fuel is returned through the fuel pump module and back into the fuel tank through the fuel filter/fuel pressure regulator. A separate fuel return line from the engine to the tank is not used.

The fuel tank assembly consists of: the fuel tank, fuel pump module assembly, fuel pump module locknut/gasket, and fuel tank check valve (refer to Emission Control System for fuel tank check valve information).

A fuel filler/vent tube assembly using a pressure/vacuum fuel filler cap is used. The fuel filler tube contains a flap door located below the fuel fill cap.

Also to be considered part of the fuel system is the evaporation control system. This is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evaporative Control System is located in Emission Control Systems.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

STANDARD PROCEDURE - FUEL SYSTEM PRESSURE RELEASE

Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.

(1) Remove fuel fill cap.

(2) Remove fuel pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.

(3) Start and run engine until it stalls.

(4) Attempt restarting engine until it will no longer run.

(5) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(6) Unplug connector from any fuel injector.

(7) Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.

(8) Connect other end of jumper wire to positive side of battery.

(9) Connect one end of a second jumper wire to remaining injector terminal.

CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.

(10) Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.

(11) Place a rag or towel below fuel line quick-connect fitting at fuel rail.

(12) Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.

(13) Return fuel pump relay to PDC.

(14) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB® scan tool must be used to erase a DTC.

FUEL DELIVERY (Continued)

SPECIFICATIONS

FUEL SYSTEM PRESSURE

339 kPa +/- 34 kPa (49.2 psi +/- 2 psi).

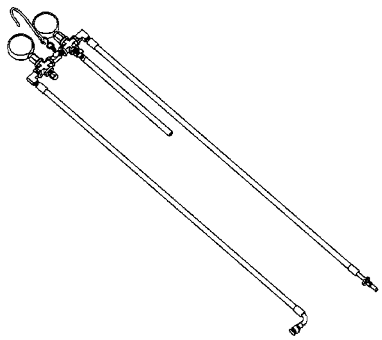
TORQUE - FUEL DELIVERY

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Accelerator Pedal Bracket Mounting Nuts	8.5	-	75
Fuel Hose Clamps	3	-	25
Fuel Rail Mounting Bolts - 2.4L	28	-	250
Fuel Rail Mounting Bolts or Nuts - 4.0L	11	-	100
Fuel Tank Mounting Strap Bolts	Refer to service manual text.	-	-
Fuel Pump Module Locknut	74	55	-
Fuel Tank Skidplate Bolts	16	-	141

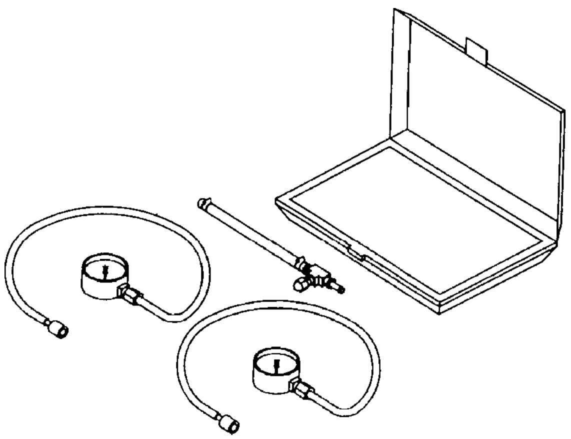
FUEL DELIVERY (Continued)

SPECIAL TOOLS

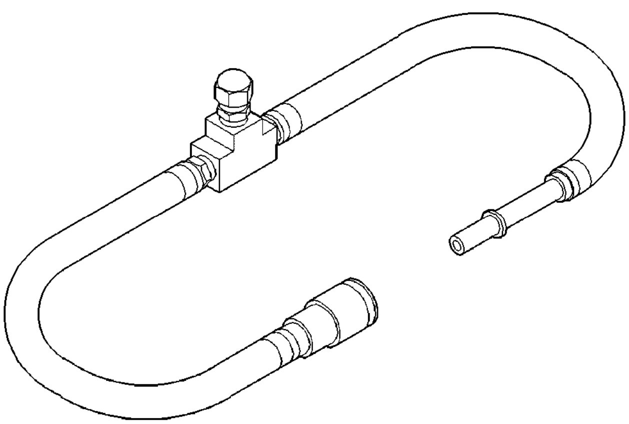
FUEL SYSTEM



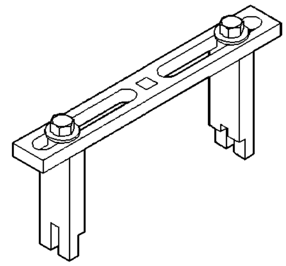
FUEL PRESSURE TESTER - #8978



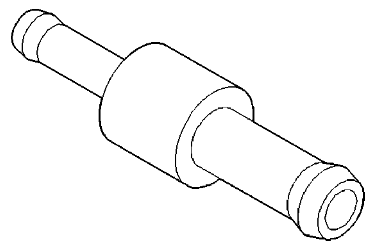
TEST KIT, FUEL PRESSURE, 8.0L ENGINE - #5069



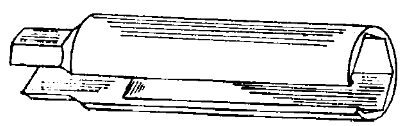
ADAPTERS, FUEL PRESSURE TEST, 8.0L - #6539 AND/OR #6631



SPANNER WRENCH - #6856



FITTING, AIR METERING - #6714



O2S (OXYGEN SENSOR) REMOVER/INSTALLER - #C-4907

FUEL FILTER/PRESSURE REGULATOR

DESCRIPTION

The combination fuel filter and fuel pressure regulator is located on the top of fuel pump module (Fig. 6).

OPERATION

A combination fuel filter and fuel pressure regulator is used on all engines. A separate frame mounted fuel filter is not used with any engine.

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is not controlled by engine vacuum or the Powertrain Control Module (PCM).

The regulator is calibrated to maintain fuel system operating pressure of approximately 339 ± 34 kPa (49.2 ± 5 psi) at the fuel injectors. It contains a diaphragm, calibrated springs and a fuel return valve. The internal fuel filter is also part of the assembly.

Fuel is supplied to the filter/regulator by the electric fuel pump through an opening tube at the bottom of filter/regulator (Fig. 3).

The regulator acts as a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine. A second check valve is located at the outlet end of the electric fuel pump.

If fuel pressure at the pressure regulator exceeds approximately 49 psi, an internal diaphragm closes and excess fuel pressure is routed back into the tank through the pressure regulator. A separate fuel return line is not used with any engine.

REMOVAL

The combination Fuel Filter/Fuel Pressure Regulator is located on the fuel pump module. The fuel pump module is located on top of fuel tank.

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Clean area around filter/regulator.

(3) Disconnect fuel line at filter/regulator. Refer to Quick-Connect Fittings in this group for procedures.

(4) Remove retainer clamp from top of filter/regulator (Fig. 1). Clamp snaps to tabs on pump module. Discard old clamp.

(5) Pry filter/regulator from top of pump module with 2 screwdrivers. Unit is snapped into module.

(6) Discard gasket below filter/regulator (Fig. 2).

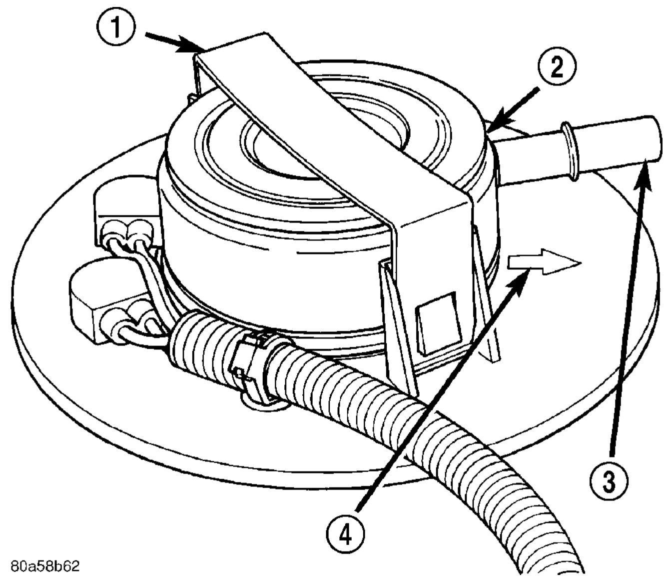


Fig. 1 Fuel Filter/Fuel Pressure Regulator

1 - RETAINER CLAMP
2 - FUEL FILTER/FUEL PRESSURE REGULATOR
3 - FUEL SUPPLY TUBE
4 - ALIGNMENT ARROW

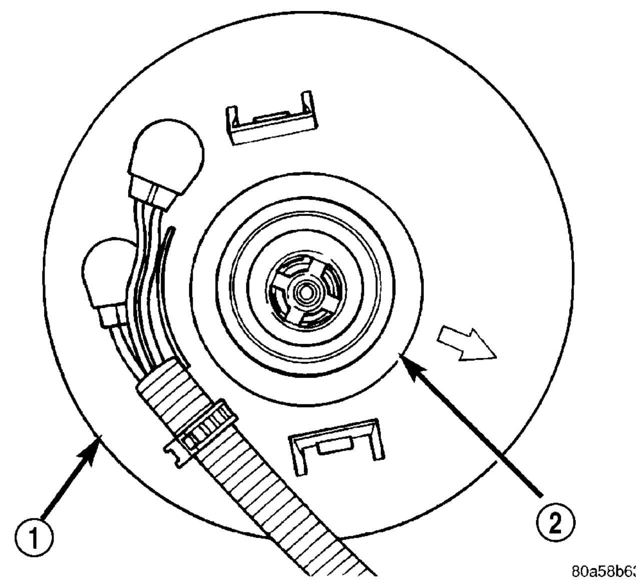


Fig. 2 Fuel Filter/Fuel Pressure Regulator Gasket

1 - TOP OF MODULE
2 - GASKET

FUEL FILTER/PRESSURE REGULATOR (Continued)

(7) Before discarding filter/regulator assembly, inspect assembly to verify that o-rings (Fig. 3) are intact. If the smallest of the two o-rings can not be found on bottom of filter/regulator, it may be necessary to remove it from the fuel inlet passage in fuel pump module.

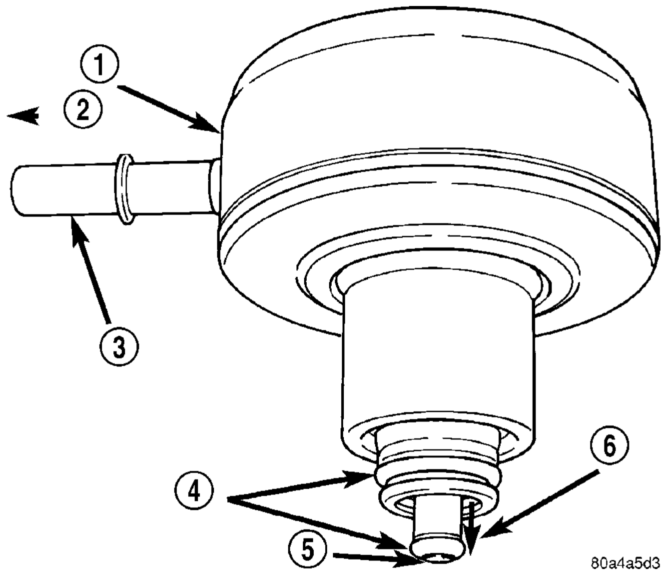


Fig. 3 Fuel Filter/Fuel Pressure Regulator

1 - FUEL FILTER/FUEL PRESSURE REGULATOR
2 - TO FUEL INJECTORS
3 - FUEL SUPPLY TUBE
4 - O-RINGS
5 - FUEL INLET FROM PUMP
6 - FUEL RETURN TO TANK

INSTALLATION

The combination Fuel Filter/Fuel Pressure Regulator is located on the fuel pump module. The fuel pump module is located on top of fuel tank.

(1) Clean recessed area in pump module where filter/regulator is to be installed.

(2) Obtain new filter/regulator (two new o-rings should already be installed) .

(3) Apply a small amount of clean engine oil to o-rings. **Do not install o-rings separately into fuel pump module. They will be damaged when installing filter/regulator.**

(4) Install new gasket to top of fuel pump module.

(5) Press new filter/regulator into top of pump module until it snaps into position (a positive click must be heard or felt).

(6) The molded arrow (Fig. 1) on top of fuel pump module should be pointed towards front of vehicle (12 o'clock position).

(7) Rotate filter/regulator until fuel supply tube (fitting) is pointed to 10 o'clock position.

(8) Install new retainer clamp (clamp snaps over top of filter/regulator and locks to flanges on pump module).

(9) Connect fuel line at filter/regulator. Refer to Quick-Connect Fittings in this group for procedures.

(10) Install fuel tank. Refer to Fuel Tank Removal/Installation.

FUEL LEVEL SENDING UNIT / SENSOR

DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor track (card).

OPERATION

The fuel pump module has 4 different circuits (wires). Two of these circuits are used for the fuel gauge sending unit for fuel gauge operation, and for certain OBD II emission requirements. The other 2 wires are used for electric fuel pump operation.

For Fuel Gauge Operation: A constant input voltage source of about 12 volts (battery voltage) is supplied to the resistor track on the fuel gauge sending unit. This is fed directly from the Powertrain Control Module (PCM). **NOTE: For diagnostic purposes, this 12V power source can only be verified with the circuit opened (fuel pump module electrical connector unplugged). With the connectors plugged, output voltages will vary from about 0.6 volts at FULL, to about 8.6 volts at EMPTY (about 8.6 volts at EMPTY for Jeep models, and about 7.0 volts at EMPTY for Dodge Truck models).** The resistor track is used to vary the voltage (resistance) depending on fuel tank float level. As fuel level increases, the float and arm move up, which decreases voltage. As fuel level decreases, the float and arm move down, which increases voltage. The varied voltage signal is returned back to the PCM through the sensor return circuit.

Both of the electrical circuits between the fuel gauge sending unit and the PCM are hard-wired (not multi-plexed). After the voltage signal is sent from the resistor track, and back to the PCM, the PCM will interpret the resistance (voltage) data and send a message across the multi-plex bus circuits to the instrument panel cluster. Here it is translated into the appropriate fuel gauge level reading. Refer to Instrument Panel for additional information.

For OBD II Emission Monitor Requirements: The PCM will monitor the voltage output sent from the resistor track on the sending unit to indicate fuel level. The purpose of this feature is to prevent the OBD II system from recording/setting false misfire and fuel system monitor diagnostic trouble codes.

FUEL LEVEL SENDING UNIT / SENSOR (Continued)

The feature is activated if the fuel level in the tank is less than approximately 15 percent of its rated capacity. If equipped with a Leak Detection Pump (EVAP system monitor), this feature will also be activated if the fuel level in the tank is more than approximately 85 percent of its rated capacity.

REMOVAL

The fuel level sending unit (fuel level sensor) and float assembly is located on the side of fuel pump module (Fig. 4). The fuel pump module is located within the fuel tank.

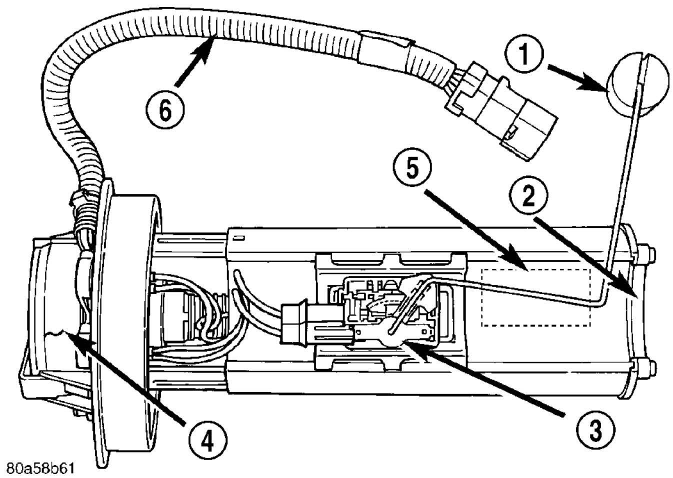


Fig. 4 Fuel Level Sending Unit Location

1 - FUEL GAUGE FLOAT
2 - PICK-UP FILTER
3 - FUEL GAUGE SENDING UNIT
4 - FUEL FILTER/FUEL PRESSURE REGULATOR
5 - ELECTRIC FUEL PUMP
6 - PIGTAIL WIRING HARNESS

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Remove electrical wire connector at sending unit terminals.

(4) Press on release tab (Fig. 5) to remove sending unit from pump module.

INSTALLATION

(1) Position sending unit to pump module and snap into place.

(2) Connect electrical connector to terminals.

(3) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(4) Install fuel tank. Refer to Fuel Tank Removal/Installation.

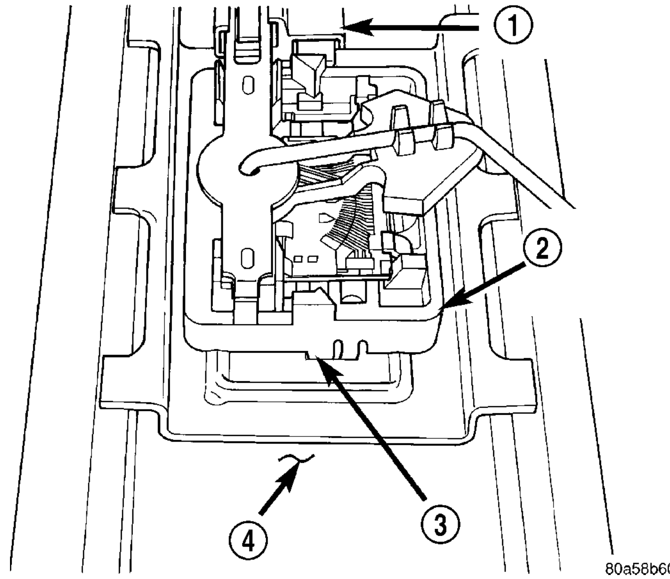


Fig. 5 Fuel Level Sending Unit Release Tab

1 - ELECTRICAL CONNECTOR
2 - FUEL GAUGE SENDING UNIT
3 - RELEASE TAB
4 - FUEL PUMP MODULE

FUEL LINES

DESCRIPTION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

FUEL PUMP

DESCRIPTION

The electric fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump. The electric fuel pump is not a separate, serviceable component.

OPERATION

Voltage to operate the electric pump is supplied through the fuel pump relay.

Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

Check Valve Operation: The pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** Refer to the Fuel Pressure Leak Down Test for more information.

The electric fuel pump is not a separate, serviceable component.

FUEL PUMP MODULE

DESCRIPTION

The fuel pump module on all models is installed into the top of the fuel tank (Fig. 6). The fuel pump module contains the following components (Fig. 6) or (Fig. 7):

- A combination fuel filter/fuel pressure regulator
- A separate fuel pick-up filter (strainer)
- An electric fuel pump
- A threaded locknut to retain module to tank
- A gasket between tank flange and module
- Fuel gauge sending unit (fuel level sensor)
- Fuel supply tube (line) connection

The fuel gauge sending unit, pick-up filter and fuel filter/fuel pressure regulator may be serviced separately. If the electrical fuel pump requires service, the entire fuel pump module must be replaced.

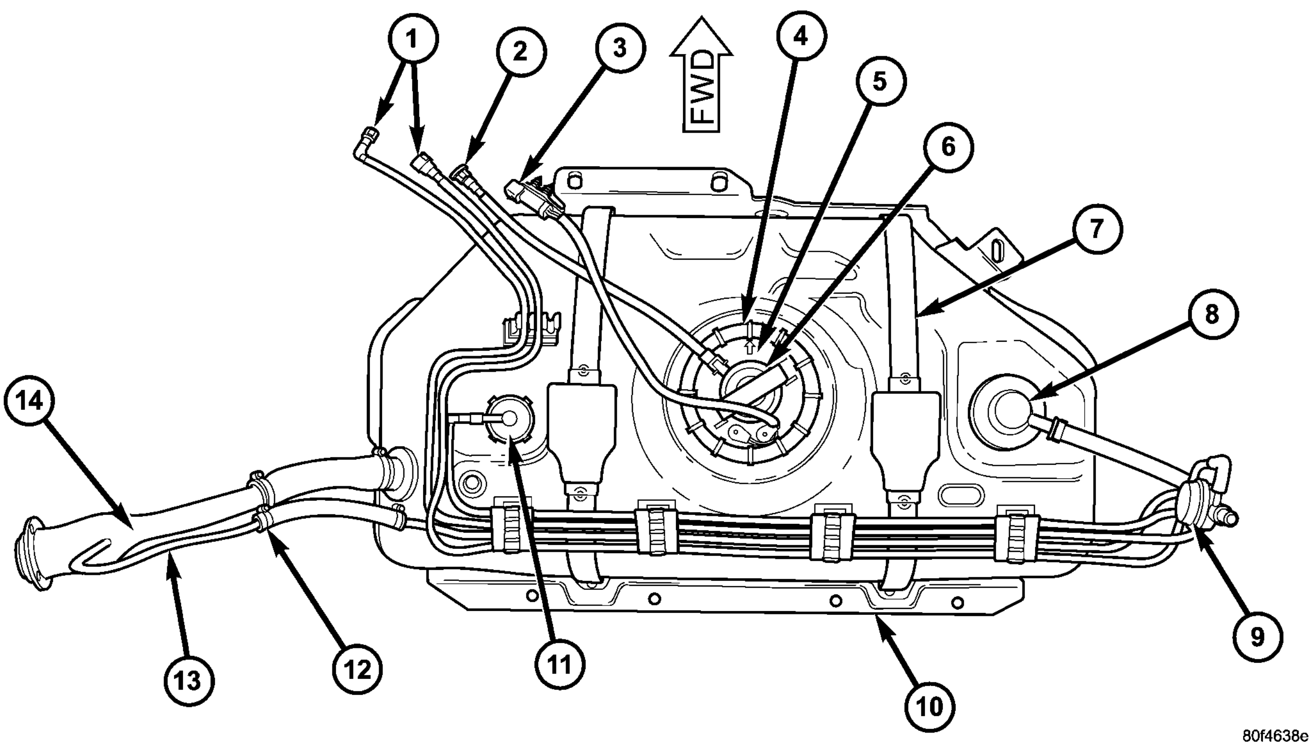


Fig. 6 FUEL TANK/FUEL PUMP MODULE (TOP VIEW)

1 - VAPOR LINES (2)
2 - FUEL SUPPLY LINE
3 - ELECTRICAL CONNECTOR
4 - MODULE LOCKNUT
5 - FUEL PUMP MODULE ASSEMBLY
6 - FUEL FILTER/FUEL PRESSURE REGULATOR
7 - FUEL TANK STRAPS (2)
8 - CHECK VALVE
9 - FUEL MANAGEMENT VALVE
10 - SKID PLATE
11 - CHECK VALVE
12 - CLAMPS (2)
13 - VENT LINE
14 - FUEL FILL TUBE

FUEL PUMP MODULE (Continued)

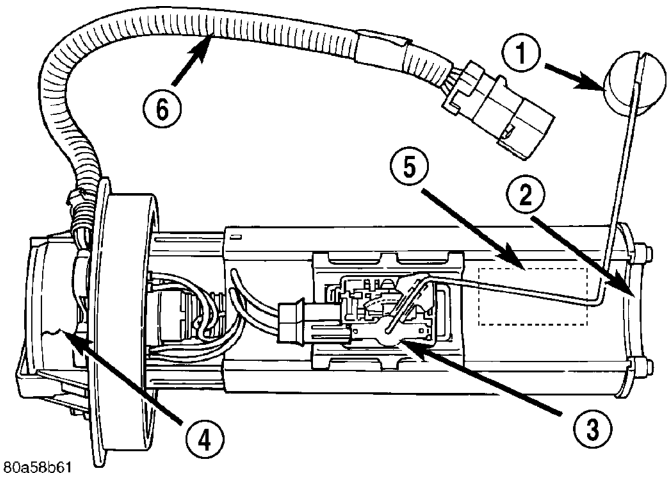


Fig. 7 FUEL PUMP MODULE COMPONENTS

1 - FUEL GAUGE FLOAT
2 - PICK-UP FILTER
3 - FUEL GAUGE SENDING UNIT
4 - FUEL FILTER/FUEL PRESSURE REGULATOR
5 - ELECTRIC FUEL PUMP
6 - PIGTAIL WIRING HARNESS

OPERATION

Refer to Fuel Pump, Fuel Filter/Fuel Pressure Regulator and Fuel Gauge Sending Unit.

REMOVAL

Fuel tank removal will be necessary for fuel pump module removal.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING THE FUEL PUMP MODULE, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

(1) Drain fuel tank and remove tank. Refer to the Fuel Tank Removal/Installation section of this group.

(2) Thoroughly wash and clean area around pump module to prevent contaminants from entering tank.

(3) The plastic fuel pump module locknut is threaded onto fuel tank (Fig. 6). Install Special Tool 6856 to fuel pump module locknut and remove locknut (Fig. 8). The fuel pump module will spring up when locknut is removed.

(4) Remove module from fuel tank.

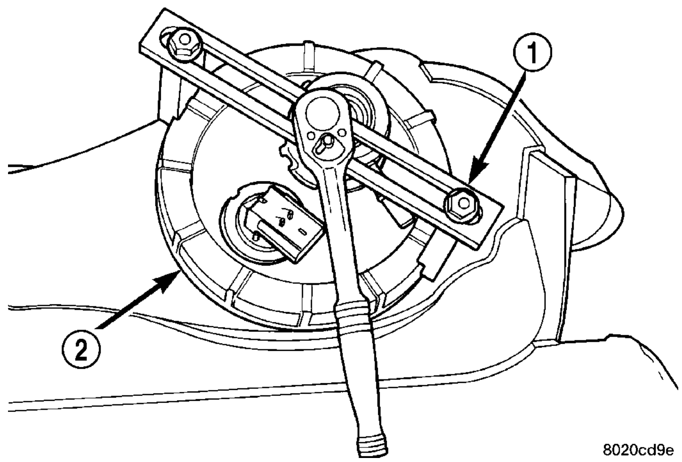


Fig. 8 LOCKNUT REMOVAL/INSTALLATION—TYPICAL

1 - SPECIAL TOOL #6856
2 - LOCKNUT

INSTALLATION

Fuel tank removal will be necessary for fuel pump module removal.

CAUTION: Whenever the fuel pump module is serviced, the module gasket must be replaced.

(1) Thoroughly clean locknut threads and mating fuel tank threads. Use a soap/water solution. Do not use carburetor cleaner to clean threads.

(2) Using new gasket, position fuel pump module into opening in fuel tank.

(3) Apply clean water to locknut threads.

(4) Position locknut over top of fuel pump module.

(5) Rotate module until arrow (Fig. 1) is pointed toward front of vehicle (12 o'clock position). This step must be done to prevent float/float rod assembly from contacting sides of fuel tank.

(6) Install Special Tool 6856 to locknut.

(7) Tighten locknut to 74 N·m (55 ft. lbs.) torque.

(8) Rotate fuel filter/fuel pressure regulator until its fitting is pointed to 10 o'clock position.

(9) Install fuel tank. Refer to Fuel Tank Installation.

FUEL RAIL/FUEL DAMPER - 2.4L

DESCRIPTION - 2.4L

The fuel injector rail is used to mount the fuel injectors to the engine (Fig. 9). On the 2.4L 4-cylinder engine, a **fuel damper** is located near the front of the fuel rail (Fig. 9).

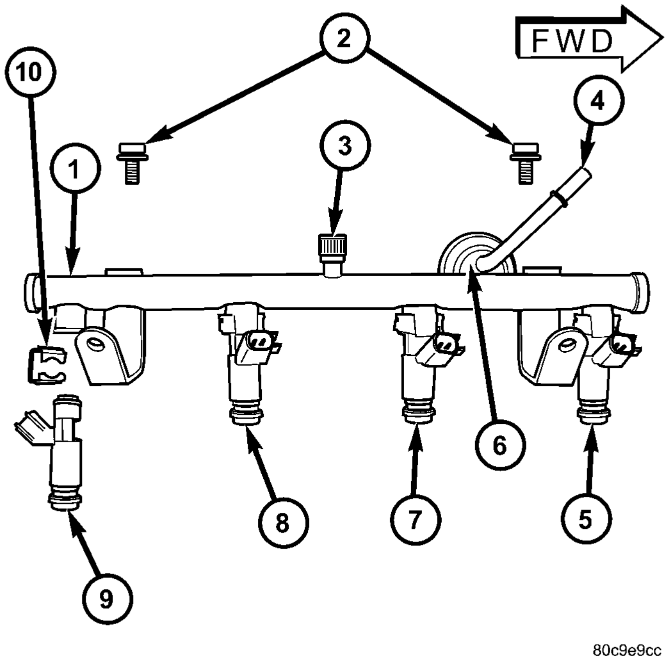


Fig. 9 FUEL RAIL - 2.4L

1 - FUEL RAIL
2 - MOUNTING BOLTS
3 - TEST PORT (IF USED)
4 - QUICK-CONNECT FITTING
5 - INJ. #1
6 - DAMPER
7 - INJ #2
8 - INJ #3
9 - INJ #4
10- INJECTOR RETAINING CLIP

OPERATION - 2.4L

The fuel injector rail supplies the necessary fuel to each individual fuel injector.

The fuel damper is used only to help control fuel pressure pulsations. These pulsations are the result of the firing of the fuel injectors. It is **not used** as a fuel pressure regulator. The fuel pressure regulator is **not mounted** to the fuel rail on any engine. It is located on the fuel tank mounted fuel pump module. Refer to Fuel Pressure Regulator for additional information.

The fuel rail is not repairable.

A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

REMOVAL - 2.4L

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

The fuel rail can be removed without removing the intake manifold if the following procedures are followed.

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Remove negative battery cable at battery.

(4) Remove air duct at throttle body.

(5) Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.

(6) Remove necessary vacuum lines at throttle body.

(7) Drain engine coolant and remove thermostat and thermostat housing.

(8) Remove PCV hose and valve at valve cover.

(9) Remove 3 upper intake manifold mounting bolts (Fig. 11), but only loosen 2 lower bolts about 2 turns.

(10) Disconnect 2 main engine harness connectors at rear of intake manifold (Fig. 10).

(11) Disconnect 2 injection wiring harness clips at harness mounting bracket (Fig. 11).

(12) Disconnect electrical connectors at all 4 fuel injectors. To remove connector refer to (Fig. 12). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

(13) Remove 2 injection rail mounting bolts (Fig. 9).

(14) Gently rock and pull fuel rail until fuel injectors just start to clear machined holes in intake manifold.

(15) Remove fuel rail (with injectors attached) from intake manifold.

(16) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

INSTALLATION - 2.4L

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

(2) Clean out fuel injector machined bores in intake manifold.

(3) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.

FUEL RAIL/FUEL DAMPER - 2.4L (Continued)

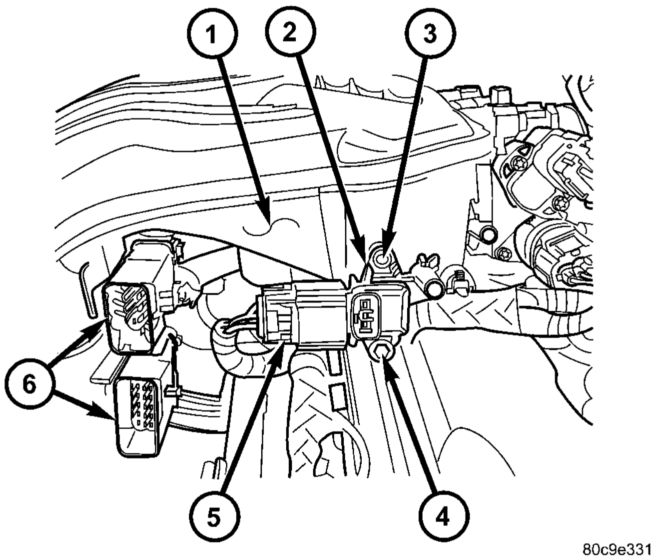


Fig. 10 MAP SENSOR LOCATION - 2.4L

1 - REAR OF INTAKE MANIFOLD
2 - MAP SENSOR
3 - ALIGNMENT PIN
4 - MOUNTING BOLT (TORX)
5 - ELECTRICAL CONNECTOR
6 - MAIN ENGINE HARNESS CONNECTORS

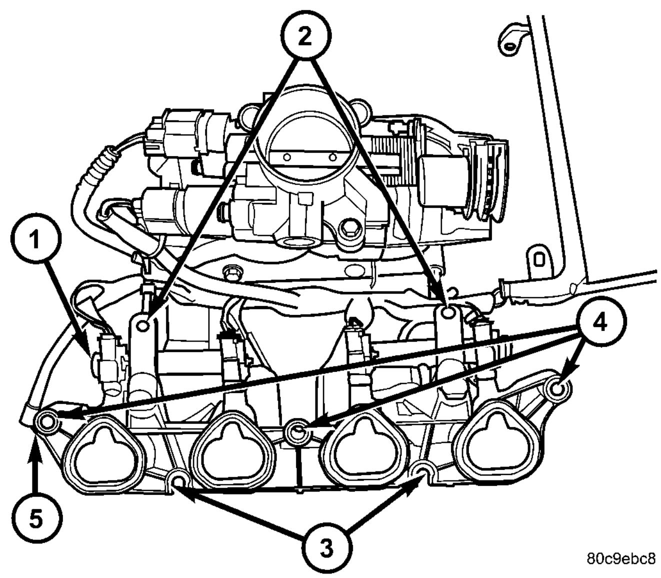


Fig. 11 FUEL RAIL MOUNTING - 2.4L

1 - FUEL RAIL
2 - INJECTION HARNESS CLIPS
3 - LOWER MOUNTING HOLES
4 - UPPER MOUNTING HOLES
5 - INTAKE MANIFOLD

(4) Position fuel rail/fuel injector assembly to machined injector openings in intake manifold.

(5) Guide each injector into cylinder head. Be careful not to tear injector o-rings.

(6) Push fuel rail down until fuel injectors have bottomed on shoulders.

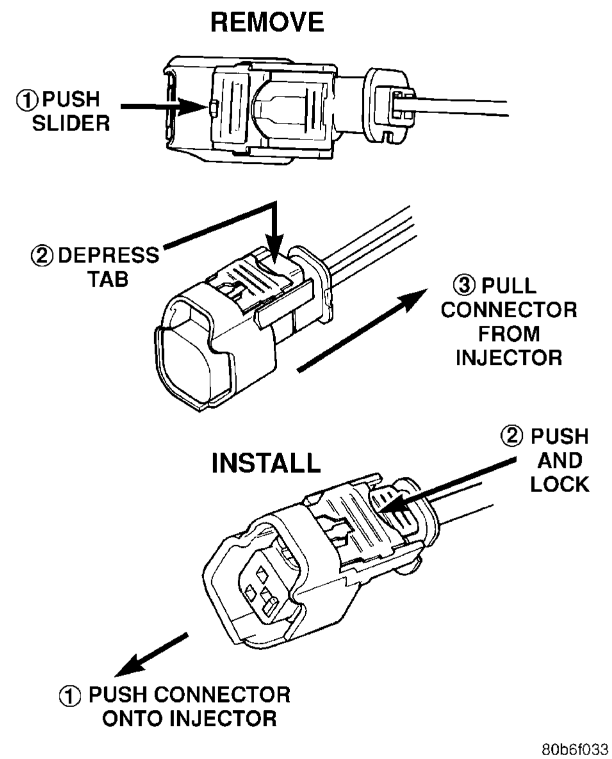


Fig. 12 REMOVE/INSTALL INJECTOR CONNECTOR

(7) Install 2 fuel rail mounting bolts and tighten. Refer to torque specifications.

(8) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 12). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(9) Snap 2 injection wiring harness clips (Fig. 11) into brackets.

(10) Connect 2 main engine harness connectors at rear of intake manifold (Fig. 10).

(11) Tighten 5 intake manifold mounting bolts. Refer to Engine Torque Specifications.

(12) Install PCV valve and hose.

(13) Install thermostat and radiator hose. Fill with coolant. Refer to Cooling.

(14) Connect necessary vacuum lines to throttle body.

(15) Connect fuel line latch clip and fuel line to fuel rail. Refer to Quick-Connect Fittings.

(16) Install air duct to throttle body.

(17) Connect battery cable to battery.

(18) Start engine and check for leaks.

FUEL RAIL - 4.0L ENGINE

DESCRIPTION - 4.0L

The fuel rail is mounted to the intake manifold (Fig. 13). It is used to mount the fuel injectors to the engine. On the 4.0L 6–cylinder engine, a **fuel damper** is located near the center of the fuel rail (Fig. 13).

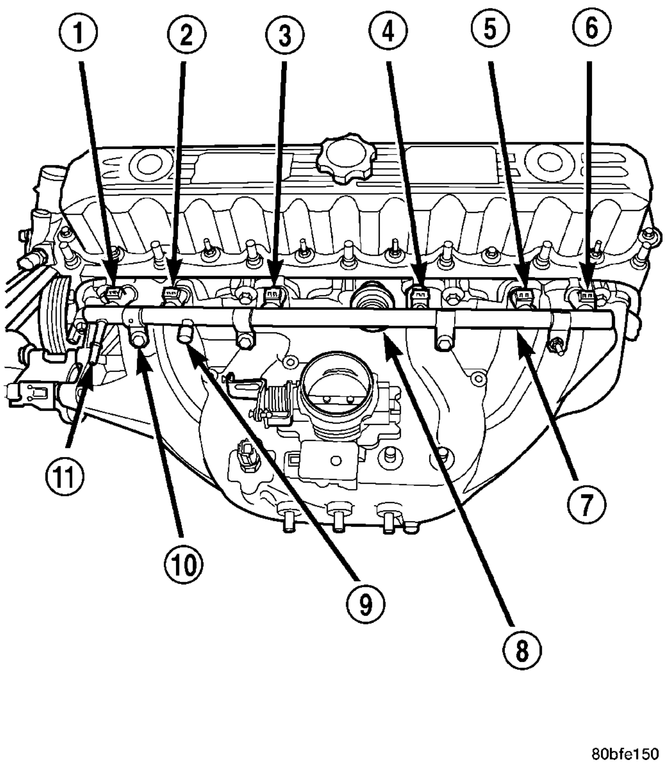


Fig. 13 FUEL RAIL/FUEL DAMPER - 4.0L ENGINE

1 - INJ. #1
2 - INJ. #2
3 - INJ. #3
4 - INJ. #4
5 - INJ. #5
6 - INJ. #6
7 - FUEL INJECTOR RAIL
8 - FUEL DAMPER
9 - PRESSURE TEST PORT CAP
10 - MOUNTING BOLTS (4)
11 - QUICK-CONNECT FITTING

OPERATION - 4.0L

The fuel injector rail supplies the necessary fuel to each individual fuel injector.

The fuel damper is used only to help control fuel pressure pulsations. These pulsations are the result of the firing of the fuel injectors. It is **not used** as a fuel pressure regulator. The fuel pressure regulator is **not mounted** to the fuel rail on any engine. It is located on the fuel tank mounted fuel pump module. Refer to Fuel Filter/Fuel Pressure Regulator for information.

The fuel rail is not repairable.

REMOVAL - 4.0L

The fuel damper is not serviced separately.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL RAIL.

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Disconnect negative battery cable from battery.

(4) Remove air tube at top of throttle body. Note: Some engine/vehicles may require removal of air cleaner ducts at throttle body.

(5) Disconnect electrical connectors at all 6 fuel injectors. To remove connector refer to (Fig. 14). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

(6) Disconnect fuel supply line latch clip and fuel line at fuel rail. Refer to Quick-Connect Fittings.

(7) Disconnect throttle cable at throttle body. Refer to Throttle Cable Removal/Installation.

(8) Disconnect speed control cable at throttle body (if equipped). Refer to Speed Control Cable in Speed Control System.

(9) Disconnect automatic transmission cable at throttle body (if equipped).

(10) Remove cable routing bracket at intake manifold.

(11) If equipped, remove wiring harnesses at injection rail studs by removing nuts.

(12) Clean dirt/debris from each fuel injector at intake manifold.

(13) Remove fuel rail mounting nuts/bolts (Fig. 15).

(14) Remove fuel rail by gently rocking until all the fuel injectors are out of intake manifold.

INSTALLATION - 4.0L

(1) Clean each injector bore at intake manifold.

(2) Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.

(3) Position tips of all fuel injectors into the corresponding injector bore in intake manifold. Seat injectors into manifold.

(4) Install and tighten fuel rail mounting bolts to 11 ±3 N·m (100 ±25 in. lbs.) torque.

(5) If equipped, connect wiring harnesses to injection rail studs.

(6) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 14). Push con-

FUEL RAIL - 4.0L ENGINE (Continued)

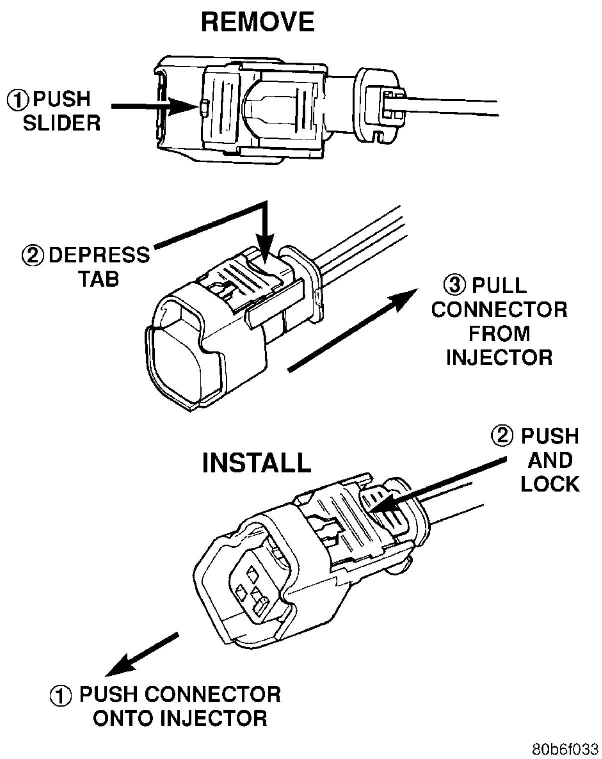


Fig. 14 REMOVE/INSTALL FUEL INJECTOR CONNECTOR

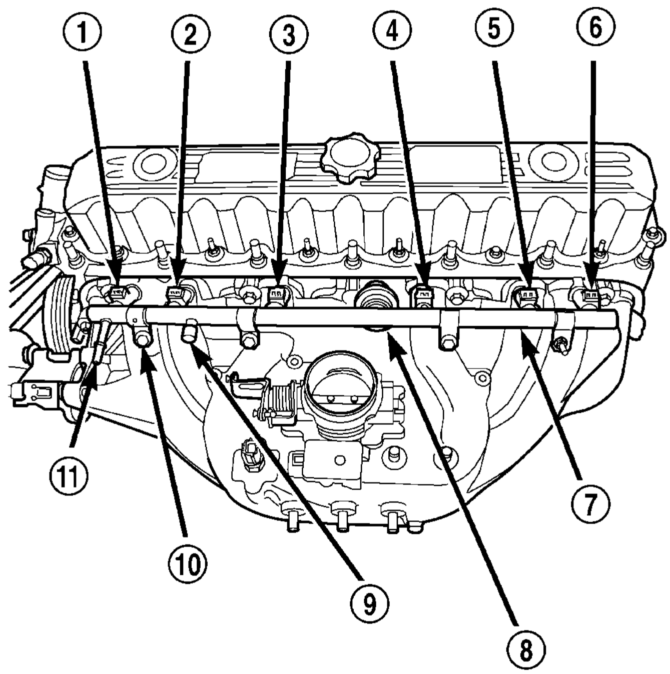


Fig. 15 FUEL RAIL MOUNTING - 4.0L

1 - INJ. #1
2 - INJ. #2
3 - INJ. #3
4 - INJ. #4
5 - INJ. #5
6 - INJ. #6
7 - FUEL INJECTOR RAIL
8 - FUEL DAMPER
9 - PRESSURE TEST PORT CAP
10 - MOUNTING BOLTS (4)
11 - QUICK-CONNECT FITTING

nector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(7) Connect fuel line and fuel line latch clip to fuel rail. Refer Quick-Connect Fittings.

(8) Install protective cap to pressure test port fitting (if equipped).

(9) Install cable routing bracket to intake manifold.

(10) Connect throttle cable at throttle body.

(11) Connect speed control cable at throttle body (if equipped).

(12) Connect automatic transmission cable at throttle body (if equipped).

(13) Install air tube (or duct) at top of throttle body.

(14) Install fuel tank cap.

(15) Connect negative battery cable to battery.

(16) Start engine and check for fuel leaks.

FUEL TANK

DESCRIPTION

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module.

OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

A fuel tank check valve(s) is mounted into the top of the fuel tank (or pump module). Refer to Fuel Tank Check Valve for additional information.

An evaporation control system is connected to the check valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using either a Leak Detection Pump (LDP), or an NVLD pump. Refer to Emission Control System for additional information.

Refer to ORVR for On-Board Refueling Vapor Recovery system information.

FUEL TANK (Continued)

REMOVAL

This vehicle is equipped with an ORVR (On-Board Refueling Vapor Recovery) system. Because of this, the fuel tank may be drained the conventional way through the filler cap opening.

On this model, the fuel tank is mounted to the vehicle skid plate. The skid plate is mounted to vehicle body. The tank and skid plate are removed as 1 assembly.

(1) Remove fuel filler cap.

(2) Perform the Fuel System Pressure Release Procedure as described elsewhere in this group.

(3) Disconnect negative battery cable.

(4) Using an approved portable gasoline siphon/storage tank, drain fuel from tank through filler cap opening.

(5) Remove 8 screws retaining plastic fuel filler bezel to body (Fig. 16). Remove plastic fuel filler bezel.

(6) To prevent contaminants from entering tank, temporarily install fuel cap to fill hoses.

(7) Remove right/rear tire/wheel.

(8) Remove wheelhouse liner at right/rear wheel.

(9) Remove vertical support bracket (Fig. 17) to gain access to 2 ORVR vapor lines.

(10) Two vapor lines connect the fuel tank to the EVAP canister and Leak Detection Pump (LDP). This connection is made near the right/rear corner of the fuel tank. Carefully disconnect these 2 vapor lines (Fig. 18) near top of flow management valve (Fig. 18). Be very careful not to bend or kink the vapor

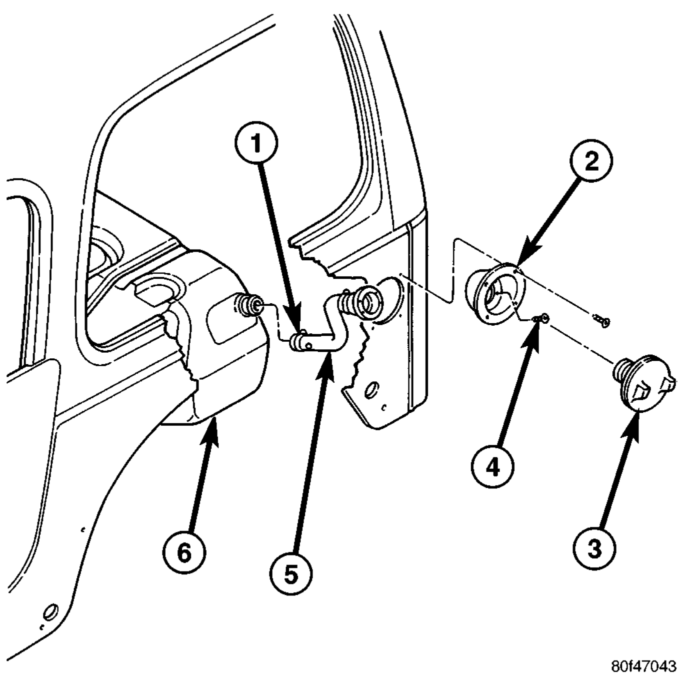


Fig. 16 FUEL FILL HOSE AT BODY

1 - FILLER HOSE CLAMP
2 - BEZEL
3 - FUEL FILLER CAP
4 - BEZEL SCREWS (8)
5 - FUEL FILLER HOSE
6 - FUEL TANK

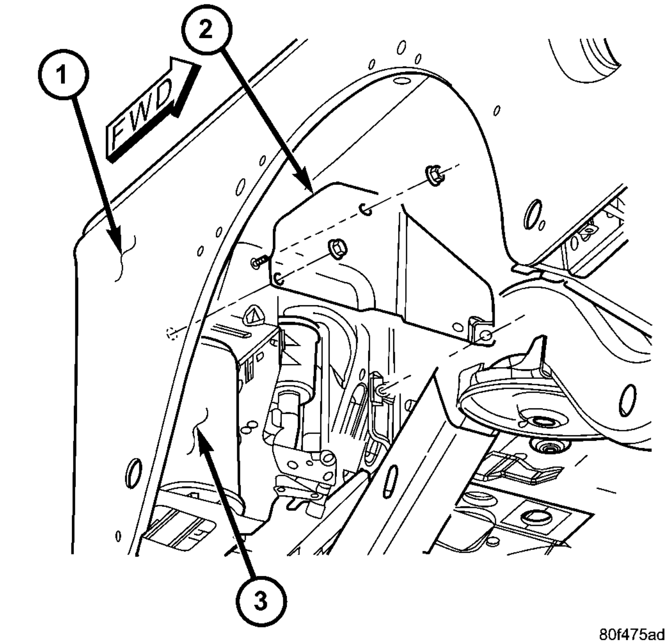


Fig. 17 EVAP CANISTER / LDP LOCATION

1 - RIGHT / REAR FENDER (WHEELHOUSE)
2 - BRACKET
3 - EVAP CANISTER

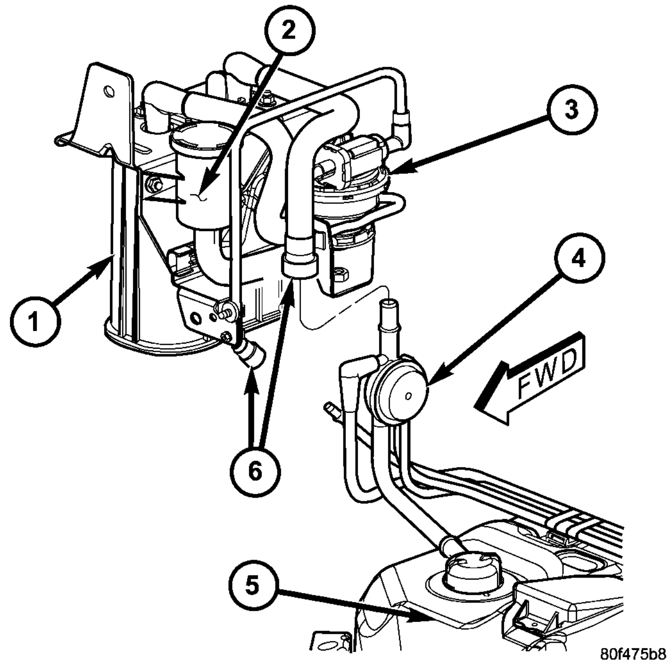


Fig. 18 DISCONNECTING ORVR VAPOR LINES

1 - EVAP CANISTER
2 - LDP FILTER
3 - LDP
4 - FLOW MANAGEMENT VALVE
5 - FUEL TANK
6 - VAPOR LINES (2)

FUEL TANK (Continued)

lines. If lines leak, a Diagnostic Trouble Code (DTC) will be set.

(11) Cut plastic tie wrap securing rear axle vent hose to fuel fill hose.

(12) Disconnect fuel tank electrical connector at left/front of fuel tank (Fig. 19).

(13) Disconnect 2 vapor lines (Fig. 19) at left/front of fuel tank.

(14) Disconnect quick-connect fitting from fuel supply line at front of fuel tank (Fig. 19). Refer to Quick-Connect Fittings in this group for procedures.

(15) The fuel tank and skid plate are removed as an assembly. Centrally position a transmission jack (or equivalent lifting device) under skid plate/fuel tank assembly. Secure tank assembly to jack.

(16) Remove three skid plate-to-body nuts at front of tank (Fig. 21). Remove one of the nuts through access hole on skid plate (Fig. 21).

(17) Remove four skid plate-to-body nuts at rear of tank (Fig. 20). **Do not loosen tank strap nuts (Fig. 20).**

(18) Lower the tank assembly.

(19) If fuel pump module is to be removed, refer to Fuel Pump Module Removal/Installation.

(20) Disconnect fuel filler hose at tank. Before disconnecting, mark and note the hose rotational position in relation to tank fitting.

(21) To separate tank from skid plate, remove two protective caps at tank strap studs (Fig. 20) and remove tank strap nuts.

(22) Remove both straps and remove tank from skid plate.

INSTALLATION

(1) If necessary, install fuel pump module to fuel tank. Refer to Fuel Pump Module Removal / Installation.

(2) Place fuel tank into skid plate. Wrap straps around tank with strap studs inserted through holes in skid plate. Tighten strap nuts to attain 30 mm (±2 mm) between bottom of nut to end of strap stud (Fig. 20). **Do not over tighten nuts.**

(3) Install two protective caps to tank strap studs.

(4) Connect fuel fill hose at tank. Tighten hose clamp.

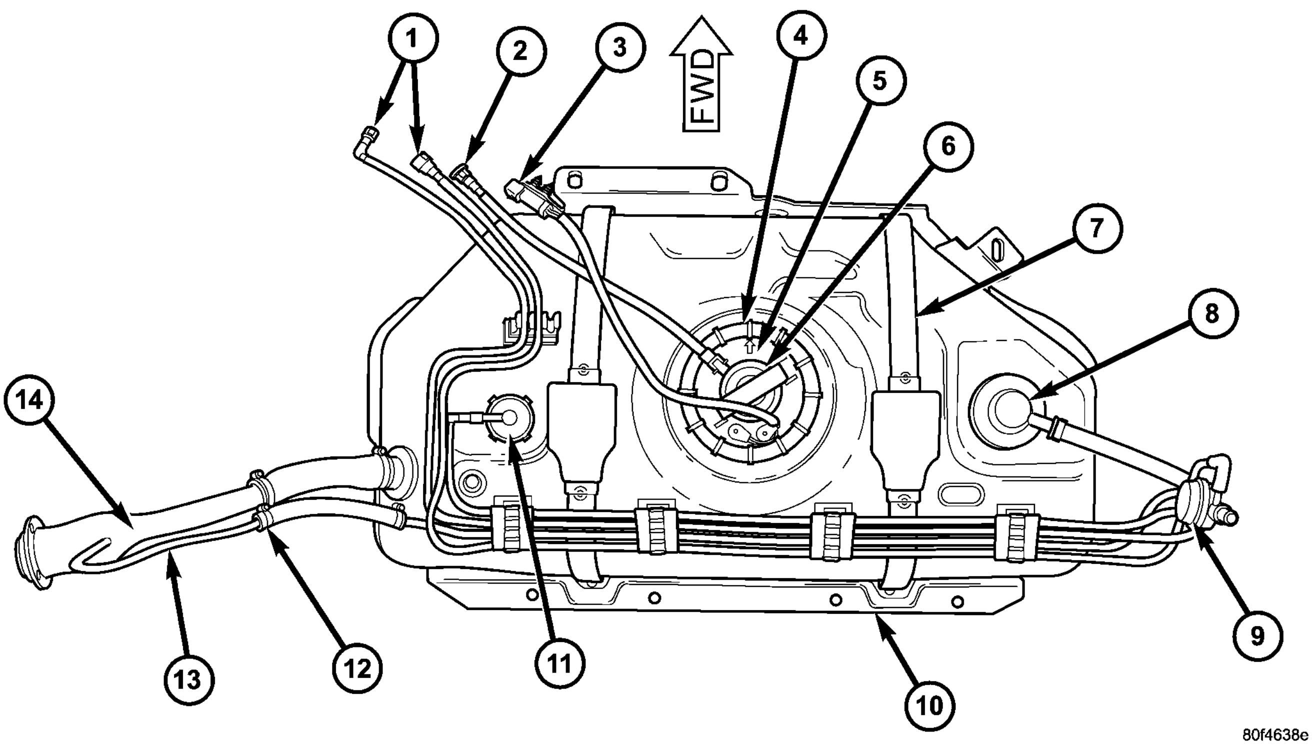


Fig. 19 FUEL TANK/FUEL PUMP MODULE (TOP VIEW)

1 - VAPOR LINES (2)
2 - FUEL SUPPLY LINE
3 - ELECTRICAL CONNECTOR
4 - MODULE LOCKNUT
5 - FUEL PUMP MODULE ASSEMBLY
6 - FUEL FILTER/FUEL PRESSURE REGULATOR
7 - FUEL TANK STRAPS (2)
8 - CHECK VALVE
9 - FUEL MANAGEMENT VALVE
10 - SKID PLATE
11 - CHECK VALVE
12 - CLAMPS (2)
13 - VENT LINE
14 - FUEL FILL TUBE

FUEL TANK (Continued)

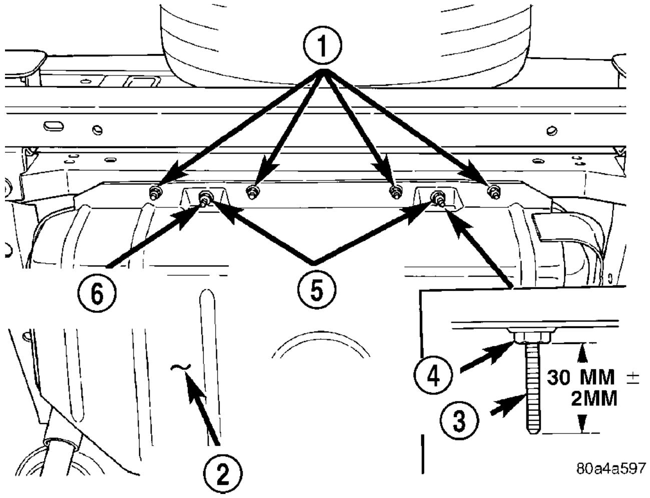


Fig. 20 FUEL TANK MOUNTING NUTS - REAR

1 - REAR SKID PLATE NUTS (4)
2 - SKID PLATE
3 - TANK STRAP STUD
4 - TANK STRAP NUT
5 - TANK STRAP NUTS (2)
6 - PROTECTIVE CAPS (2)

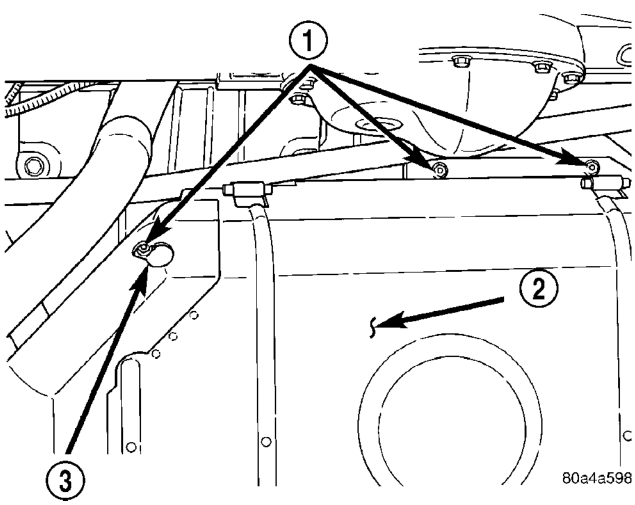


Fig. 21 FUEL TANK MOUNTING NUTS - FRONT

1 - FRONT SKID PLATE NUTS (3)
2 - SKID PLATE
3 - ACCESS HOLE

(5) Raise skid plate/fuel tank assembly into position on body while carefully guiding plastic vapor lines and fill hose.

(6) Install 7 skid plate mounting nuts. Tighten to 16 N·m (141 in. lbs.) torque.

(7) Remove tank jacking device.

(8) Carefully connect the 2 vapor lines (Fig. 18) near top of flow management valve (Fig. 18). Be very careful not to bend or kink the vapor lines. If lines leak, a Diagnostic Trouble Code (DTC) will be set.

(9) Install EVAP canister bracket (Fig. 17).

(10) Install wheelhouse liner at right/rear wheel.

(11) Install right/rear tire/wheel.

(12) Connect electrical connector at left/front of fuel tank.

(13) Connect 2 vapor lines at left/front of fuel tank.

(14) Connect quick-connect fitting to fuel supply line at left/front of fuel tank. Refer to Quick-Connect Fittings in this group for procedures.

(15) Use a new plastic tie wrap to secure rear axle vent hose to fuel fill hose.

(16) Position fuel fill bezel to body. Install 8 screws and tighten.

(17) Fill fuel tank. Install filler cap.

(18) Connect negative battery cable to battery.

(19) Start vehicle and inspect for leaks.

INLET FILTER

REMOVAL

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 22). The fuel pump module is located on top of fuel tank.

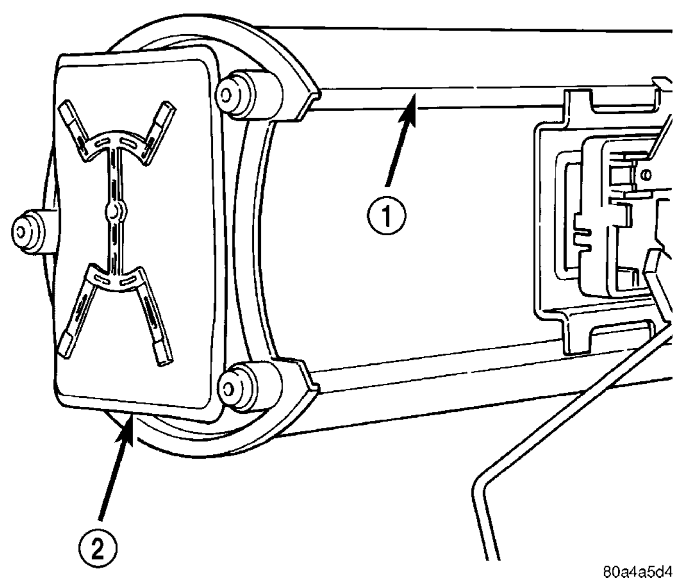


Fig. 22 Fuel Pump Inlet Filter

1 - FUEL PUMP MODULE
2 - FUEL PUMP INLET FILTER

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Remove filter by prying from bottom of module with 2 screwdrivers. Filter is snapped to module.

(4) Clean bottom of pump module.

INLET FILTER (Continued)

INSTALLATION

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 23). The fuel pump module is located on top of fuel tank.

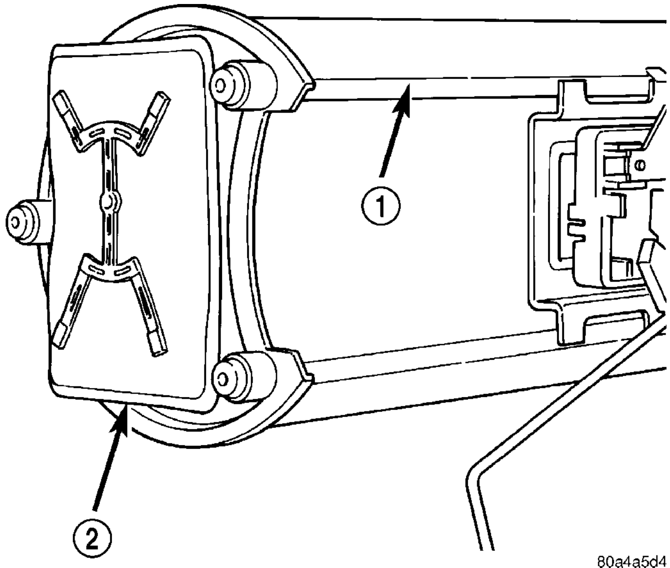


Fig. 23 Fuel Pump Inlet Filter

1 - FUEL PUMP MODULE
2 - FUEL PUMP INLET FILTER

(1) Snap new filter to bottom of module.

(2) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Install fuel tank. Refer to Fuel Tank Removal/ Installation.

QUICK CONNECT FITTING

DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. Refer to Quick-Connect Fittings Removal/Installation for more information.

CAUTION: The interior components (o-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

STANDARD PROCEDURE - QUICK-CONNECT FITTINGS

Also refer to Fuel Tubes/Lines/Hoses and Clamps.

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Safety latch clips are used on certain components/lines. Certain fittings may require use of a special tool for disconnection.

DISCONNECTING

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSE, FITTING OR LINE, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

CAUTION: The interior components (o-rings, spacers) of some types of quick-connect fitting are not serviced separately. If service parts are not available, do not attempt to repair a damaged fitting or fuel line. If repair is necessary, replace complete fuel line assembly.

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure.

(2) Disconnect negative battery cable from battery.

(3) Clean fitting of any foreign material before disassembly.

(4) **2–Button Type Fitting:** This type of fitting is equipped with a push-button located on each side of quick-connect fitting (Fig. 24). Press on both buttons simultaneously for removal. Special tools are not required for disconnection.

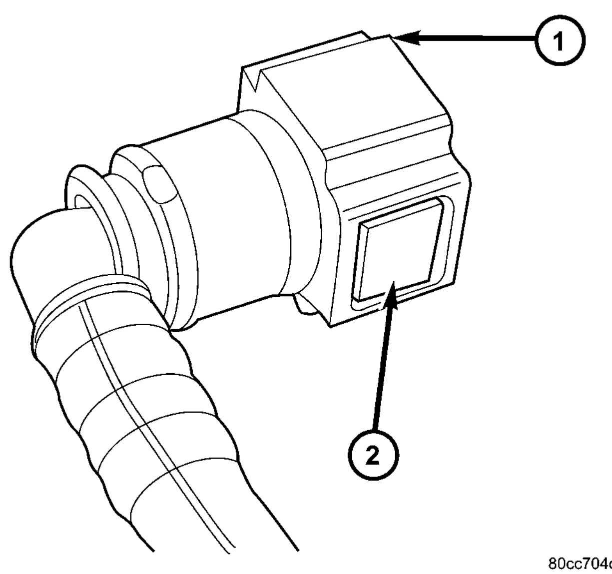


Fig. 24 2-BUTTON TYPE FITTING

1 - QUICK-CONNECT FITTING
2 - PUSH-BUTTONS (2)

QUICK CONNECT FITTING (Continued)

(5) **Pinch-Type Fitting:** This fitting is equipped with two finger tabs. Pinch both tabs together while removing fitting (Fig. 25). Special tools are not required for disconnection.

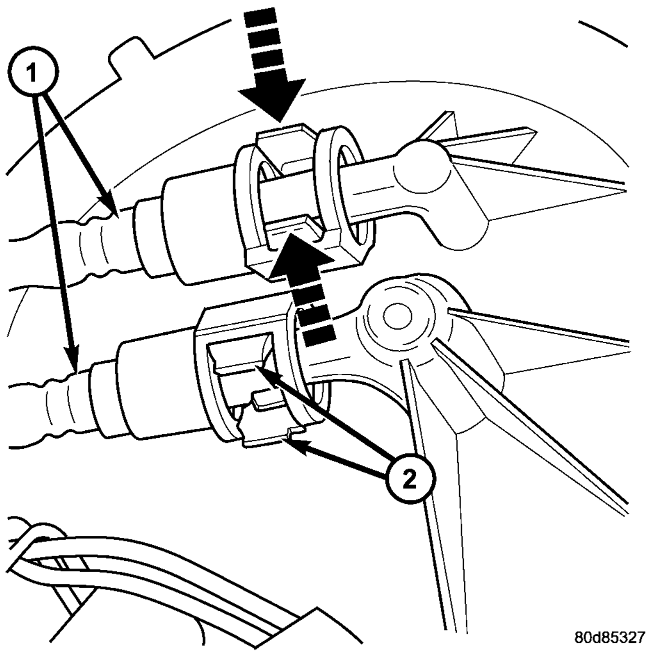


Fig. 25 PINCH TYPE QUICK-CONNECT FITTING

1 - QUICK-CONNECT FITTINGS
2 - PINCH TABS

(6) **Single-Tab Type Fitting:** This type of fitting is equipped with a single pull tab (Fig. 26). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component. Special tools are not required for disconnection.

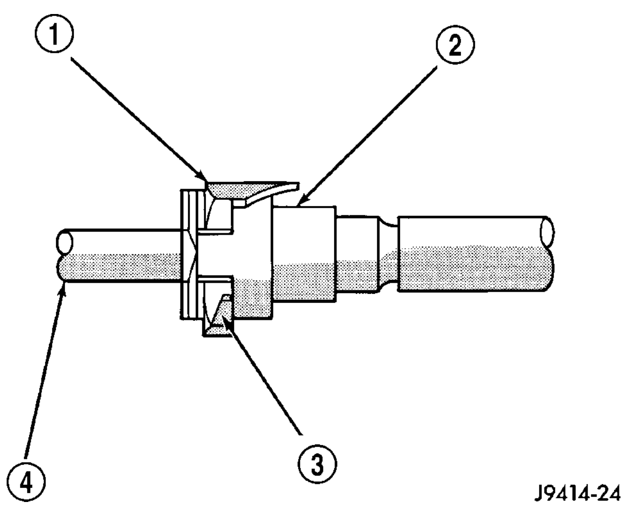


Fig. 26 SINGLE-TAB TYPE FITTING

1 - PULL TAB
2 - QUICK-CONNECT FITTING
3 - PRESS HERE TO REMOVE PULL TAB
4 - INSERTED TUBE END

(a) Press release tab on side of fitting to release pull tab (Fig. 27). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**

(b) While pressing release tab on side of fitting, use screwdriver to pry up pull tab (Fig. 27).

(c) Raise pull tab until it separates from quick-connect fitting (Fig. 28).

(7) **Two-Tab Type Fitting:** This type of fitting is equipped with tabs located on both sides of fitting (Fig. 29). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.

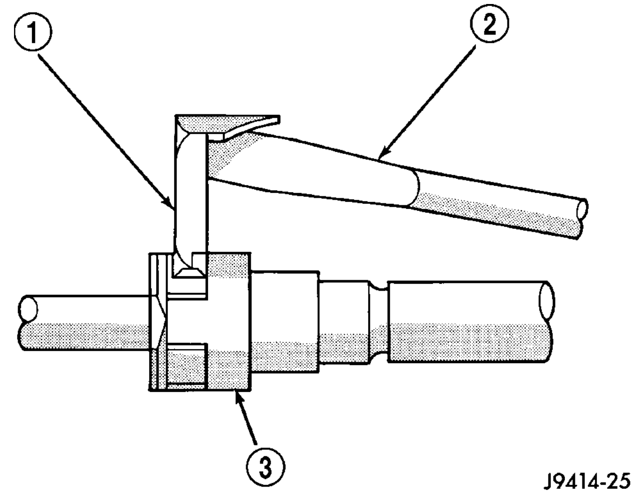


Fig. 27 DISCONNECTING SINGLE-TAB TYPE FITTING

1 - PULL TAB
2 - SCREWDRIVER
3 - QUICK-CONNECT FITTING

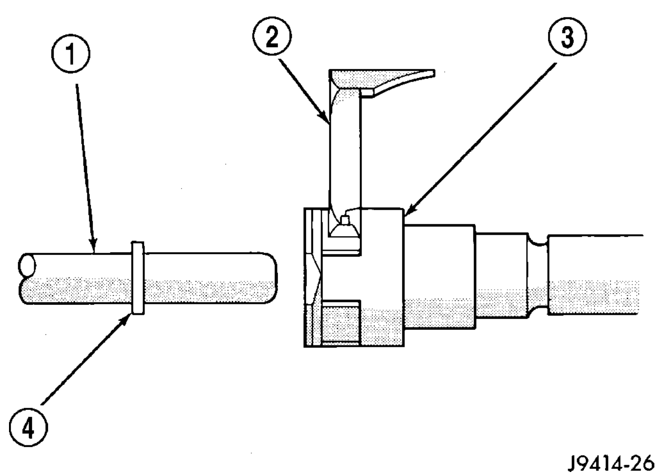


Fig. 28 REMOVING PULL TAB

1 - FUEL TUBE OR FUEL SYSTEM COMPONENT
2 - PULL TAB
3 - QUICK-CONNECT FITTING
4 - FUEL TUBE STOP

QUICK CONNECT FITTING (Continued)

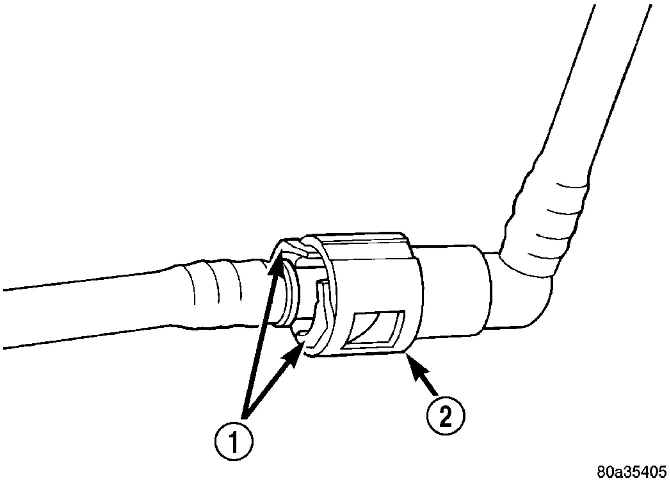


Fig. 29 TYPICAL 2–TAB TYPE FITTING

1 - TAB(S)
2 - QUICK-CONNECT FITTING

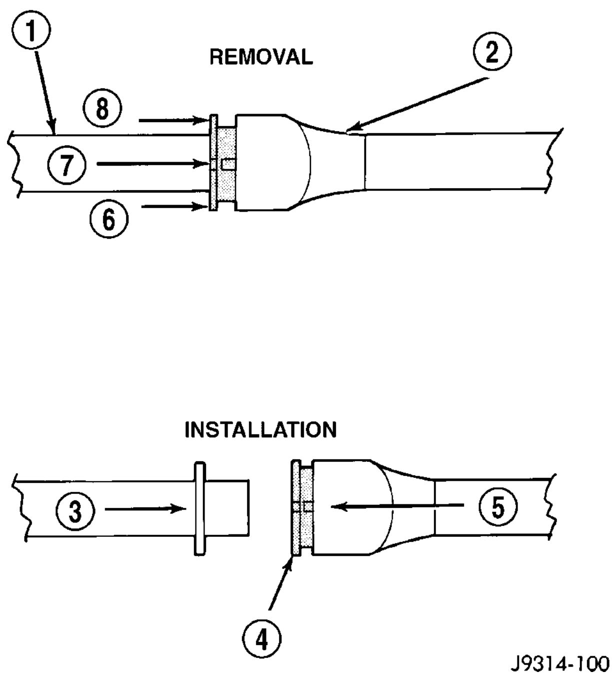


Fig. 30 PLASTIC RETAINER RING TYPE FITTING

1 - FUEL TUBE
2 - QUICK CONNECT FITTING
3 - PUSH
4 - PLASTIC RETAINER
5 - PUSH
6 - PUSH
7 - PUSH
8 - PUSH

(a) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 29) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.

(b) Pull fitting from fuel system component being serviced.

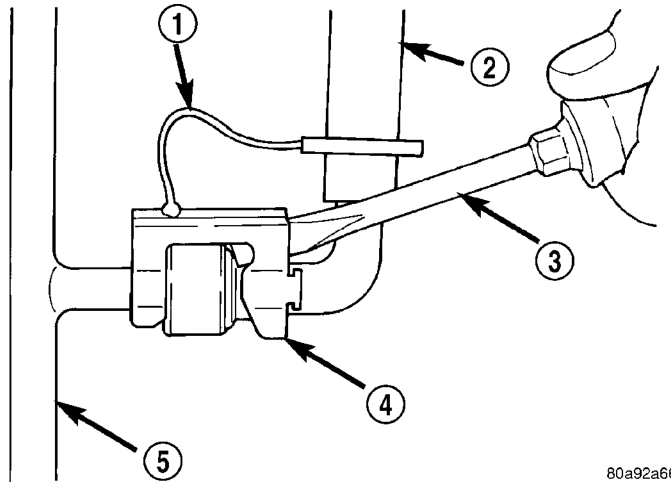


Fig. 31 LATCH CLIP-TYPE 1

1 - TETHER STRAP
2 - FUEL LINE
3 - SCREWDRIVER
4 - LATCH CLIP
5 - FUEL RAIL

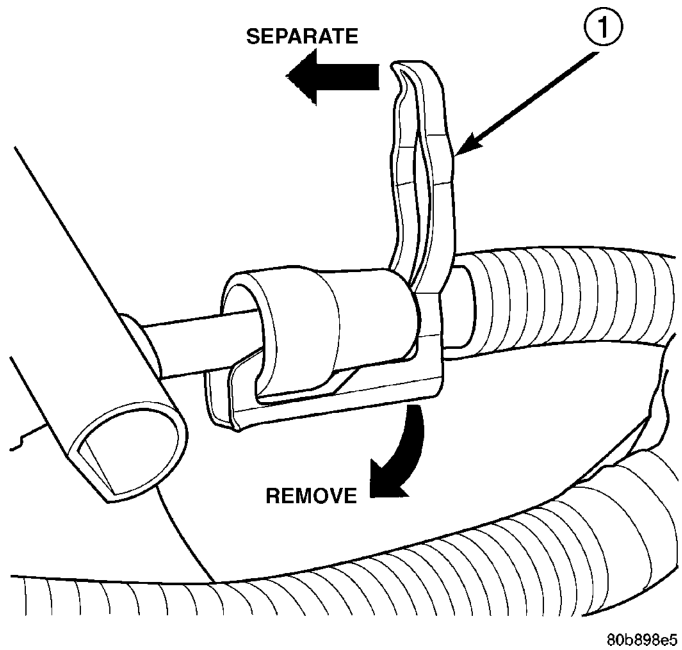


Fig. 32 LATCH CLIP-TYPE 2

1 - LATCH CLIP

(c) The plastic retainer will remain on component being serviced after fitting is disconnected. The o-rings and spacer will remain in quick-connect fitting connector body.

(8) **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 30) usually black in color.

(a) To release fuel system component from quick-connect fitting, firmly push fitting towards compo-

QUICK CONNECT FITTING (Continued)

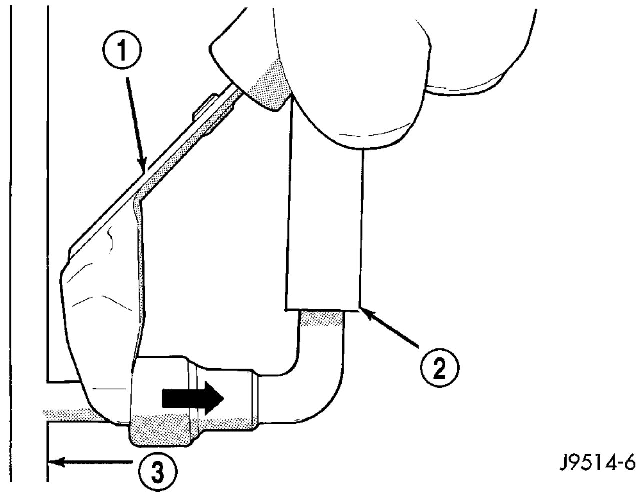


Fig. 33 FUEL LINE DISCONNECTION USING SPECIAL TOOL

1 - SPECIAL FUEL LINE TOOL
2 - FUEL LINE
3 - FUEL RAIL

nent being serviced while firmly pushing plastic retainer ring into fitting (Fig. 30). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(b) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(c) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(9) **Latch Clips:** Depending on vehicle model and engine, 2 different types of safety latch clips are used (Fig. 31) or (Fig. 32). Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

(a) Type 1: Pry up on latch clip with a screwdriver (Fig. 31).

(b) Type 2: Separate and unlatch 2 small arms on end of clip (Fig. 32) and swing away from fuel line.

(c) Slide latch clip toward fuel rail while lifting with screwdriver.

(d) Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (Fig. 33). Use tool to release locking fingers in end of line.

(e) With special tool still inserted, pull fuel line from fuel rail.

(f) After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

(10) Disconnect quick-connect fitting from fuel system component being serviced.

CONNECTING

(1) Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.

(2) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(3) Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.

(4) Continue pushing until a click is felt.

(5) Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.

(6) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(7) Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**

(8) Connect negative cable to battery.

(9) Start engine and check for leaks.

FLOW MANAGEMENT VALVE

DESCRIPTION

The flow management valve is a part of the On-Board Refueling Vapor Recovery (ORVR) system. This plastic valve is placed in-line between the fuel tank and the EVAP canister. It is located near the right side of the fuel tank (Fig. 19).

OPERATION

The flow management valve (Fig. 19) is one of the components used in the ORVR system. The valve meters the flow of fuel vapors to the EVAP canister during vehicle run and refueling. Pressure from the tank during refueling opens the main port valve and allows vapors to enter the EVAP canister. During vehicle run, the vapors are metered through an orifice to the EVAP canister. It is also used as a liquid separator to keep liquid fuel out of the EVAP canister.

REMOVAL

The fuel tank must be lowered for flow management valve removal or replacement. Refer to Fuel Tank Removal / Installation. The valve is replaced as an assembly along with a vapor line bundle.

FUEL INJECTION

TABLE OF CONTENTS

FUEL INJECTION

DESCRIPTION

The Powertrain Control Module (PCM) operates the fuel injection system. Refer to Powertrain Control Module in Electronic Control Modules for information.

FUEL INJECTION (Continued)

SPECIFICATIONS

TORQUE - FUEL INJECTION

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Accelerator Pedal Bracket Mounting Nuts	8.5	-	75
Engine Coolant Temperature Sensor - 2.4L/4.0L	11	-	96
IAC Motor-To-Throttle Body Bolts - 2.4L/4.0L	7	-	60
Intake Manifold Air Temp. Sensor - 4.0L	28	20	-
MAP Sensor Mounting Screws - 2.4L/4.0L	3	-	25
Oxygen Sensor - 2.4L/4.0L	30	22	-
PCM Mounting Screws	4	-	35
Throttle Body Mounting Bolts - 2.4L/4.0L	11	-	100
Throttle Position Sensor Mounting Screws - 2.4L/4.0L	7	-	60
Vehicle Speed Sensor Mounting Bolt	2.2	-	20

ACCELERATOR PEDAL

REMOVAL

The accelerator pedal is connected to the throttle body linkage by the throttle cable. The cable is protected by a plastic sheathing and is connected to the throttle body linkage by a ball socket. It is connected to the upper part of the accelerator pedal arm by a plastic retainer (clip) (Fig. 1). This retainer (clip) snaps into the top of the accelerator pedal arm. Retainer tabs (built into the cable sheathing) (Fig. 1) fasten the cable to the dash panel.

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing the accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of accelerator pedal arm (Fig. 1). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove accelerator pedal mounting bracket nuts.

(3) Remove accelerator pedal assembly.

INSTALLATION

(1) Place accelerator pedal assembly over mounting studs protruding from floor pan. Tighten mounting nuts to 8.5 N·m (75 in. lbs.) torque.

(2) Slide throttle cable into opening (slot) in top of pedal arm. An index tab is located on pedal arm. Rotate and push plastic cable retainer (clip) into accelerator pedal arm opening until it snaps into place on index tab.

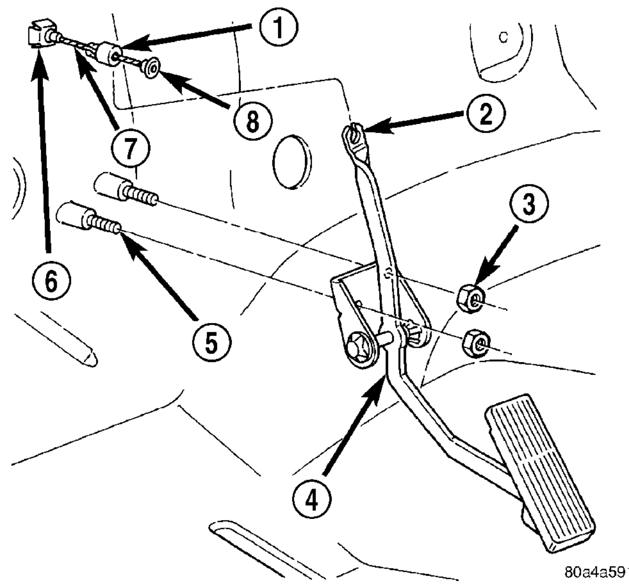


Fig. 1 Accelerator Pedal Mounting

1 - CABLE RETAINER
2 - SLOT
3 - MOUNTING STUDS (2)
4 - PEDAL/BRACKET ASSEMBLY
5 - MOUNTING STUDS
6 - RETAINER TABS
7 - CABLE
8 - CABLE STOP

(3) Before starting engine, operate accelerator pedal to check for any binding.

CRANKSHAFT POSITION SENSOR

DESCRIPTION

2.4L

The Crankshaft Position (CKP) sensor is mounted into the right front side of the cylinder block. It is positioned and bolted into a machined hole.

4.0L

The Crankshaft Position (CKP) sensor is located near the outer edge of the flywheel (starter ringear).

OPERATION

2.4L

Engine speed and crankshaft position are provided through the CKP (Crankshaft Position) sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

A tonewheel (targetwheel) is a part of the engine crankshaft (Fig. 2). This tonewheel has sets of notches at its outer edge.

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

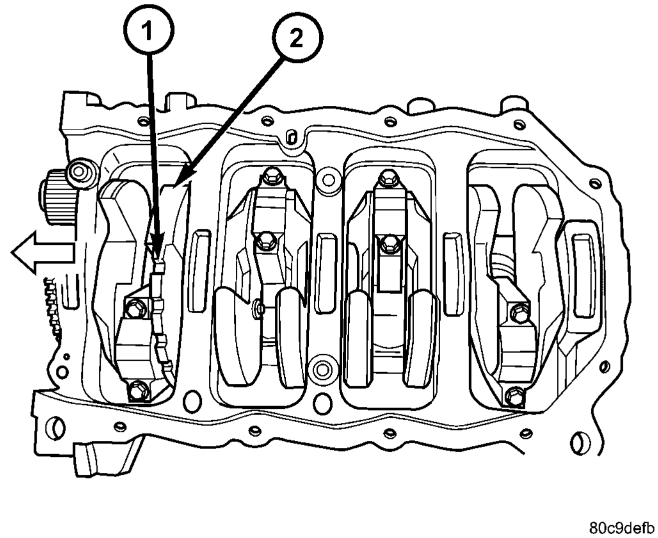


Fig. 2 CKP OPERATION - 2.4L

1 - NOTCHES
2 - CRANKSHAFT

The trailing edge of the fourth notch, which causes the pulse, is four degrees before top dead center (TDC) of the corresponding piston.

The engine will not operate if the PCM does not receive a CKP sensor input.

4.0L

Engine speed and crankshaft position are provided through the CKP sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

The flywheel/drive plate has groups of four notches at its outer edge. On 4.0L 6-cylinder engines there are three sets of notches (Fig. 3).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution there are 3 groups of four pulses generated on 4.0L 6-cylinder engines.

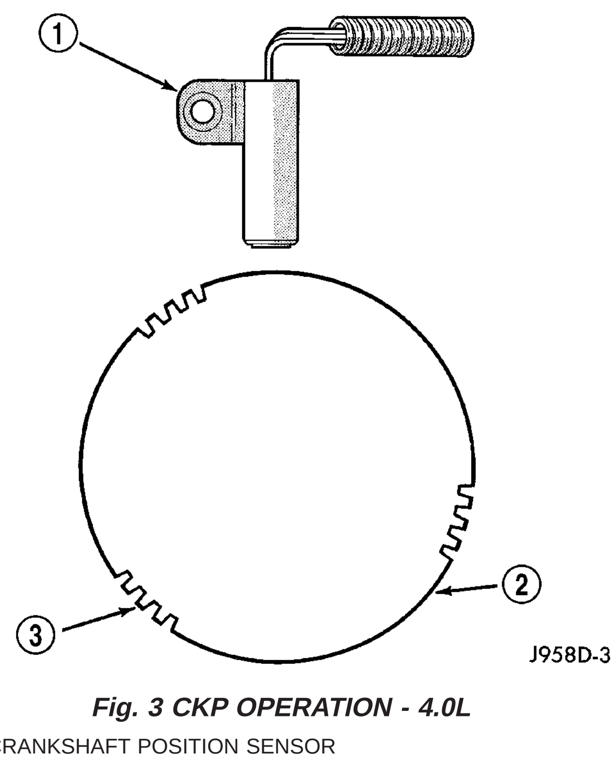


Fig. 3 CKP OPERATION - 4.0L

1 - CRANKSHAFT POSITION SENSOR
2 - FLYWHEEL
3 - FLYWHEEL NOTCHES

CRANKSHAFT POSITION SENSOR (Continued)

REMOVAL

2.4L

The Crankshaft Position (CKP) sensor is mounted into the right front side of the cylinder block (Fig. 4). It is positioned and bolted into a machined hole.

(1) Disconnect sensor electrical connector.

(2) Remove sensor bolt.

(3) Carefully twist sensor from cylinder block.

(4) Check condition of sensor o-ring (Fig. 5).

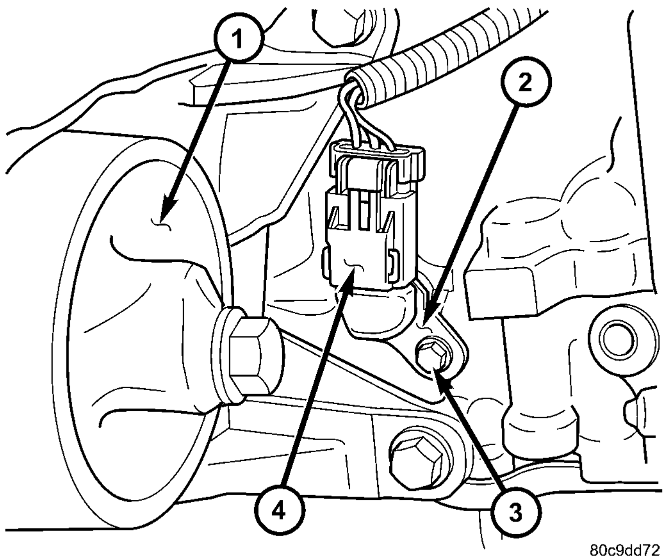


Fig. 4 CKP SENSOR LOCATION - 2.4L

1 - RIGHT FRONT ENGINE MOUNT
2 - CKP SENSOR
3 - MOUNTING BOLT
4 - ELECTRICAL CONNECTOR

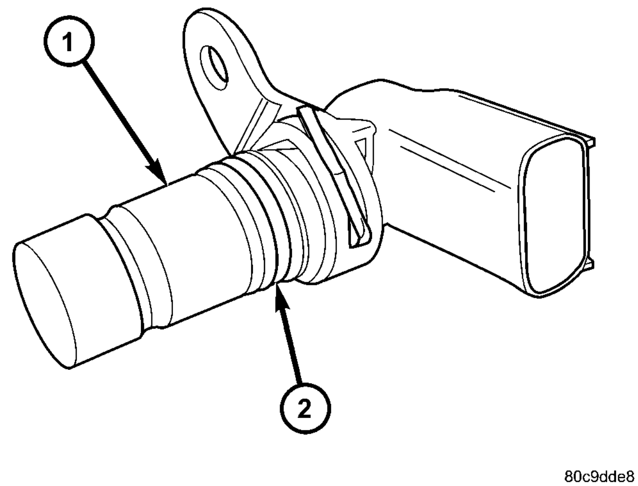


Fig. 5 CKP AND O-RING - 2.4L

1 - CKP SENSOR
2 - O-RING

4.0L

The crankshaft position (CKP) sensor is mounted to the transmission bellhousing near the rear of the engine block.

The sensor may be mounted to the transmission with one of the following four different configurations:

• with one bolt to the right side of the transmission if equipped with a 42RLE automatic transmission (Fig. 6).

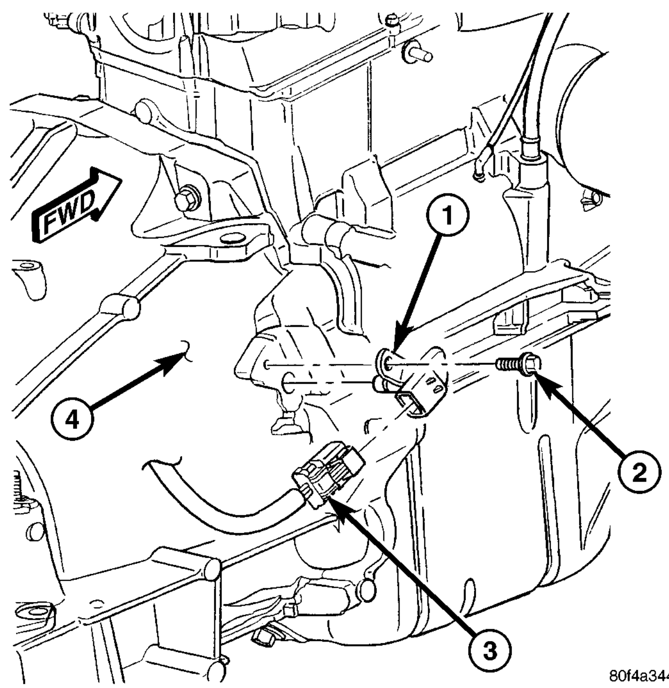


Fig. 6 CKP (WITH 42RLE AUTO. TRANS.)

1 - CKP SENSOR
2 - MOUNTING BOLT
3 - ELEC. CONNECTOR
4 - TRANS. BELLHOUSING

CRANKSHAFT POSITION SENSOR (Continued)

• with one bolt to the left side of the transmission (Fig. 7). If sensor is equipped with one mounting bolt, **it is adjustable.**.

• with two nuts to the left side of the transmission (Fig. 8).

• with two bolts to the left side of the transmission (Fig. 9).

(1) Disconnect sensor pigtail harness (electrical connector) from main electrical harness.

(2) Depending upon application, remove either sensor mounting bolt(s) or nuts.

(3) Remove sensor from engine.

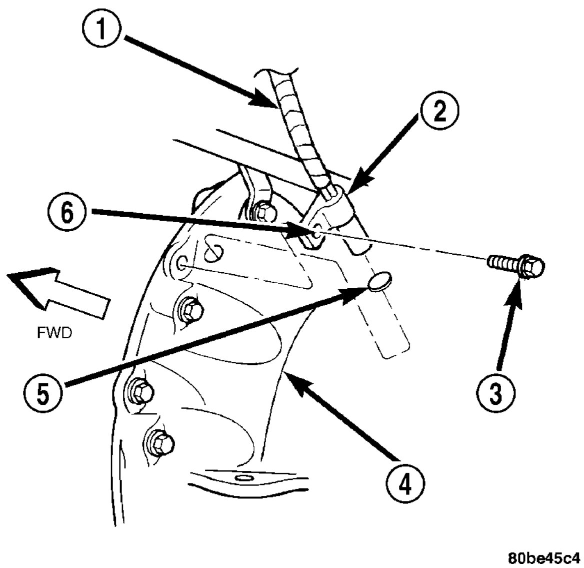


Fig. 7 CKP - ONE-BOLT MOUNTING (EXCEPT 42RLE AUTO. TRANS.)

1 - SENSOR PIGTAIL
2 - CRANKSHAFT POSITION SENSOR
3 - MOUNTING BOLT
4 - TRANSMISSION HOUSING
5 - PAPER SPACER
6 - SLOTTED HOLE

INSTALLATION

2.4L

(1) Clean out machined hole in engine block.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into engine block with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 28 N·m (21 ft. lbs.) torque.

(5) Connect electrical connector to sensor.

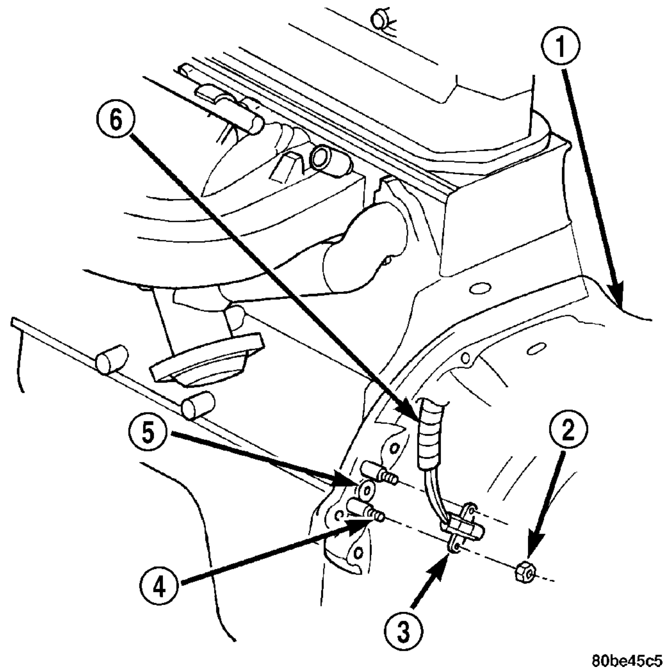


Fig. 8 CKP - TWO-NUT MOUNTING

1 - TRANSMISSION BELLHOUSING
2 - MOUNTING NUTS (2)
3 - CRANKSHAFT POSITION SENSOR
4 - MOUNTING STUDS (2)
5 - RUBBER GROMMET
6 - SENSOR PIGTAIL

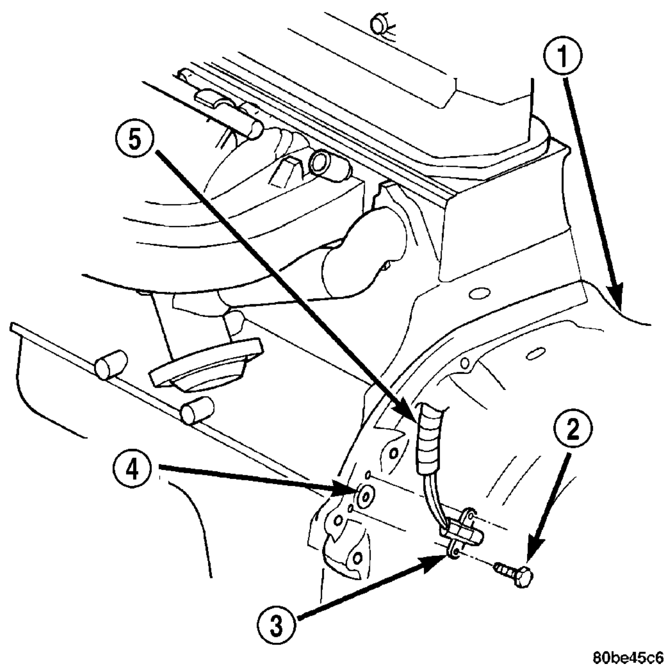


Fig. 9 CKP - TWO-BOLT MOUNTING

1 - TRANSMISSION BELLHOUSING
2 - MOUNTING BOLTS (2)
3 - CRANKSHAFT POSITION SENSOR
4 - RUBBER GROMMET
5 - SENSOR PIGTAIL

CRANKSHAFT POSITION SENSOR (Continued)

4.0L

Sensor With 1–Bolt Mounting (Equipped With 42 RLE Automatic Transmission):

(1) Install sensor flush against opening in transmission housing.

(2) Install and tighten sensor mounting bolt to 12 N·m (9 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

Sensor With 2–Bolt Mounting:

(4) Install sensor flush against opening in transmission housing.

(5) Install and tighten two sensor mounting bolts to 12 N·m (9 ft. lbs.) torque. The two sensor mounting bolts are specially machined to correctly space unit to flywheel. Do not attempt to install any other bolts.

(6) Connect sensor pigtail harness electrical connector to main wiring harness.

Sensor With 2–Nut Mounting:

(7) Install and tighten two sensor mounting nuts to 12 N·m (9 ft. lbs.) torque.

(8) Connect sensor pigtail harness electrical connector to main wiring harness.

Sensor With One-Bolt Mounting (Not Equipped With 42 RLE Automatic Transmission):

New replacement sensors will be equipped with a paper spacer glued to bottom of sensor. If installing (returning) a **used** sensor to vehicle, a new paper spacer must be installed to bottom of sensor. This spacer will be ground off the first time engine is started. If spacer is not used, sensor will be broken the first time engine is started.

(9) New Sensors: Be sure paper spacer is installed to bottom of sensor. If not, obtain spacer PN05252229.

(10) Used Sensors: Clean bottom of sensor and install spacer PN05252229.

(11) Install sensor into transmission bellhousing hole.

(12) Push sensor against flywheel/drive plate. With sensor pushed against flywheel/drive plate, tighten mounting bolt to 7 N·m (60 in. lbs.) torque.

(13) Connect sensor pigtail harness electrical connector to main wiring harness.

FUEL INJECTOR

DESCRIPTION

An individual fuel injector (Fig. 10) is used for each individual cylinder.

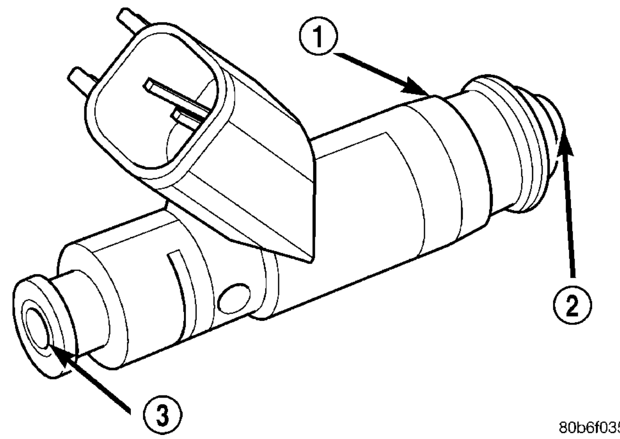


Fig. 10 FUEL INJECTOR - TYPICAL

1 - FUEL INJECTOR
2 - NOZZLE
3 - TOP (FUEL ENTRY)

OPERATION

OPERATION - PCM OUTPUT

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector with its respective cylinder number.

The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage (12 volts +) is supplied to the injectors through the ASD relay. The ASD relay will shutdown the 12 volt power source to the fuel injectors if the PCM senses the ignition is on, but the engine is not running. This occurs after the engine has not been running for approximately 1.8 seconds.

The PCM determines injector on-time (pulse width) based on various inputs.

FUEL INJECTOR (Continued)

OPERATION - FUEL INJECTOR

The top (fuel entry) end of the injector (Fig. 10) is attached into an opening on the fuel rail.

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

The nozzle (outlet) ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are energized individually in a sequential order by the powertrain control module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage is supplied to the injectors through the ASD relay.

The PCM determines injector pulse width based on various inputs.

REMOVAL

(1) Remove fuel rail. Refer to Fuel Injector Rail Removal in this section.

(2) Disconnect clip(s) that retain fuel injector(s) to fuel rail (Fig. 11).

INSTALLATION

(1) Install fuel injector(s) into fuel rail assembly and install retaining clip(s).

(2) If same injector(s) is being reinstalled, install new o-ring(s).

(3) Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.

(4) Install fuel rail. Refer to Fuel Rail Installation.

(5) Start engine and check for fuel leaks.

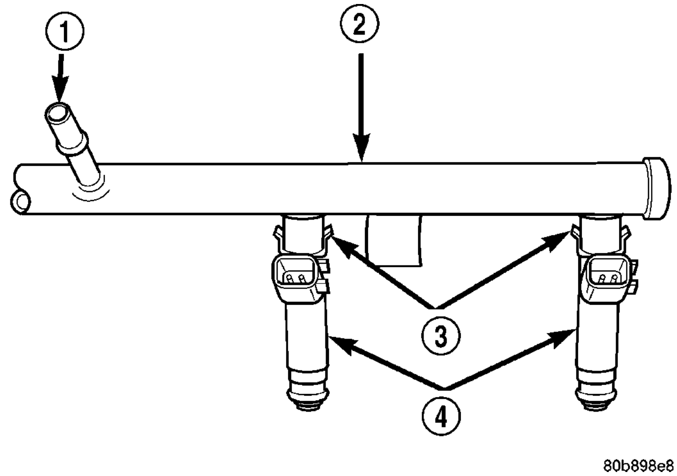


Fig. 11 FUEL INJECTOR MOUNTING

1 - INLET FITTING
2 - FUEL INJECTOR RAIL
3 - CLIP
4 - FUEL INJECTOR

FUEL PUMP RELAY

DESCRIPTION

The 5–pin, 12–volt, fuel pump relay is located in the Power Distribution Center (PDC). Refer to the label on the PDC cover for relay location.

OPERATION

The Powertrain Control Module (PCM) energizes the electric fuel pump through the fuel pump relay. The fuel pump relay is energized by first applying battery voltage to it when the ignition key is turned ON, and then applying a ground signal to the relay from the PCM.

Whenever the ignition key is turned ON, the electric fuel pump will operate. But, the PCM will shutdown the ground circuit to the fuel pump relay in approximately 1–3 seconds unless the engine is operating or the starter motor is engaged.

FUEL PUMP RELAY (Continued)

REMOVAL

The fuel pump relay is located in the Power Distribution Center (PDC) (Fig. 12). Refer to label on PDC cover for relay location.

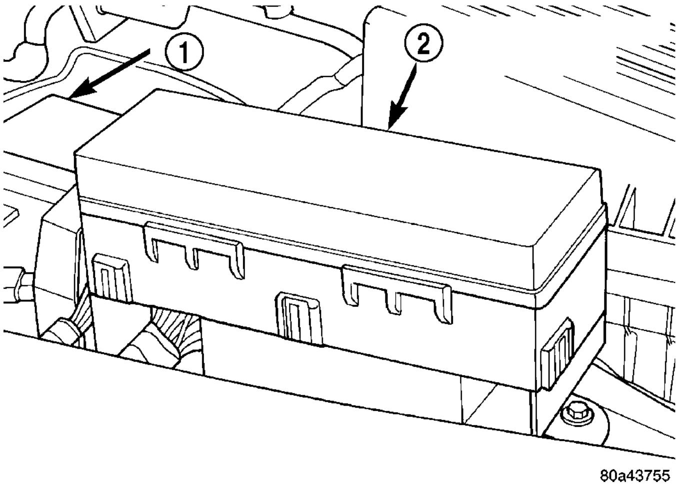


Fig. 12 Power Distribution Center (PDC)

1 - BATTERY
2 - POWER DISTRIBUTION CENTER (PDC)

(1) Remove PDC cover.
(2) Remove relay from PDC.
(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

The fuel pump relay is located in the Power Distribution Center (PDC) (Fig. 12). Refer to label on PDC cover for relay location.
(1) Install relay to PDC.
(2) Install cover to PDC.

IDLE AIR CONTROL MOTOR

DESCRIPTION

The IAC stepper motor is mounted to the throttle body, and regulates the amount of air bypassing the control of the throttle plate. As engine loads and ambient temperatures change, engine rpm changes. A pintle on the IAC stepper motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC is controlled by the Powertrain Control Module (PCM) to maintain the target engine idle speed.

OPERATION

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

The IAC is called a stepper motor because it is moved (rotated) in steps, or increments. Opening the IAC opens an air passage around the throttle blade which increases RPM.

The PCM uses the IAC motor to control idle speed (along with timing) and to reach a desired MAP during decel (keep engine from stalling).

The IAC motor has 4 wires with 4 circuits. Two of the wires are for 12 volts and ground to supply electrical current to the motor windings to operate the stepper motor in one direction. The other 2 wires are also for 12 volts and ground to supply electrical current to operate the stepper motor in the opposite direction.

To make the IAC go in the opposite direction, the PCM just reverses polarity on both windings. If only 1 wire is open, the IAC can only be moved 1 step (increment) in either direction. To keep the IAC motor in position when no movement is needed, the PCM will energize both windings at the same time. This locks the IAC motor in place.

In the IAC motor system, the PCM will count every step that the motor is moved. This allows the PCM to determine the motor pintle position. If the memory is cleared, the PCM no longer knows the position of the pintle. So at the first key ON, the PCM drives the IAC motor closed, regardless of where it was before. This zeros the counter. From this point the PCM will back out the IAC motor and keep track of its position again.

When engine rpm is above idle speed, the IAC is used for the following:

- Off-idle dashpot (throttle blade will close quickly but idle speed will not stop quickly)
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM can control polarity of the circuit to control direction of the stepper motor.

IAC Stepper Motor Program: The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory

IDLE AIR CONTROL MOTOR (Continued)

cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

Another function of the memory program, which occurs when the power steering switch (if equipped), or the A/C request circuit, requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. The PCM can anticipate A/C compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change. Finally, the PCM incorporates a ″No-Load″ engine speed limiter of approximately 1800 - 2000 rpm, when it recognizes that the TPS is indicating an idle signal and IAC motor cannot maintain engine idle.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the IAC motor through the PCM.

REMOVAL

2.4L

The Idle Air Control (IAC) motor is located on the rear side of the throttle body (Fig. 13).

(1) Disconnect electrical connector from IAC motor.
(2) Remove two mounting bolts (screws).
(3) Remove IAC motor from throttle body.

4.0L

The IAC motor is located on the side of the throttle body.

(1) Remove air cleaner tube at throttle body.
(2) Disconnect electrical connector from IAC motor.
(3) Remove two mounting bolts (screws) (Fig. 14).
(4) Remove IAC motor from throttle body.

INSTALLATION

(1) Install IAC motor to throttle body.
(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
(3) Install electrical connector.
(4) Install air cleaner tube to throttle body.

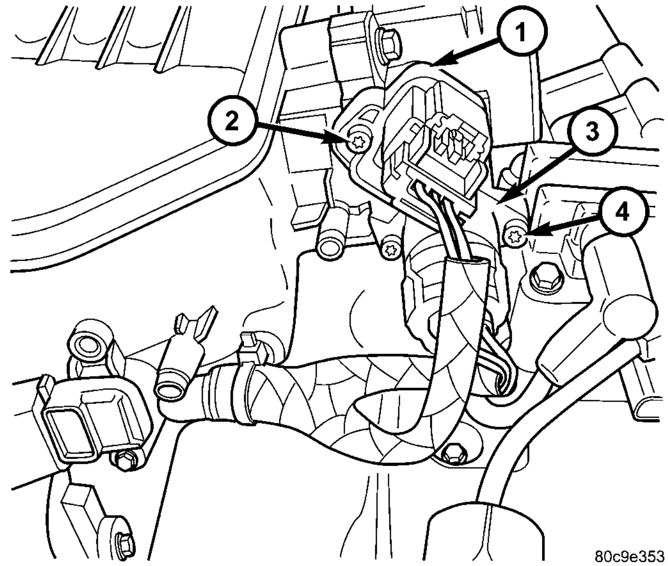


Fig. 13 TPS/IAC MOTOR - 2.4L

1 - THROTTLE POSITION SENSOR (TPS)
2 - MOUNTING SCREWS
3 - IDLE AIR CONTROL MOTOR (IAC)
4 - MOUNTING SCREWS

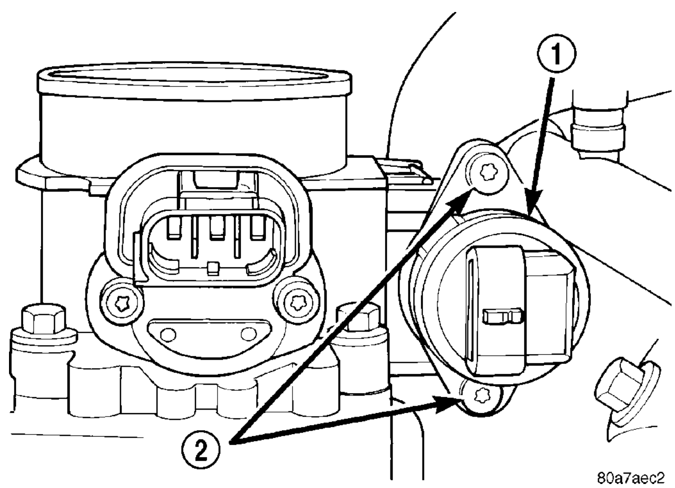


Fig. 14 MOUNTING BOLTS

1 - IDLE AIR CONTROL MOTOR
2 - MOUNTING SCREWS

INTAKE AIR TEMPERATURE SENSOR

DESCRIPTION

The 2–wire Intake Manifold Air Temperature (IAT) sensor is installed in the intake manifold with the sensor element extending into the air stream.

The IAT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as intake manifold temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

INTAKE AIR TEMPERATURE SENSOR (Continued)

OPERATION

The IAT sensor provides an input voltage to the Powertrain Control Module (PCM) indicating the density of the air entering the intake manifold based upon intake manifold temperature. At key-on, a 5–volt power circuit is supplied to the sensor from the PCM. The sensor is grounded at the PCM through a low-noise, sensor-return circuit.

The PCM uses this input to calculate the following:

- Injector pulse-width
- Adjustment of spark timing (to help prevent spark knock with high intake manifold air-charge temperatures)

The resistance values of the IAT sensor is the same as for the Engine Coolant Temperature (ECT) sensor.

REMOVAL

2.4L

The intake manifold air temperature (IAT) sensor is installed into the intake manifold plenum at the rear end of the intake manifold (Fig. 15).

(1) Disconnect electrical connector from IAT sensor.

(2) Clean dirt from intake manifold at sensor base.

(3) Gently lift on small plastic release tab (Fig. 15) or (Fig. 16) and rotate sensor about 1/4 turn counter-clockwise for removal.

(4) Check condition of sensor o-ring (Fig. 16).

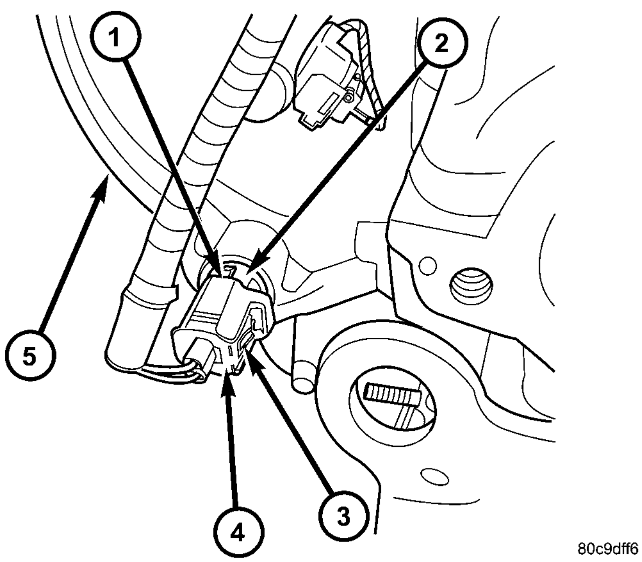


Fig. 15 IAT SENSOR - 2.4L

1 - RELEASE TAB
2 - IAT SENSOR
3 - PRESS HERE FOR REMOVAL
4 - ELECTRICAL CONNECTOR
5 - REAR END OF INTAKE MANIFOLD

4.0L

The intake manifold air temperature (IAT) sensor is installed into intake manifold plenum near throttle body (Fig. 17).

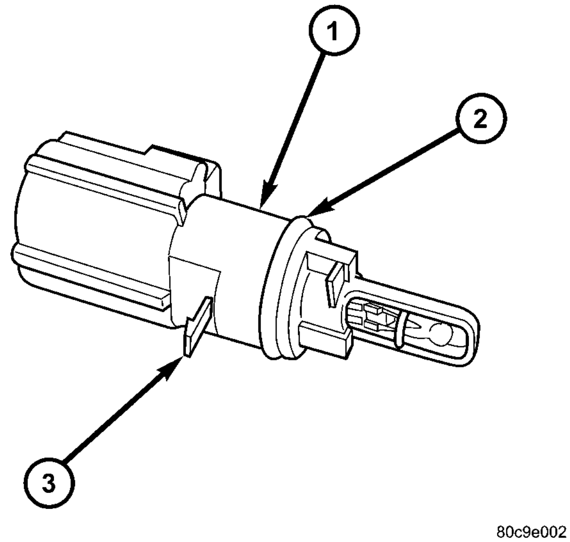


Fig. 16 IAT SENSOR TAB / O-RING - 2.4L

1 - IAT SENSOR
2 - SENSOR O-RING
3 - RELEASE TAB

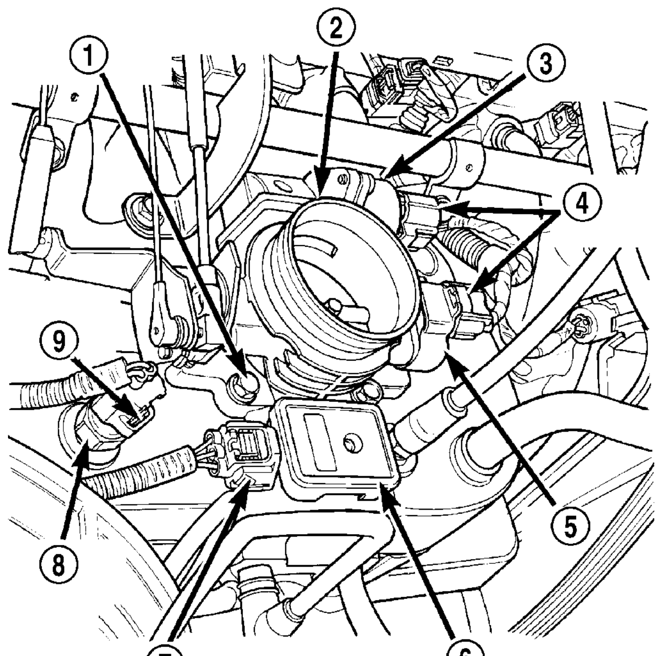


Fig. 17 IAT SENSOR - 4.0L

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

(1) Disconnect electrical connector from IAT sensor.

(2) Remove sensor from intake manifold.

INTAKE AIR TEMPERATURE SENSOR (Continued)

INSTALLATION

2.4L

(1) Check condition of sensor o-ring.
(2) Clean sensor mounting hole in intake manifold.
(3) Position sensor into intake manifold and rotate clockwise until past release tab.
(4) Install electrical connector.

4.0L

(1) Install IAT sensor into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.
(2) Connect electrical connector to sensor.

MAP SENSOR

DESCRIPTION

2.4L

The Manifold Absolute Pressure (MAP) sensor is mounted into the rear of the intake manifold with 1 screw.

4.0L Early

The Manifold Absolute Pressure (MAP) sensor is attached to the side of the engine throttle body with 2 screws. The sensor is connected to the throttle body with a rubber L-shaped fitting.

4.0L Late

The Manifold Absolute Pressure (MAP) sensor is attached to the side of the engine throttle body with 1 screw. The sensor is connected to the throttle body with a rubber L-shaped fitting.

OPERATION

The MAP sensor is used as an input to the Powertrain Control Module (PCM). It contains a silicon based sensing unit to provide data on the manifold vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When manifold absolute pressure (MAP) equals Barometric pressure, the pulse width will be at maximum.

A 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0–15 psi, the voltage changes 4.0V. To operate the sensor, it is supplied a regulated 4.8 to 5.1 volts. Ground is provided through the low-noise, sensor return circuit at the PCM.

The MAP sensor input is the number one contributor to fuel injector pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or at a higher altitude, because the air density changes with altitude. It will also help to correct for varying barometric pressure. Barometric pressure and altitude have a direct inverse correlation; as altitude goes up, barometric goes down. At key-on, the PCM powers up and looks at MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure (relative to altitude). Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key-on. The difference between current voltage and what it was at key-on, is manifold vacuum.

During key-on (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring a known good sensor.

As the altitude increases, the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key-on, the barometric pressure needs to be updated. Any time the PCM sees Wide Open Throttle (WOT), based upon Throttle Position Sensor (TPS) angle and RPM, it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor input to aid in calculating the following:

- Manifold pressure
- Barometric pressure
- Engine load
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (certain automatic transmissions only)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As manifold pressure changes, the diaphragm moves causing the element to deflect, which stresses the silicone. When silicone is exposed to stress, its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor also contains electronics that condition the signal and provide temperature compensation.

The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; meaning as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3

MAP SENSOR (Continued)

volts at 26 in. of Hg. Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is approximately 29.92 in Hg. For every 100 feet of altitude, barometric pressure drops 0.10 in. Hg. If a storm goes through, it can change barometric pressure from what should be present for that altitude. You should know what the average pressure and corresponding barometric pressure is for your area.

REMOVAL

2.4L

The Manifold Absolute Pressure (MAP) sensor is mounted into the rear of the intake manifold (Fig. 18). An o-ring is used to seal the sensor to the intake manifold (Fig. 19).

(1) Disconnect electrical connector at sensor.
(2) Clean area around MAP sensor.
(3) Remove sensor mounting screw (TORX head).
(4) Remove MAP sensor from intake manifold.
(5) Check condition of sensor o-ring (Fig. 19).

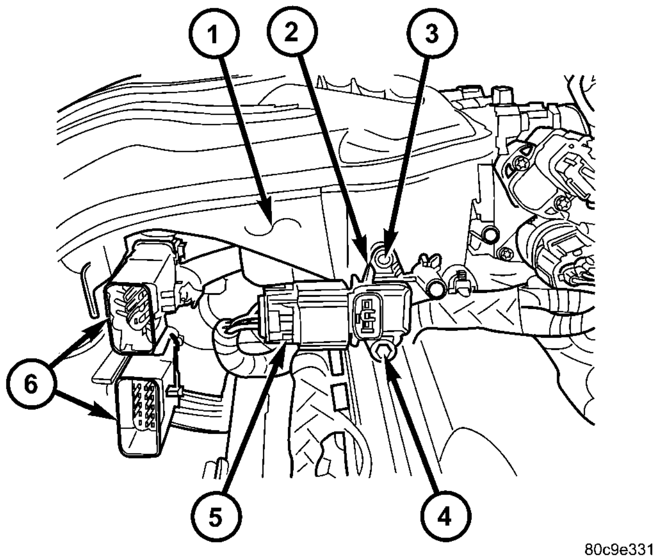


Fig. 18 MAP SENSOR LOCATION - 2.4L

1 - REAR OF INTAKE MANIFOLD
2 - MAP SENSOR
3 - ALIGNMENT PIN
4 - MOUNTING BOLT (TORX)
5 - ELECTRICAL CONNECTOR
6 - MAIN ENGINE HARNESS CONNECTORS

4.0L Early

An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 20).

(1) Remove air cleaner intake tube at throttle body.
(2) Remove two MAP sensor mounting bolts (screws) (Fig. 20).

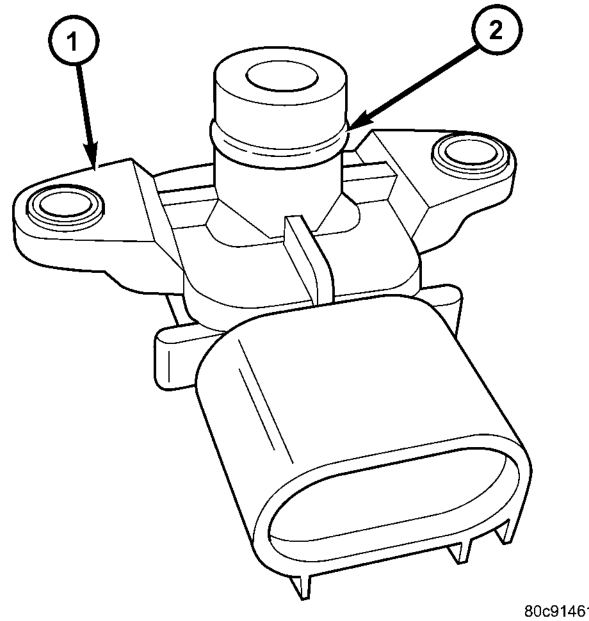


Fig. 19 MAP SENSOR O-RING - 2.4L

1 - MAP SENSOR
2 - O-RING

(3) While removing MAP sensor, slide the rubber L-shaped fitting (Fig. 20) from throttle body.
(4) Remove rubber L-shaped fitting from MAP sensor.

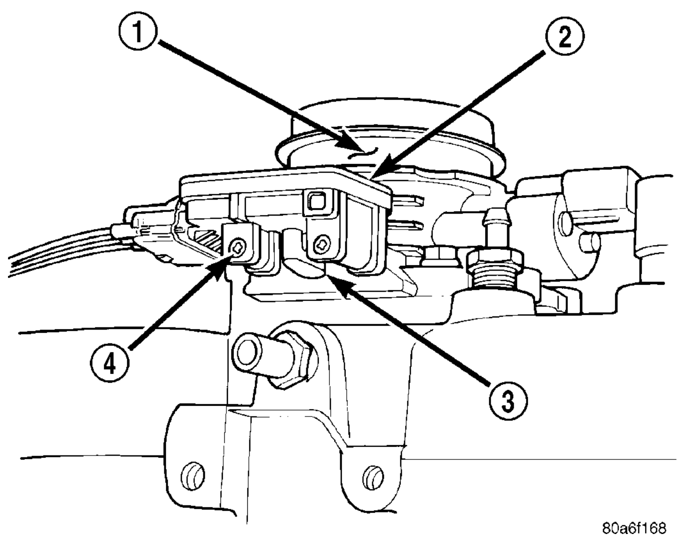


Fig. 20 4.0L MAP SENSOR MOUNTING - EARLY

1 - THROTTLE BODY
2 - MAP SENSOR
3 - RUBBER FITTING
4 - MOUNTING SCREWS (2)

4.0L Late

An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 21).

MAP SENSOR (Continued)

(1) Remove air cleaner intake tube at throttle body.

(2) Remove MAP sensor mounting bolt (screw) (Fig. 21).

(3) While removing MAP sensor, slide the rubber L-shaped fitting (Fig. 21) from throttle body.

(4) Remove rubber L-shaped fitting from MAP sensor.

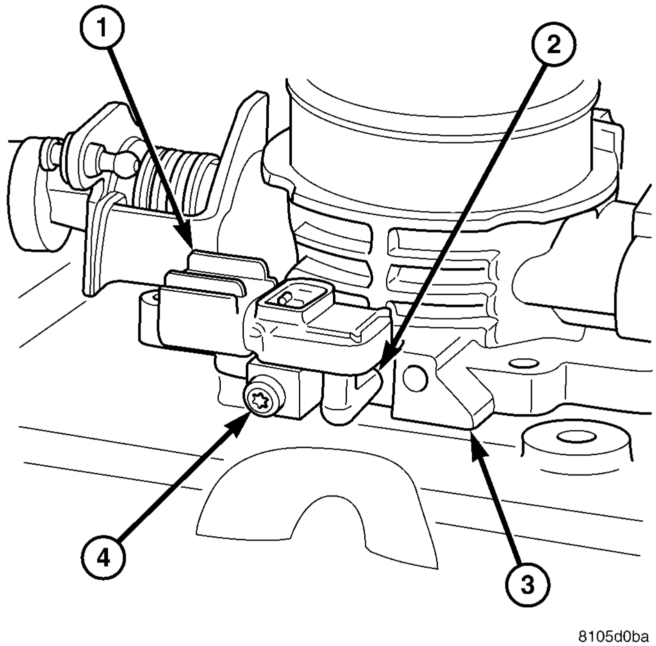


Fig. 21 4.0L MAP SENSOR MOUNTING - LATE

1 - MAP SENSOR
2 - RUBBER FITTING
3 - THROTTLE BODY
4 - MOUNTING SCREW (1)

INSTALLATION

2.4L

(1) Clean MAP sensor mounting hole at intake manifold.

(2) Check MAP sensor o-ring seal for cuts or tears.

(3) Position sensor into manifold.

(4) Install MAP sensor mounting screws. Tighten screw to 3 N·m (25 in. lbs.) torque.

(5) Connect electrical connector.

4.0L

(1) Install rubber L-shaped fitting to MAP sensor.

(2) Position sensor to throttle body while guiding rubber fitting over throttle body vacuum nipple.

(3) Install MAP sensor mounting bolt(s) (screws). Tighten screw(s) to 3 N·m (25 in. lbs.) torque.

(4) Install air cleaner intake tube.

(5) Connect electrical connector.

O2 HEATER RELAY

DESCRIPTION

The oxygen (O2) sensor heater relay is located in the Powertrain Distribution Center (PDC).

OPERATION

Refer to Oxygen Sensor for oxygen sensor relay information.

REMOVAL

The oxygen sensor heater relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

The oxygen sensor heater relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

(1) Install relay to PDC.

(2) Install cover to PDC.

O2 SENSOR

DESCRIPTION

The Oxygen Sensors (O2S) are attached to, and protrude into the vehicle exhaust system. Depending on the engine or emission package, the vehicle may use a total of either 2 or 4 sensors.

OPERATION

An O2 sensor is a galvanic battery that provides the PCM with a voltage signal (0-1 volt) inversely proportional to the amount of oxygen in the exhaust. In other words, if the oxygen content is low, the voltage output is high; if the oxygen content is high the output voltage is low. The PCM uses this information to adjust injector pulse-width to achieve the 14.7–to–1 air/fuel ratio necessary for proper engine operation and to control emissions.

The O2 sensor must have a source of oxygen from outside of the exhaust stream for comparison. Current O2 sensors receive their fresh oxygen (outside air) supply through the O2 sensor case housing.

Four wires (circuits) are used on each O2 sensor: a 12–volt feed circuit for the sensor heating element; a ground circuit for the heater element; a low-noise

O2 SENSOR (Continued)

sensor return circuit to the PCM, and an input circuit from the sensor back to the PCM to detect sensor operation.

Oxygen Sensor Heater Relay: If the vehicle is equipped with 4 oxygen sensors, a separate oxygen sensor relay is used to supply voltage to the sensor heating elements. This particular relay is used only for the 1/2 and 2/2 downstream sensors. Voltage for the other 2 sensor heating elements is supplied directly from the ASD relay. Refer to 8, Wiring Diagrams to determine which relay is used.

To avoid the large simultaneous current surge needed to operate all 4 sensors, power is delayed to the 2 downstream heater elements by the PCM for approximately 2 seconds.

Oxygen Sensor Heater Elements:

The O2 sensor uses a Positive Thermal Co-efficient (PTC) heater element. As temperature increases, resistance increases. At ambient temperatures around 70°F, the resistance of the heating element is approximately 4.5 ohms. As the sensor's temperature increases, resistance in the heater element increases. This allows the heater to maintain the optimum operating temperature of approximately 930°-1100°F (500°-600° C). Although the sensors operate the same, there are physical differences, due to the environment that they operate in, that keep them from being interchangeable.

Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation, the PCM monitors certain O2 sensor input(s) along with other inputs, and adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

Upstream Sensor - Engine Equipped With 2 Sensors: The upstream sensor (1/1) provides an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensor. The PCM will change the air/fuel ratio until the upstream sensor inputs a voltage that the PCM has determined will make the downstream sensor output (oxygen content) correct.

The upstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Downstream Sensor - Engine Equipped With 2 Sensors: The downstream oxygen sensor (1/2) is also used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Upstream Sensors - Engine Equipped With 4 Sensors: Two upstream sensors are used (1/1 and 2/1). The 1/1 sensor is the first sensor to receive exhaust gases from the #1 cylinder. They provide an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensors. The PCM will change the air/fuel ratio until the upstream sensors input a voltage that the PCM has determined will make the downstream sensors output (oxygen content) correct.

The upstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Downstream Sensors - Engine Equipped With 4 Sensors: Two downstream sensors are used (1/2 and 2/2). The downstream sensors are used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage, and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Engines equipped with either a downstream sensor(s), or a post-catalytic sensor, will monitor catalytic convertor efficiency. If efficiency is below emission standards, the Malfunction Indicator Lamp (MIL) will be illuminated and a Diagnostic Trouble Code (DTC) will be set. Refer to Monitored Systems in Emission Control Systems for additional information.

REMOVAL

2.4L

CAUTION: Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.

Refer to (Fig. 22) for O2S (oxygen sensor) location.

O2 SENSOR (Continued)

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support vehicle.
(2) Disconnect wire connector from O2S sensor.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

(3) Remove O2S sensor with an oxygen sensor removal and installation tool.
(4) Clean threads in exhaust pipe using appropriate size tap.

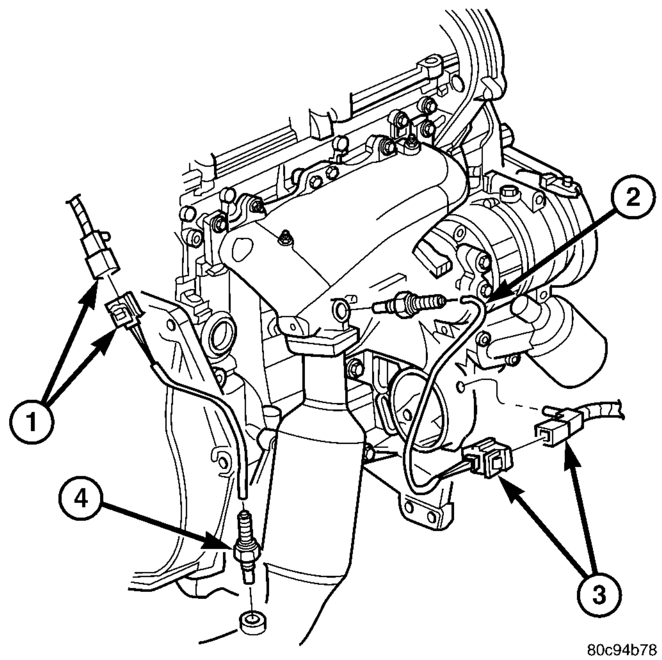


Fig. 22 OXYGEN SENSORS - 2.4L

1 - ELECTRICAL CONNECTORS
2 - UPSTREAM SENSOR (1/1)
3 - ELECTRICAL CONNECTORS
4 - DOWNSTREAM SENSOR (1/2)

4.0L

CAUTION: Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness.

Refer to (Fig. 23), (Fig. 24) for O2S (oxygen sensor) location.

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support vehicle.
(2) Disconnect wire connector from O2S sensor.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

(3) Remove O2S sensor with an oxygen sensor removal and installation tool.
(4) Clean threads in exhaust pipe using appropriate size tap.

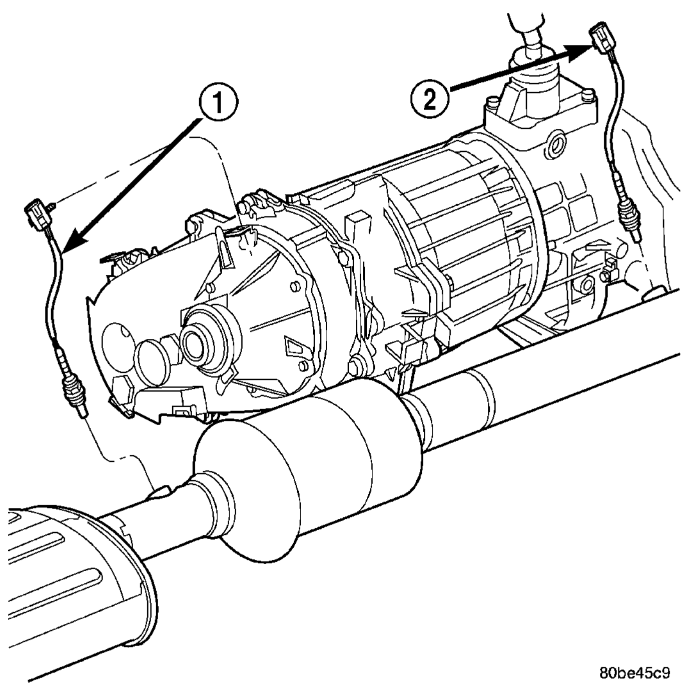


Fig. 23 OXYGEN SENSORS - 4.0L - FEDERAL EMISSIONS

1 - 1/2 O2S
2 - 1/1 02S

O2 SENSOR (Continued)

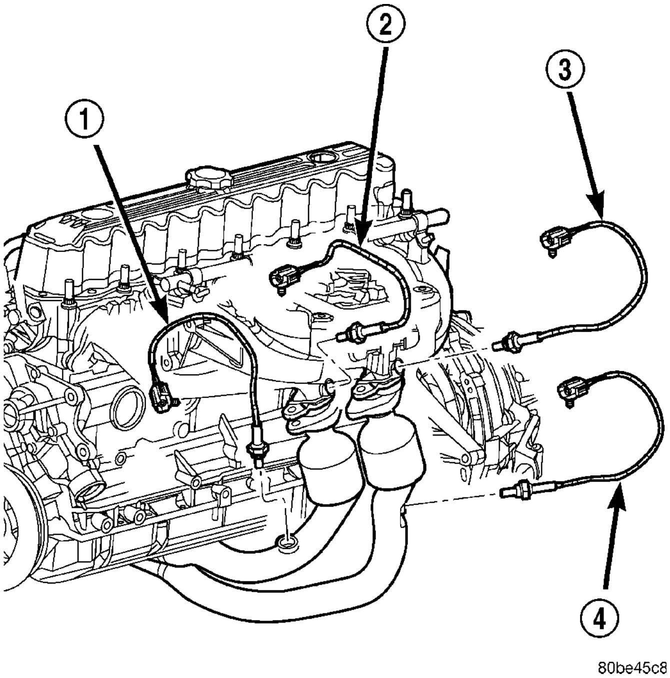


Fig. 24 OXYGEN SENSORS - 4.0L - CALIFORNIA EMISSIONS

1 - 1/2 O2S
2 - 1/1 O2S
3 - 2/1 O2S
4 - 2/2 O2S

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to the threads of a new oxygen sensor.**

(1) Install O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.

(2) Connect O2S sensor wire connector.

(3) Lower vehicle.

THROTTLE BODY

DESCRIPTION

The throttle body is located on the intake manifold. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors.

OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. The throttle body contains an air control passage controlled by an Idle Air Control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage arm.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

REMOVAL

2.4L

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

(1) Remove air cleaner tube at throttle body.

(2) Disconnect throttle body electrical connectors at IAC motor and TPS.

(3) Remove all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section for removal/installation procedures.

(4) Disconnect necessary vacuum lines at throttle body.

(5) Remove 3 throttle body mounting bolts (Fig. 25).

(6) Remove throttle body from intake manifold.

(7) Check condition of old throttle body-to-intake manifold o-ring.

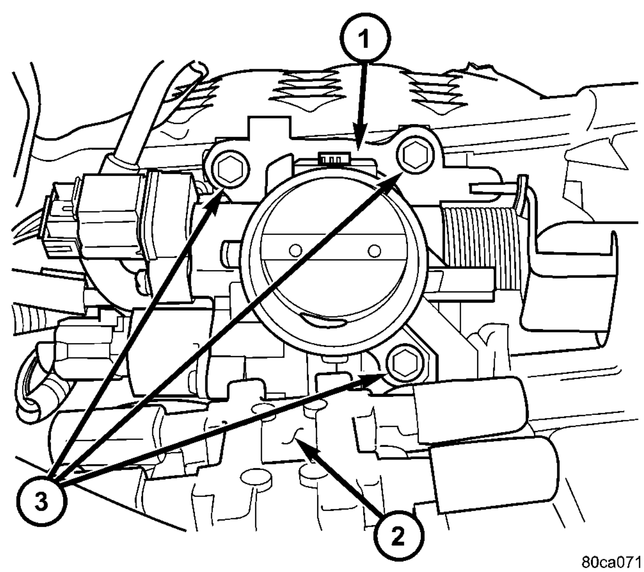


Fig. 25 THROTTLE BODY MOUNTING BOLTS - 2.4L

1 - THROTTLE BODY
2 - IGNITION COIL
3 - MOUNTING BOLTS (3)

THROTTLE BODY (Continued)

4.0L

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

(1) Remove air cleaner tube at throttle body.

(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 26).

(3) Remove all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section of this group for additional information.

(4) Remove four throttle body mounting bolts.

(5) Remove throttle body from intake manifold.

(6) Discard old throttle body-to-intake manifold gasket.

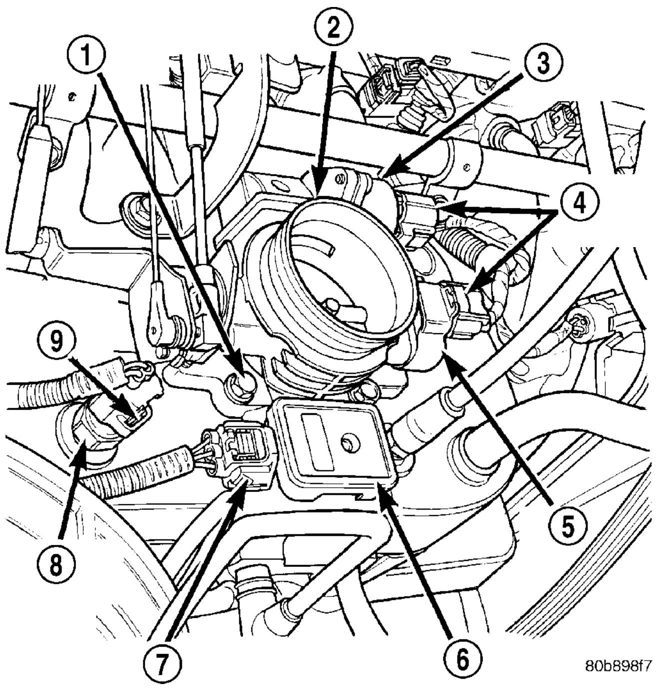


Fig. 26 THROTTLE BODY AND SENSOR LOCATIONS - 4.0L

1 - MOUNTING BOLTS (4)
2 - THROTTLE BODY
3 - IAC MOTOR
4 - ELEC. CONN.
5 - TPS
6 - MAP SENSOR
7 - ELEC. CONN.
8 - IAT SENSOR
9 - ELEC. CONN.

INSTALLATION

2.4L

(1) Check condition of throttle body-to-intake manifold o-ring. Replace as necessary.

(2) Clean mating surfaces of throttle body and intake manifold.

(3) Install throttle body-to-intake manifold o-ring.

(4) Install throttle body to intake manifold.

(5) Install 3 mounting bolts. Tighten bolts to 12 N·m (105 in. lbs.) torque.

(6) Install control cables.

(7) Install electrical connectors.

(8) Install necessary vacuum lines.

(9) Install air cleaner duct at throttle body.

4.0L

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

(1) Clean mating surfaces of throttle body and intake manifold.

(2) Install new throttle body-to-intake manifold gasket.

(3) Install throttle body to intake manifold.

(4) Install four mounting bolts. Tighten bolts to 11 N·m (100 in. lbs.) torque.

(5) Install control cables.

(6) Install electrical connectors.

(7) Install air cleaner at throttle body.

THROTTLE CONTROL CABLE

REMOVAL

2.4L

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 27). Plastic cable retainer snaps into top of pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, pinch both sides of cable housing retainer tabs (Fig. 27) at dash panel. Remove cable housing from dash panel and pull into engine compartment.

(4) Remove air box at throttle body.

(5) Unsnap cable from dashpanel routing clip.

(6) Remove cable housing from dash panel and pull into engine compartment.

(7) Hold throttle in wide open position. While held in this position, slide throttle cable pin (Fig. 28) from throttle body bellcrank.

THROTTLE CONTROL CABLE (Continued)

(8) Using a pick or small screwdriver, press release tab (Fig. 28) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** To remove throttle cable from throttle body bracket, slide cable towards front of vehicle.

(9) Remove throttle cable from vehicle.

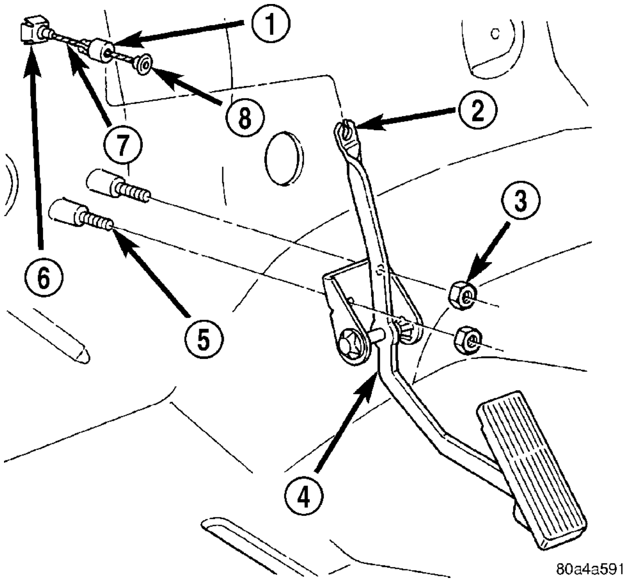


Fig. 27 ACCELERATOR PEDAL MOUNTING

1 - CABLE RETAINER
2 - SLOT
3 - MOUNTING STUDS (2)
4 - PEDAL/BRACKET ASSEMBLY
5 - MOUNTING STUDS
6 - RETAINER TABS
7 - CABLE
8 - CABLE STOP

4.0L

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of accelerator pedal arm (Fig. 29). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, pinch both sides of cable housing retainer tabs (Fig. 29) at dash panel. Remove cable housing from dash panel and pull into engine compartment.

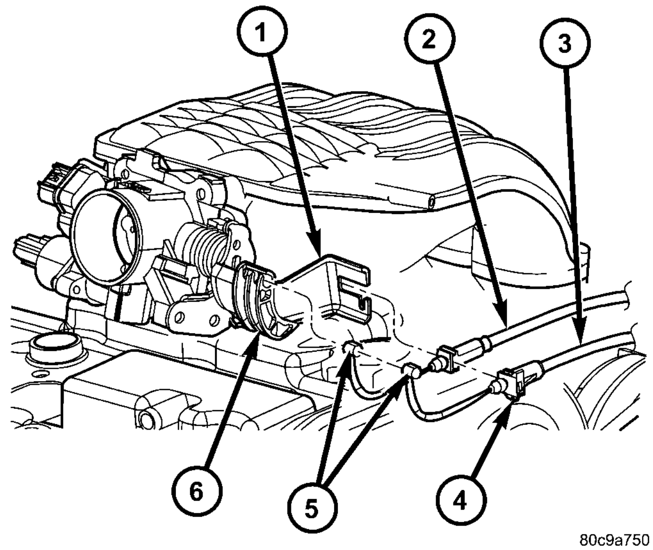


Fig. 28 THROTTLE CABLE, PIN, RELEASE TAB - 2.4L

1 - MOUNTING BRACKET
2 - SPEED CONTROL CABLE
3 - THROTTLE CABLE
4 - RELEASE TAB
5 - CABLE PINS
6 - BELLCRANK

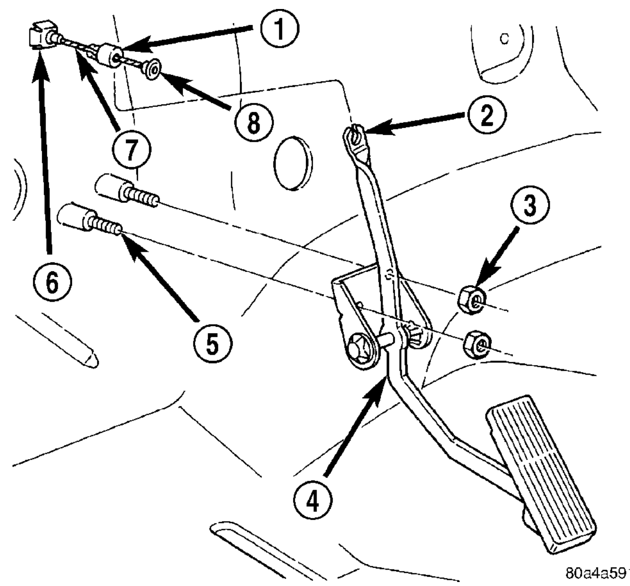


Fig. 29 ACCELERATOR PEDAL MOUNTING

1 - CABLE RETAINER
2 - SLOT
3 - MOUNTING STUDS (2)
4 - PEDAL/BRACKET ASSEMBLY
5 - MOUNTING STUDS
6 - RETAINER TABS
7 - CABLE
8 - CABLE STOP

THROTTLE CONTROL CABLE (Continued)

(4) Remove cable from clip guides on engine cylinder head (valve) cover (Fig. 30).

(5) Remove throttle cable ball socket at throttle body by pushing ball socket towards rear of vehicle (ball snaps off of throttle body pin) (Fig. 31).

(6) Remove throttle cable from throttle body mounting bracket by compressing release tabs (Fig. 31) and pushing cable through hole in bracket.

(7) Remove throttle cable from vehicle.

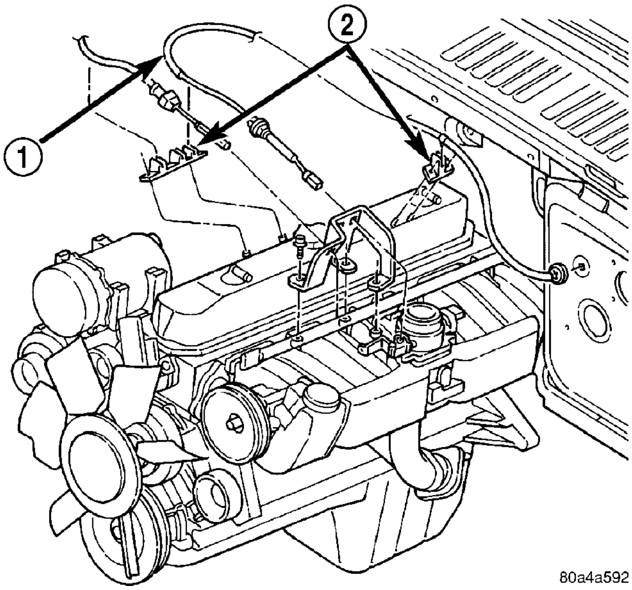


Fig. 30 THROTTLE CABLE ROUTING - 4.0L

1 - THROTTLE CABLE
2 - GUIDE

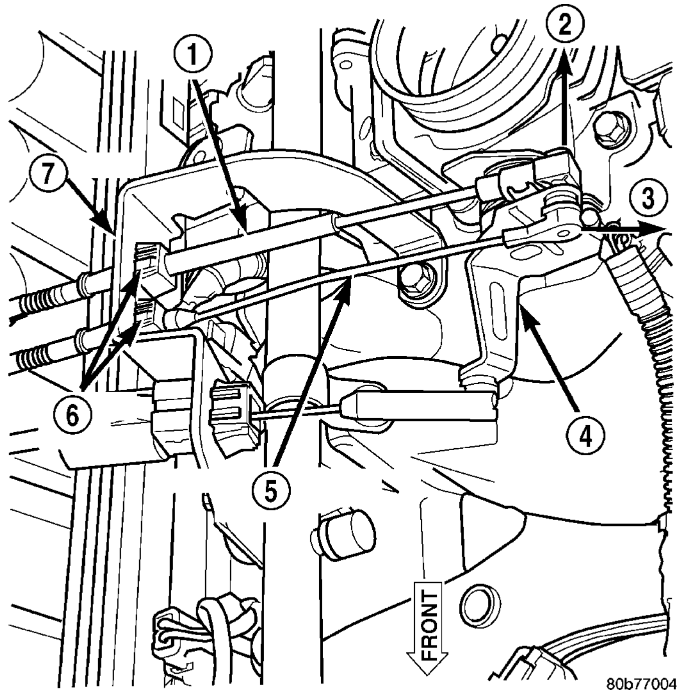


Fig. 31 THROTTLE CABLE AT THROTTLE BODY - 4.0L - TYPICAL

1 - ACCELERATOR CABLE
2 - OFF
3 - OFF
4 - THROTTLE BODY BELLCRANK
5 - SPEED CONTROL CABLE
6 - RELEASE TABS
7 - BRACKET

INSTALLATION

2.4L

(1) Slide accelerator cable plastic mount into throttle body mounting bracket. Continue sliding until release tab is aligned to hole in mounting bracket.

(2) Hold throttle in wide open position. While held in this position, slide throttle cable pin into throttle body bellcrank.

(3) Push cable housing into rubber grommet and through opening in dash panel.

(4) Push other end of cable through opening in dash panel until retaining tabs lock into panel.

(5) From inside vehicle, slide throttle cable core wire into opening (slot) in top of pedal arm.

(6) Push plastic cable retainer (clip) into pedal arm opening until it snaps in place.

(7) Install air box to throttle body.

(8) Before starting engine, operate accelerator pedal to check for any binding.

4.0L

(1) Slide throttle cable through hole in throttle body bracket until retainer tabs lock into bracket. Connect cable ball end to throttle body linkage ball (snaps on).

(2) Snap cable into clip guides on engine cylinder head (valve) cover.

(3) Push other end of cable through opening in dash panel until retaining tabs lock into panel.

(4) From inside drivers compartment, slide throttle cable core wire into opening in top of accelerator pedal arm. An index tab is located on pedal arm. Rotate and push cable retainer (clip) into pedal arm opening until it snaps in place on index tab.

(5) Install air box to throttle body.

(6) Before starting engine, operate accelerator pedal to check for any binding.

THROTTLE POSITION SENSOR

DESCRIPTION

The 3–wire Throttle Position Sensor (TPS) is mounted on the throttle body and is connected to the throttle blade.

OPERATION

The TPS is a 3–wire variable resistor that provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents the throttle blade position of the throttle body. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the resistance (output voltage) of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from .26 volts at minimum throttle opening (idle), to 4.49 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

The PCM needs to identify the actions and position of the throttle blade at all times. This information is needed to assist in performing the following calculations:

- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value or minimum TPS)
- Off-idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT cutoff (certain automatic transmissions only)

REMOVAL

2.4L

The Throttle Position Sensor (TPS) is mounted to the throttle body (Fig. 32).

(1) Disconnect TPS electrical connector.
(2) Remove 2 TPS mounting screws.
(3) Remove TPS.

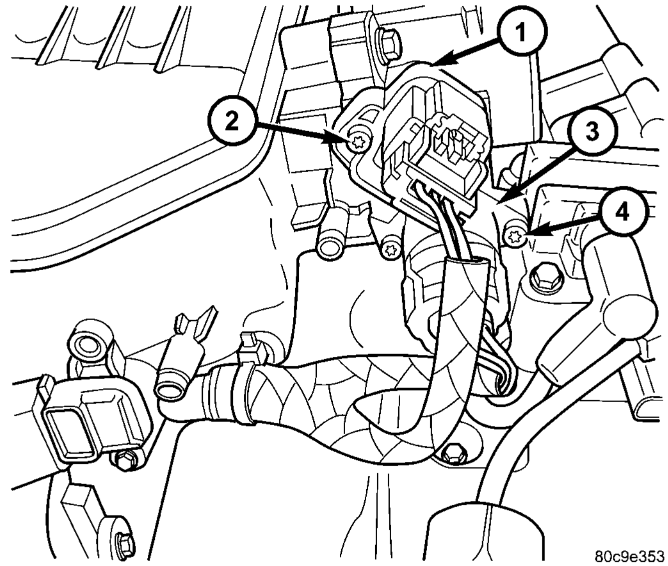


Fig. 32 TPS/IAC MOTOR - 2.4L

1 - THROTTLE POSITION SENSOR (TPS)
2 - MOUNTING SCREWS
3 - IDLE AIR CONTROL MOTOR (IAC)
4 - MOUNTING SCREWS

4.0L

The TPS is mounted to the throttle body.

(1) Remove air cleaner tube at throttle body.
(2) Disconnect TPS electrical connector.
(3) Remove TPS mounting screws (Fig. 33).
(4) Remove TPS.

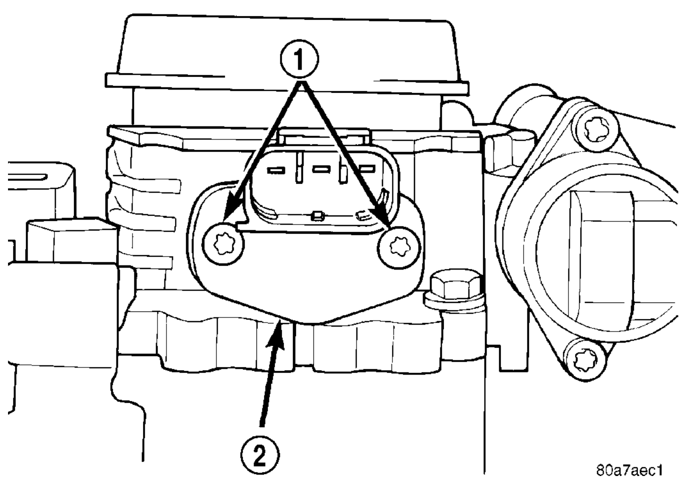


Fig. 33 TPS MOUNTING SCREWS - 4.0L

1 - MOUNTING SCREWS
2 - TPS

THROTTLE POSITION SENSOR (Continued)

INSTALLATION

2.4L

The throttle shaft end of the throttle body slides into a socket in the TPS. The TPS must be installed so that it can be rotated a few degrees. (If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs). The TPS will be under slight tension when rotated.

(1) Install TPS and retaining screws.
(2) Tighten screws to 7 N·m (60 in. lbs.) torque.
(3) Connect TPS electrical connector to TPS.
(4) Manually operate throttle (by hand) to check for any TPS binding before starting engine.
(5) Install air cleaner tube to throttle body.

4.0L

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 34). The TPS must be installed so that it can be rotated a few degrees. (If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs). The TPS will be under slight tension when rotated.

(1) Install TPS and retaining screws.
(2) Tighten screws to 7 N·m (60 in. lbs.) torque.
(3) Connect TPS electrical connector to TPS.
(4) Manually operate throttle (by hand) to check for any TPS binding before starting engine.
(5) Install air cleaner tube to throttle body.

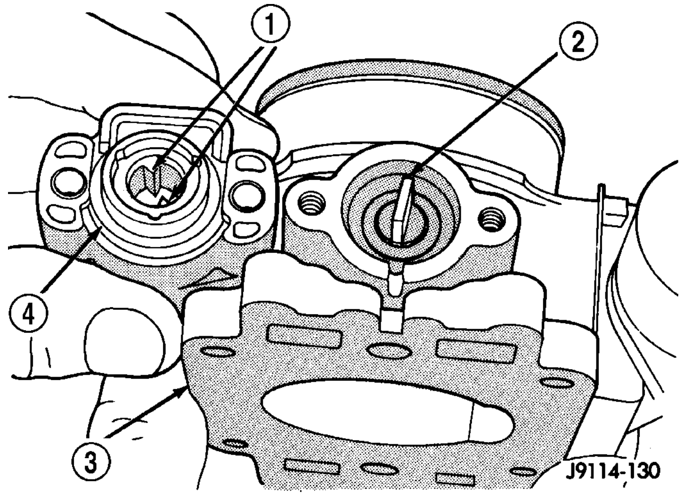


Fig. 34 TPS INSTALLATION - 4.0L

1 - TANGS
2 - THROTTLE SHAFT
3 - THROTTLE BODY
4 - TPS

STEERING

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STEERING

DESCRIPTION

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The power steering system has a hydraulic pump. The pump is a constant flow rate and displacement vane-type pump. The pump reservoir on the 4.0L engine is mounted to the pump body (Fig. 1)& (Fig. 2). The 2.4L engine has a remote pump reservoir mounted to the fan shroud (Fig. 3).

The steering gear used is a straight ratio recirculating ball type gear. A tilt and non-tilt column provide steering input.

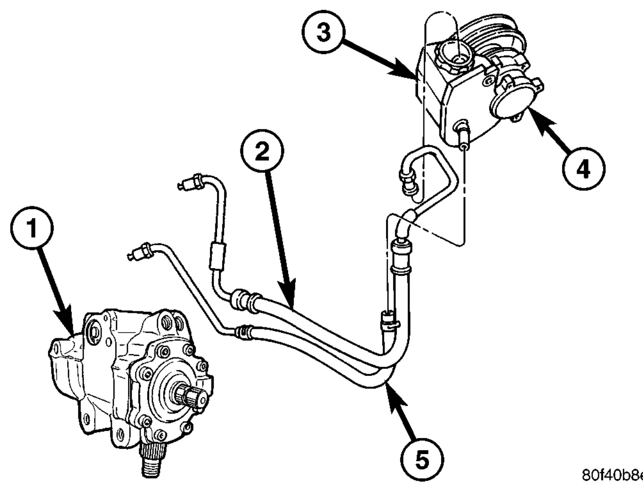

Fig. 1 POWER STEERING GEAR & PUMP - 4.0L

1 - POWER STEERING GEAR
2 - PRESSURE HOSE
3 - POWER STEERING RESERVOIR
4 - POWER STEERING PUMP
5 - RETURN HOSE

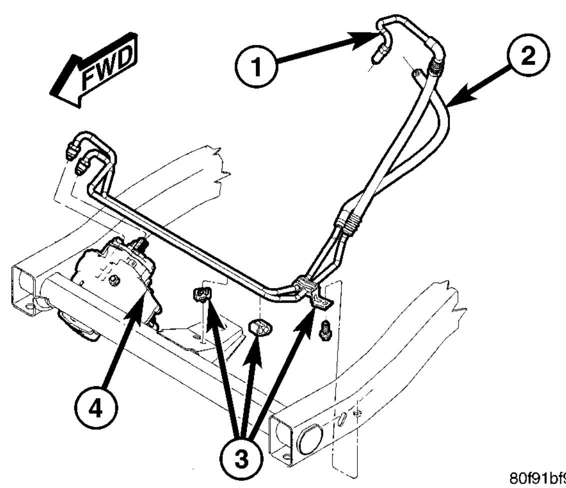

Fig. 2 RHD POWER STEERING HOSES

1 - PRESSURE HOSE
2 - RETURN HOSE
3 - MOUNTING BRACKETS
4 - STEERING GEAR

STEERING (Continued)

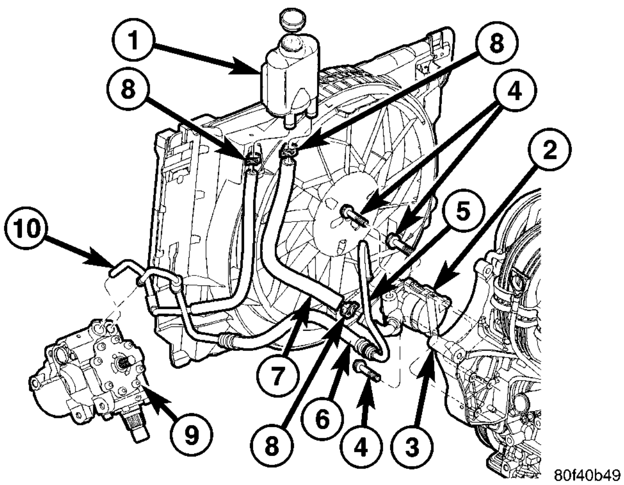

Fig. 3 POWER STEERING GEAR & PUMP - 2.4L

1 - REMOTE RESERVOIR
2 - POWER STEERING PUMP
3 - PUMP MOUNT BRACKET
4 - MOUNTING BOLTS (3)
5 - PRESSURE SWITCH LOCATION
6 - PRESSURE OUTLET HOSE (GEAR TO PUMP)
7 - RETURN HOSE (RESERVOIR TO PUMP)
8 - CLAMPS
9 - STEERING GEAR
10 - INLET HOSE (RESERVOIR TO GEAR)

OPERATION

The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the upper end. When the worm shaft is turned from input from the steering column the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - POWER STEERING SYSTEM DIAGNOSIS CHARTS

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

STEERING NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal. 2. Noisy valve in power steering gear.	1. Check and repair seal at dash panel. 2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose. 2. Loose or damaged suspension components/track bar. 3. Loose or damaged steering linkage. 4. Internal gear noise. 5. Pressure hose in contact with other components.	1. Tighten bolts to specification. 2. Inspect and repair suspension. 3. Inspect and repair steering linkage. 4. Replace gear. 5. Reposition hose.

STEERING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.
WHINE OR GROWL	1. Low fluid level. 2. Pressure hose in contact with other components. 3. Internal pump noise. 4. Air in the system.	1. Fill to proper level. 2. Reposition hose. 3. Replace pump. 4. Perform pump initial operation.
SUCKING AIR SOUND	1. Loose return line clamp. 2. O-ring missing or damaged on hose fitting. 3. Low fluid level. 4. Air leak between pump and reservoir.	1. Replace clamp. 2. Replace o-ring. 3. Fill to proper level. 4. Repair as necessary.
SCRUBBING OR KNOCKING	1. Wrong tire size. 2. Wrong gear.	1. Verify tire size. 2. Verify gear.

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level. 2. Tire pressure. 3. Steering component. 4. Loose belt. 5. Low pump pressure. 6. Column shaft coupler binding. 7. Steering gear worn or out of adjustment. 8. Ball joints binding.	1. Fill to proper level. 2. Adjust tire pressure. 3. Inspect and lube. 4. Adjust or replace. 5. Pressure test and replace if necessary. 6. Replace coupler. 7. Replace gear. 8. Inspect and repair as necessary.

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	1. Tire pressure. 2. Low fluid level. 3. Loose belt. 4. Lack of lubrication. 5. Low pump pressure. 6. Internal gear leak.	1. Adjust tire pressure. 2. Fill to proper level. 3. Adjust or replace. 4. Inspect and lubricate steering and suspension compnents. 5. Pressure test and repair as necessary. 6. Pressure and flow test, and replace as necessary.

STEERING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tire pressure. 2. Wheel alignment. 3. Lack of lubrication. 4. High friction in steering gear. 5. Ball joints binding.	1. Adjust tire pressure. 2. Align front end. 3. Inspect and lubricate steering and suspension compnents. 4. Test and adjust as necessary. 5. Inspect and repair as necessary.

NOTE:
Some roads will cause a vehicle to drift, due to the crown in the road.

LOOSE STEERING AND VEHICLE LEADS/DRIFTS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components. 2. Worn or loose wheel bearings. 3. Steering gear mounting. 4. Gear out of adjustment. 5. Worn or loose steering coupler.	1. Repair as necessary. 2. Repair as necessary. 3. Tighten gear mounting bolts to specification. 4. Adjust gear to specification. 5. Repair as necessary.
VEHICLE PULLS TO ONE SIDE DURING BRAKING	1. Tire Pressure. 2. Air in brake hydraulics system. 3. Worn brake components.	1. Adjust tire pressure. 2. Bleed brake system. 3. Repair as necessary.
VEHICLE LEADS OR DRIFTS FROM STRAIGHT AHEAD DIRECTION ON UNCROWNED ROAD.	1. Tire pressure. 2. Radial tire lead. 3. Brakes dragging. 4. Wheel alignment. 5. Weak or broken spring. 6. Loose or worn steering/ suspension components. 7. Cross caster out of spec.	1. Adjust tire pressure. 2. Cross front tires. 3. Repair as necessary. 4. Align vehicle. 5. Replace spring. 6. Repair as necessary. 7. Adjust or replace axle as necessary.

DIAGNOSIS AND TESTING - POWER STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool 6815 (Fig. 4) and Adapter kit 6893.

FLOW AND PRESSURE TEST

(1) Check the power steering belt to ensure it is in good condition and adjusted properly.

(2) Connect pressure gauge hose from the Power Steering Analyzer to Tube 6865.

(3) Connect Adapter 6826 to Power Steering Analyzer test valve end.

STEERING (Continued)

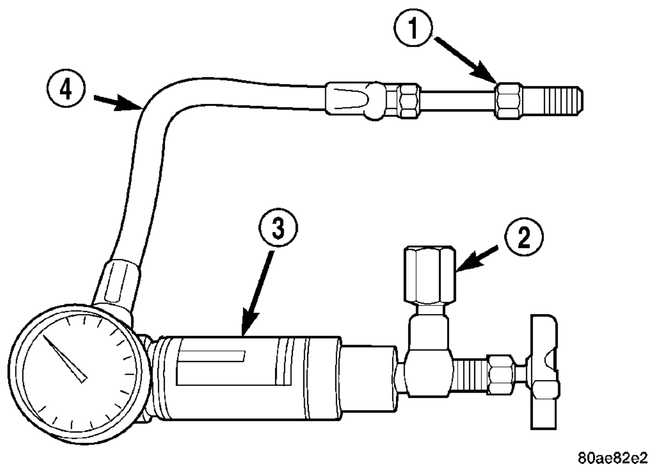

Fig. 4 Power Steering Analyzer

1 - TUBE
2 - ADAPTER FITTINGS
3 - ANALYZER
4 - GAUGE HOSE

(4) Disconnect the high pressure hose from the power steering pump.

(5) Connect Tube 6865 to the pump hose fitting.

(6) Connect the power steering hose from the steering gear to Adapter 6826.

(7) Open the test valve completely.

(8) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge.

(9) Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.

(10) Gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi).

(11) Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.4 - 2.8 GPM, if the reading is below this specification the pump should be replaced.

CAUTION: This next step involves testing maximum pump pressure output and flow control valve operation. Do not leave test valve closed for more than three seconds as the pump could be damaged.

(12) Close valve fully three times for three seconds and record highest pressure indicated each time. **All three readings must be above pump relief pressure specifications and within 345 kPa (50 psi) of each other.**

- Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
- Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.

(13) Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure reading at each position. Compare readings to pump specifications chart. If pressure readings are not within 50 psi. of each other, the gear is leaking internally and must be repaired.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because, pump damage will result.

PUMP SPECIFICATIONS

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
2.4L	9653 kPa (1400 psi)	1500 RPM 2.4 - 2.8 GPM
4.0L	9653 kPa (1400 psi)	

COLUMN

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COLUMN

DESCRIPTION

NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

The standard non-tilt and tilt steering column has been designed to be serviced as an assembly. The column is connected to the steering gear with an upper and lower shaft. The lower shaft has a support bearing mounted to a bracket. The bracket mounts to the frame rail with two bolts. These shafts and bearing are serviceable. The key cylinder, switches, clock spring, trim shrouds and steering wheel are serviced separately.

OPERATION - SERVICE PRECAUTIONS

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, refer to Electrical - Restraints and follow all WARNINGS and CAUTIONS.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

REMOVAL

(1) Position front wheels **straight ahead.**

(2) Remove and isolate the negative ground cable from the battery.

(3) Remove the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

NOTE: If equipped with cruise control, disconnect clock spring harness from the cruise switch harness on the steering wheel.

(4) Remove the steering wheel with an appropriate puller (Fig. 1).

NOTE: Ensure the puller jaws are seated in the pockets (Fig. 2) of the steering wheel armature.

(5) Turn ignition cylinder to the on position and remove cylinder by pressing release through lower shroud access hole (Fig. 3) (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL).

COLUMN (Continued)

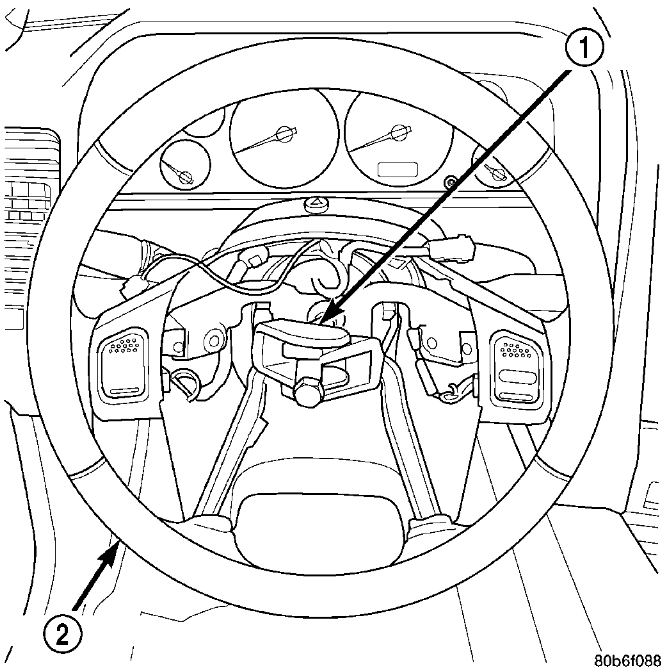

Fig. 1 STEERING WHEEL PULLER

1 - PULLER C-3894-A
2 - STEERING WHEEL

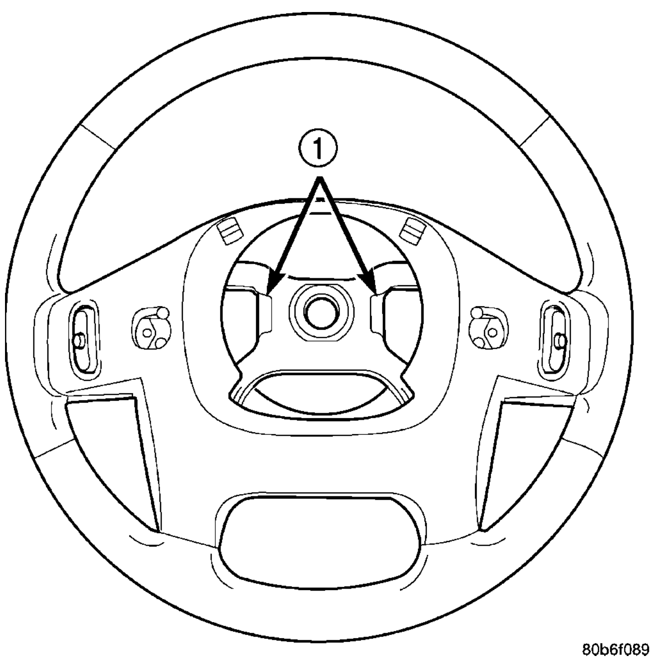

Fig. 2 Steering Wheel Pockets

1 - STEERING WHEEL POCKETS

(6) Remove knee blocker cover and knee blocker, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).

(7) Remove screws from the lower column shroud (Fig. 4) and remove the shroud.

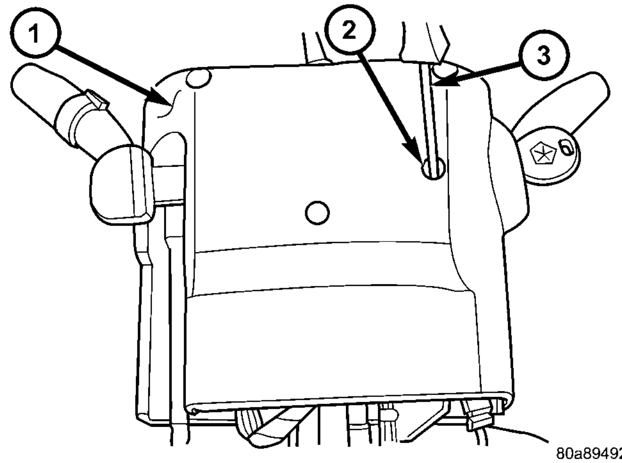

Fig. 3 LOCK CYLINDER RELEASE

1 - Lower Shroud
2 - Lock Cylinder Release Access Hole
3 - Pin Punch

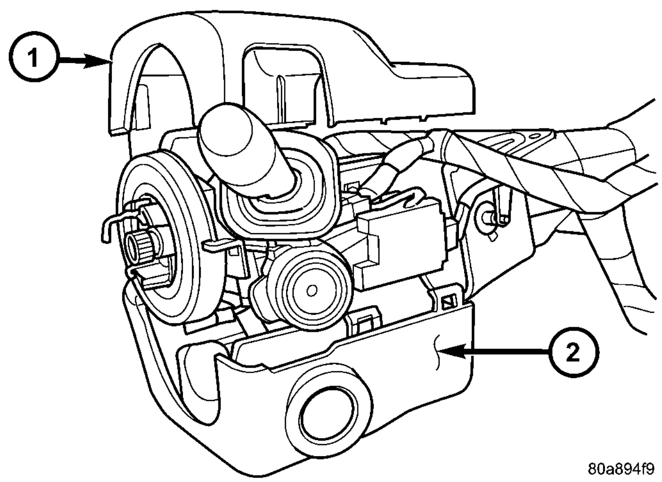

Fig. 4 SHROUD REMOVAL/INSTALL

1 - Upper Shroud
2 - Lower Shroud

(8) Remove the steering coupler bolt and column mounting nuts (Fig. 5) then lower column off the mounting studs.

(9) Remove upper column shroud (Fig. 4).

(10) Disconnect and remove the wiring harness from the column (Fig. 6).

NOTE: If vehicle is equipped with automatic transmission, remove shifter interlock cable from the column. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 30RH/GEAR SHIFT CABLE - REMOVAL).

(11) Remove column.

COLUMN (Continued)

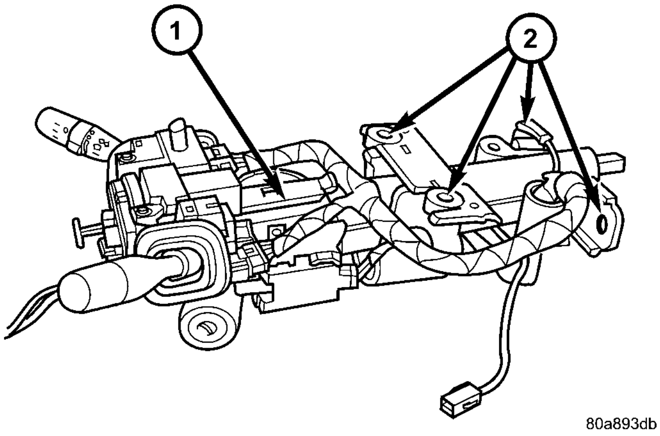

Fig. 5 STEERING COLUMN MOUNTING

1 - Steering Column
2 - Mounting Holes

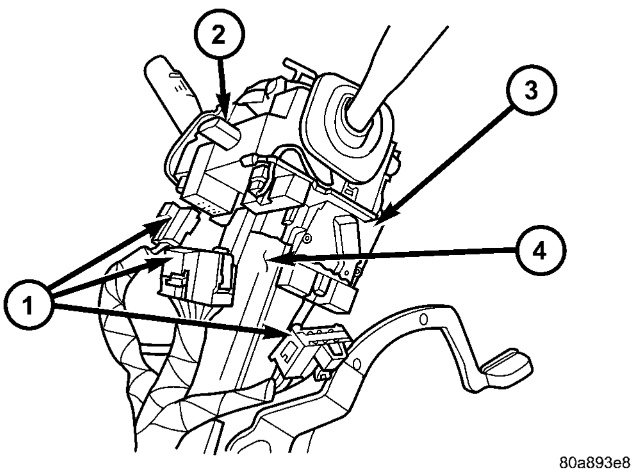

Fig. 6 WIRING HARNESS COLUMN

1 - Column Wiring Harness
2 - Multi-function Switch
3 - Ignition Switch
4 - Steering Column

(12) Remove clock spring (Fig. 7), switches, (SKIM if equipped) (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

INSTALLATION

(1) Align and install column into the steering coupler.

(2) Install column harness and connect harness to switches.

NOTE: If vehicle is equipped with automatic transmission, install shifter interlock cable. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 30RH/GEAR SHIFT CABLE - ADJUSTMENTS).

(3) Install the upper column shroud.

(4) Install the column onto the mounting studs.

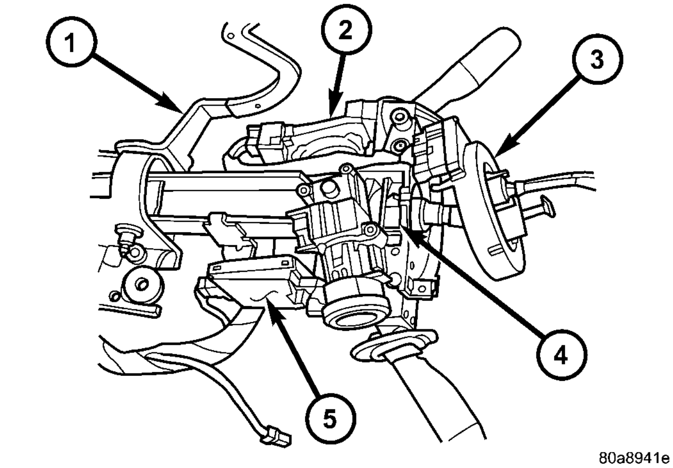

Fig. 7 CLOCK SPRING

1 - Tilt Lever
2 - Ignition Switch
3 - Clockspring
4 - Steering Column
5 - SKIM

CAUTION: Lower nuts must be installed and tightened first then the upper nuts in order to prevent damage to the capsules.

(5) Install the lower mounting nuts and tighten to 17 N·m (150 in. lbs.).

(6) Install the upper mounting nuts and tighten to 17 N·m (150 in. lbs.).

(7) Install the steering column coupler bolt and tighten to 49 N·m (36 ft. lbs.).

(8) Center the clock spring (if necessary) and install it on the column, (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

(9) Install the lower column shroud and install mounting screws.

(10) Install the ignition lock cylinder. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - INSTALLATION).

(11) Install the knee blocker and the knee blocker cover, (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).

NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)

NOTE: If equipped with cruise control, connect clock spring harness to cruise switch harness on the steering wheel.

(12) Install the steering wheel and tighten bolt to 54 N·m (40 ft. lbs.).

(13) Install the airbag, (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

(14) Install the negative battery terminal.

COLUMN (Continued)

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Tilt Steering Column Steering Wheel Nut	54	40	—
Tilt Steering Column Mounting Nuts	17	—	150
Tilt Steering Column Coupler Bolt	49	36	—
Non-Tilt Steering Column Steering Wheel Nut	54	40	—
Non-Tilt Steering Column Mounting Nuts	17	—	150
Non-Tilt Steering Column Coupler Bolt	49	36	—

IGNITION SWITCH

DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key cylinder is used to engage/disengage the electrical ignition switch.

DIAGNOSIS AND TESTING - IGNITION SWITCH

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, Refer to the appropriate section for the component.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock system is used to lock the transmission shifter in the PARK position when the key cylinder is rotated to any position. If the ignition key is difficult to rotate to or from any position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 30RH/GEAR SHIFT CABLE - ADJUSTMENTS). The interlock system within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. (Refer to 19 - STEERING/COLUMN - REMOVAL).

Vehicles equipped with a manual transmission and a floor mounted shifter: on certain models, a button is located on the steering column behind the ignition key cylinder. The button must be manually depressed to allow rotation of the ignition key cylinder from the **off** to **lock** positions. If it is difficult to rotate the key to any position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced.(Refer to 19 - STEERING/COLUMN - REMOVAL).

REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

(1) Remove key cylinder. (Refer to 19 - STEERING/COLUMN/LOCK CYLINDER HOUSING - REMOVAL).

(2) Remove lower steering column cover screws and remove cover.

(3) Remove the multi-function switch.

(4) Disconnect the electrical connector at the rear of the ignition switch.

(5) Remove the ignition switch mounting screw (Fig. 8). Use tamper proof torx bit to remove the screw.

(6) Pull the ignition switch straight out to remove from the locking tabs (Fig. 9)

IGNITION SWITCH (Continued)

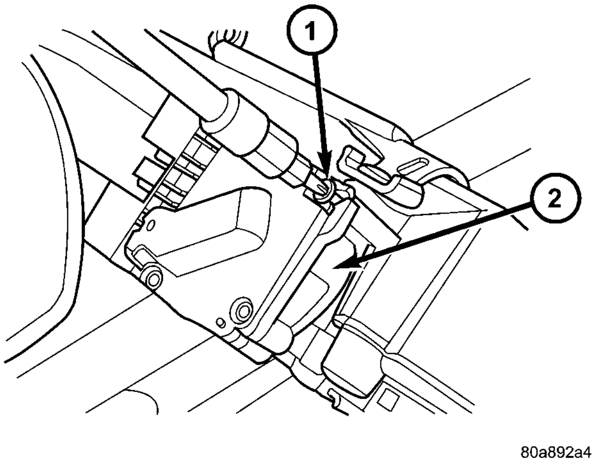

Fig. 8 IGNITION SWITCH MOUNTING SCREW

1 - Tamper Proof Torx Screw
2 - Ignition Switch

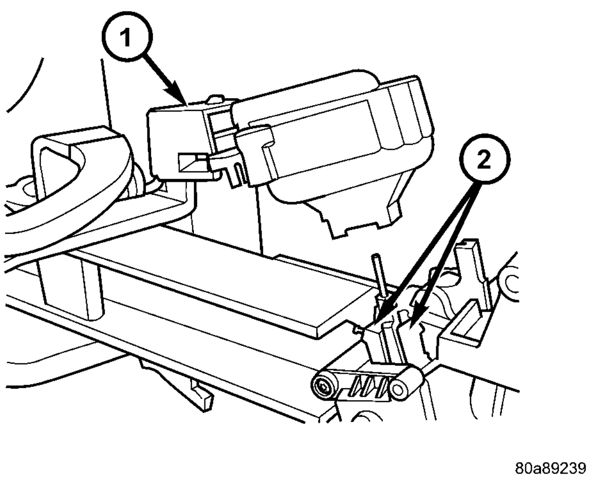

Fig. 9 IGNITION SWITCH TABS

1 - Ignition Switch
2 - Locking Tabs

INSTALLATION

The ignition key must be in the key cylinder for cylinder installation. The key cylinder must be aligned with the ignition switch for installation.

(1) Before installing ignition switch, rotate the slot in the switch to the ON position (Fig. 10).

(2) Connect the electrical connector to rear of ignition switch. Make sure that locking tab is fully seated into wiring connector.

(3) Position the switch to the column and install tamper proof screw. Tighten screw to 3 N·m (26 in. lbs.).

(4) Test the operation of the lock cylinder for smooth rotating.

(5) Install the multi-function switch.

(6) Install steering column lower cover.

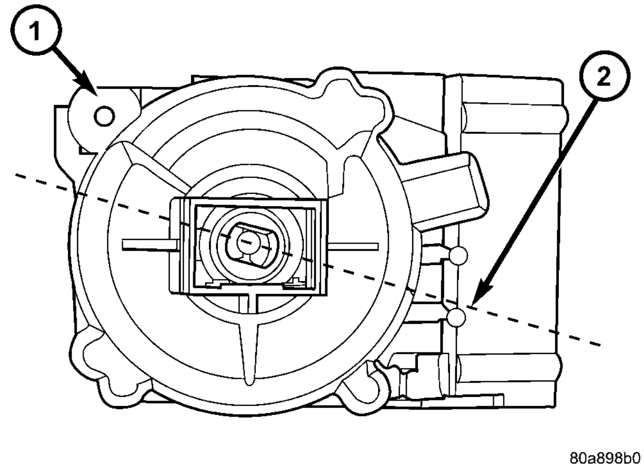

Fig. 10 IGNITION SWITCH ON POSITION

1 - Ignition Switch
2 - Rotate to On Position

KEY-IN IGNITION SWITCH

DESCRIPTION

The key-in ignition switch is integral to the ignition switch, which is mounted on the left side of the steering column, opposite the ignition cylinder. It closes a path to ground for the instrument cluster chime warning circuitry when the ignition key is inserted in the ignition cylinder and the driver door jamb switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition cylinder.

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced. (Refer to 19 - STEERING/COLUMN/IGNITION SWITCH - REMOVAL).

DIAGNOSIS AND TESTING - KEY-IN IGNITION SWITCH

For circuit descriptions and diagrams, Refer to the appropriate sections on the individual components.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO ELECTRICAL - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the steering column shrouds. Unplug the key-in ignition switch wire harness connector from the ignition switch.

KEY-IN IGNITION SWITCH (Continued)

(2) Check for continuity between the key-in switch sense circuit and the left front door jamb switch sense circuit terminals of the key-in ignition switch. There should be continuity with the key in the ignition cylinder, and no continuity with the key removed from the ignition cylinder. If OK, go to Step 3. If not OK, replace the faulty ignition switch assembly.

(3) Check for continuity between the left front door jamb switch sense circuit cavity of the key-in ignition switch wire harness connector and a good ground. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, see the diagnosis for Instrument Cluster in this group. If not OK, repair the circuit to the driver door jamb switch as required.

KEY CYLINDER

REMOVAL

The ignition key must be in the key cylinder for cylinder removal. The key cylinder must be removed first before removing ignition switch.

(1) If equipped with an automatic transmission, place shifter in PARK position.

(2) Rotate key to ON position.

(3) A release tang is located on bottom of key cylinder (Fig. 11).

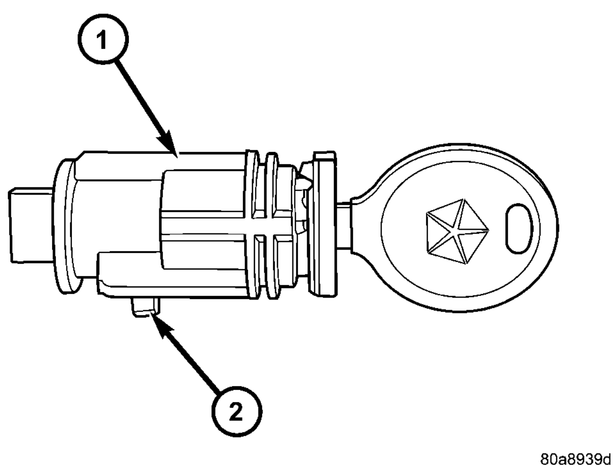

Fig. 11 KEY CYLINDER RELEASE TANG

1 - KEY CYLINDER
2 - RELEASE TANG

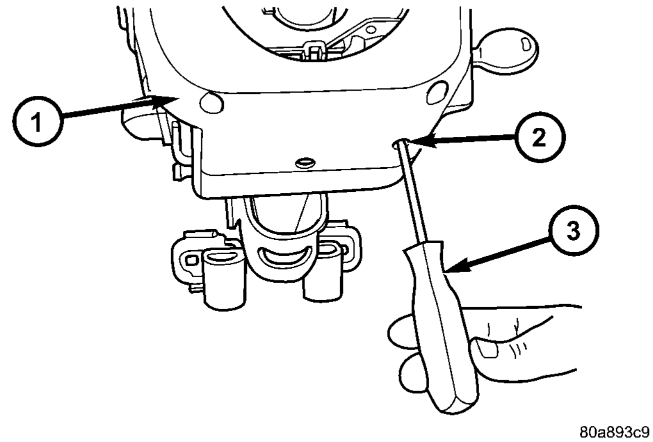

Fig. 12 KEY CYLINDER RELEASE HOLE

1 - Lower Cover
2 - Access Hole
3 - Pin Punch

(4) Position a small screwdriver or pin punch into tang access hole on bottom of steering column lower cover (Fig. 12).

(5) Push the pin punch up while pulling key cylinder from steering column.

INSTALLATION

The ignition key must be in the key cylinder for cylinder installation.

(1) Install the lock cylinder into the housing using care to align the end of the lock cylinder with the ignition switch.

(2) Push the lock cylinder in until it clicks.

(3) Rotate the key to the lock position.

STEERING WHEEL

REMOVAL

(1) Disable and remove the drivers side airbag.(Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

(2) Partially remove the steering wheel bolt and leave the bolt in the column.

(3) Install puller C-3894–A or equivalent using the top of the bolt to push on. (Fig. 13)

STEERING WHEEL (Continued)

NOTE: Ensure the puller jaws are seated in the pockets (Fig. 14) of the steering wheel armature.

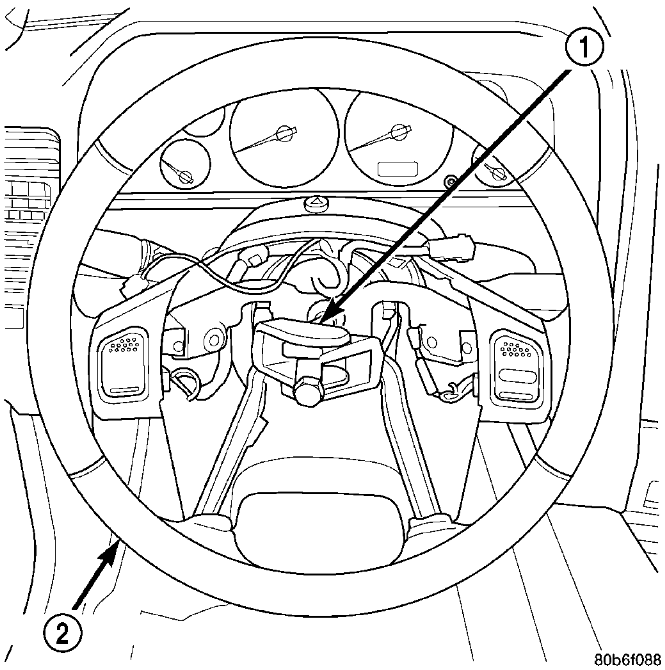

Fig. 13 STEERING WHEEL PULLER

1 - PULLER C-3894-A
2 - STEERING WHEEL

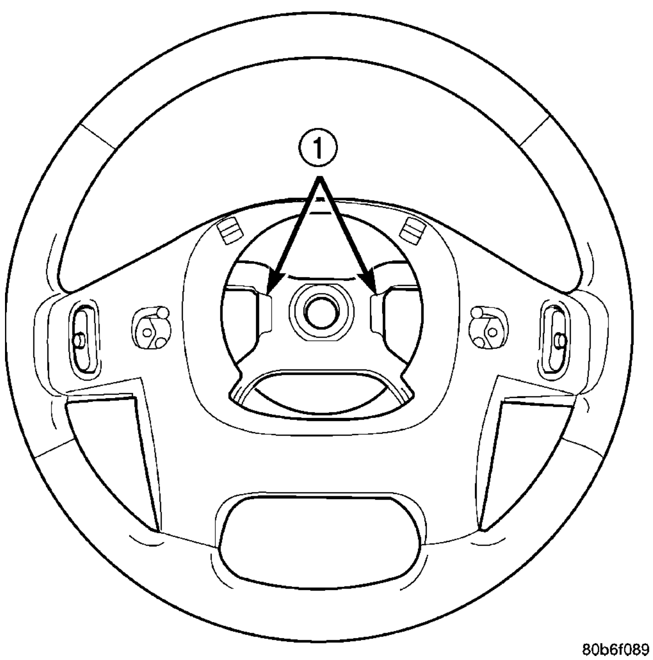

Fig. 14 Steering Wheel Pockets

1 - STEERING WHEEL POCKETS

(4) Remove the steering wheel.

INSTALLATION

NOTE: Do not reuse the old steering wheel bolt (a new bolt must be used)

(1) Install steering wheel to the column

NOTE: Be certain that the steering wheel mounting bolt is tightened to the proper torque specification to ensure proper clockspring operation.

(2) Install the new steering wheel bolt. Tighten the bolt to 54 N·m (40 ft. lbs.).

(3) Install the drivers side air bag. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

GEAR

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GEAR

DESCRIPTION

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The power steering system has a hydraulic pump. The pump is a constant flow rate and displacement vane-type pump. The pump reservoir on the 4.0L engine is mounted to the pump body (Fig. 1)& (Fig. 2). The 2.4L engine has a remote pump reservoir mounted to the fan shroud (Fig. 3).

The steering gear used is a straight ratio recirculating ball type gear. A tilt and non-tilt column provide steering input.

OPERATION

The gear acts as a rolling thread between the worm shaft and rack piston. The worm shaft is supported by a thrust bearing at the upper end. When the worm shaft is turned the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

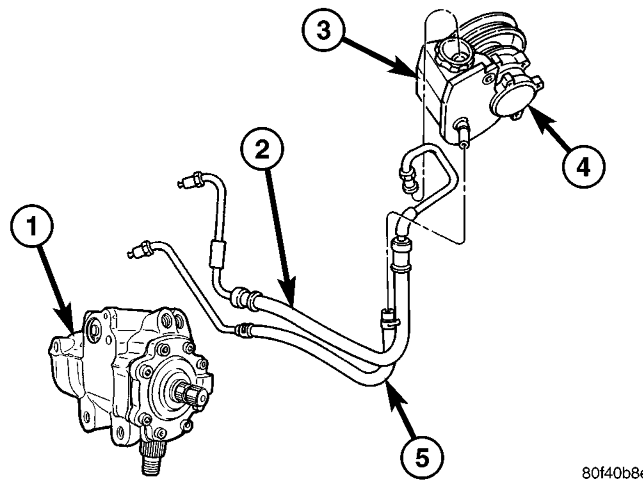


Fig. 1 POWER STEERING GEAR & PUMP - 4.0L

1 - POWER STEERING GEAR
2 - PRESSURE HOSE
3 - POWER STEERING RESERVOIR
4 - POWER STEERING PUMP
5 - RETURN HOSE

DIAGNOSIS AND TESTING - POWER STEERING GEAR LEAKAGE AREAS

NOTE: Do not service the Steering Gear, if the gear is leaking it must be replaced with a new gear assembly.

(1) Possible power steering gear leakage areas. (Fig. 4).

REMOVAL

NOTE: The steering column on vehicles with an automatic transmission may not be equipped with an internal locking shaft that allows the ignition key cylinder to be locked with the key. Alternative methods of locking the steering wheel for service will have to be used.

GEAR (Continued)

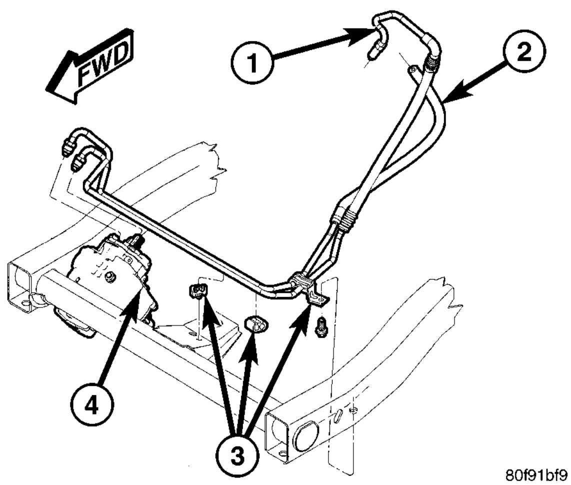


Fig. 2 RHD POWER STEERING HOSES

1 - PRESSURE HOSE
2 - RETURN HOSE
3 - MOUNTING BRACKETS
4 - STEERING GEAR

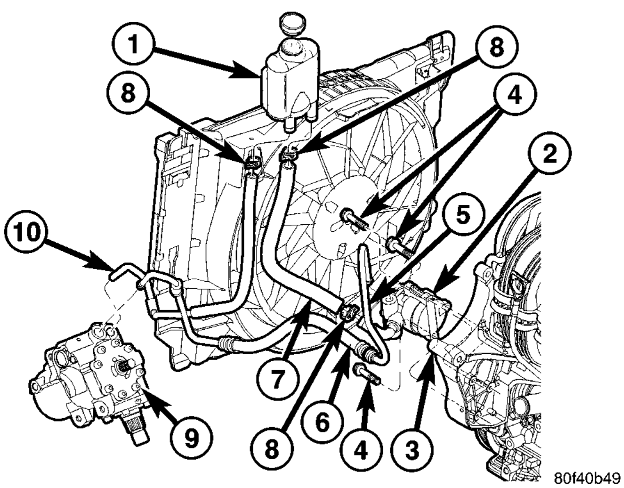


Fig. 3 POWER STEERING GEAR & PUMP - 2.4L

1 - REMOTE RESERVOIR
2 - POWER STEERING PUMP
3 - PUMP MOUNT BRACKET
4 - MOUNTING BOLTS (3)
5 - PRESSURE SWITCH LOCATION
6 - PRESSURE OUTLET HOSE (GEAR TO PUMP)
7 - RETURN HOSE (RESERVOIR TO PUMP)
8 - CLAMPS
9 - STEERING GEAR
10 - INLET HOSE (RESERVOIR TO GEAR)

(1) Place the front wheels in the straight ahead position with the steering wheel centered and locked.

(2) Siphon out as much power steering fluid as possible.

(3) Remove the bumper shield.

(4) Remove power steering hoses/tubes from steering gear.

(5) Remove the column coupler shaft from the gear.

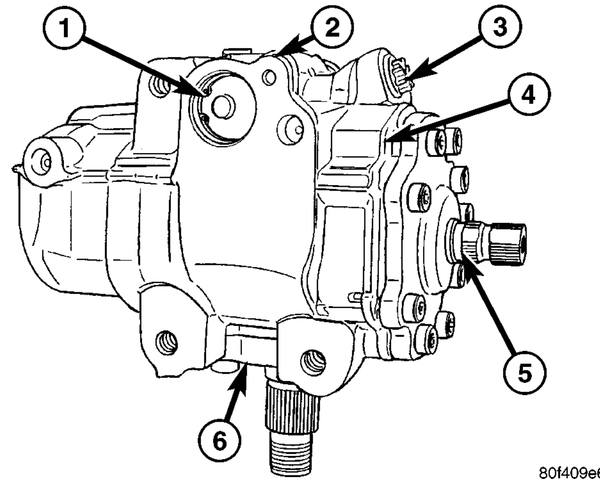


Fig. 4 STEERING GEAR

1 - VALVE HOUSING O-RING
2 - ADJUSTER NUT
3 - POWER STEERING LINE FITTINGS
4 - INPUT SHAFT HOUSING GASKET
5 - INPUT SHAFT SEAL
6 - PITMAN SHAFT SEAL HOUSING / COVER O-RING

(6) Remove pitman arm from gear. (Refer to 19 - STEERING/LINKAGE/PITMAN ARM - REMOVAL).

(7) Remove the steering gear retaining bolts and remove the gear (Fig. 5).

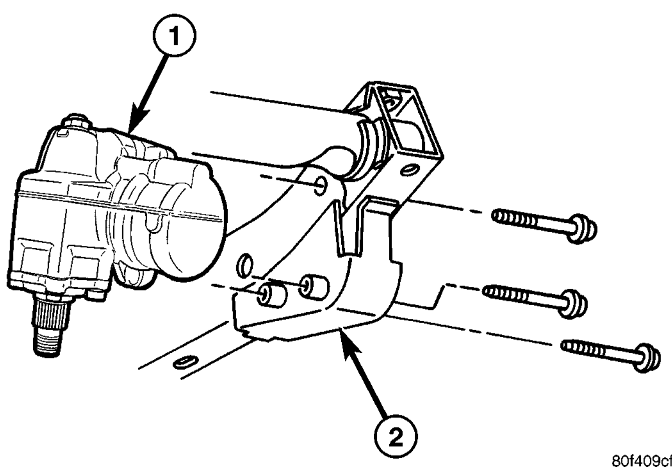


Fig. 5 STEERING GEAR REMOVAL/INSTALL

1 - STEERING GEAR
2 - FRAME MOUNT

INSTALLATION

(1) Install steering gear on the frame rail and tighten bolts to 95 N·m (70 ft. lbs.)

(2) Align and install the pitman arm and tighten nut to 251 N·m (185 ft. lbs.).

(3) Align the column coupler shaft to steering gear. Install a **new** coupler pinch bolt and tighten to 49 N·m (36 ft. lbs.).

GEAR (Continued)

(4) Install power steering hoses/tubes to steering gear and tighten to 28 N·m (21 ft. lbs.).

(5) Install the bumper shield.

(6) Fill power steering system to proper level, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

ADJUSTMENTS

CAUTION: Steering gear must be adjusted in the proper order. If adjustments are not performed in order, gear damage and improper steering response may result.

NOTE: Adjusting the steering gear in the vehicle is not recommended. Remove gear from the vehicle and drain the fluid. Then mount gear in a vise to perform adjustments.

WORM THRUST BEARING PRELOAD

NOTE: Off center torque (180 to 360 degrees from gear center) = 0.4 to 0.8 Nm (3.5 in-lb to 7.0 in-lb) This torque is set in the assembly plant and can't be adjusted in the field

OVER-CENTER ROTATING TORQUE

(1) Mount the gear carefully into a vise.

CAUTION: Do not overtighten the vise on the gear case. This may affect the adjustment

(2) Rotate the input shaft with a crows foot socket from stop to stop and count the number of turns.

(3) Starting at either stop, turn the input shaft back 1/2 the total number of turns. This is the center of the gear travel.

(4) Loosen the adjuster plug locknut.

(5) Place the torque wrench in the vertical position on the input shaft. Rotate the wrench 50 degrees each side of the center and record the highest rotational torque in this range (Fig. 6). This is the Over-Center Rotating Torque.

NOTE: The input shaft must rotate smoothly without sticking or binding.

(6) The Over-Center Rotating Torque should be 0.53-0.93 N·m (4.5 - 8 in. lbs.) **higher** in addition to the off center torque from above (Fig. 6). than the Preload Rotating Torque.

(7) If an adjustment to the Over-Center Rotating Torque is necessary, first loosen the adjuster lock nut. Then turn the pitman shaft adjuster screw back

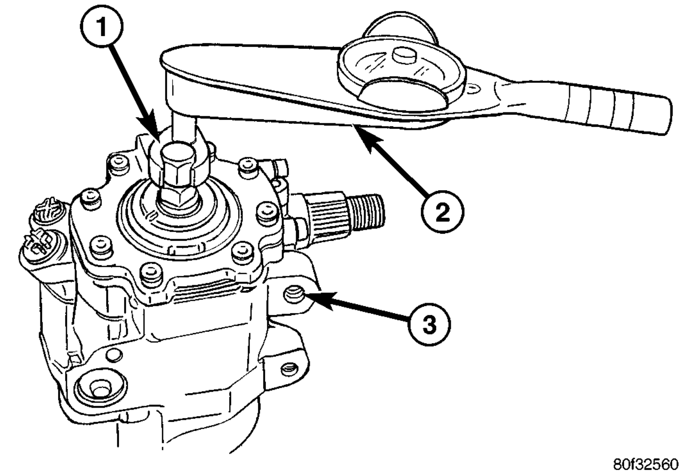


Fig. 6 OVER-CENTER TORQUE

1 - CROWSFOOT WRENCH
2 - INCH POUND TORQUE WRENCH
3 - STEERING GEAR

(COUNTERCLOCKWISE) increases torque, (CLOCKWISE) reduces torque (Fig. 7).

(8) Remeasure Over-Center Rotating Torque. If necessary turn the adjuster screw and repeat measurement until correct Over-Center Rotating Torque is reached (Fig. 7).

NOTE: To increase the Over-Center Rotating Torque turn the screw COUNTERCLOCKWISE.

(9) Prevent the adjuster screw from turning while tightening adjuster lock nut (Fig. 7). Tighten the adjuster lock nut to 65 N·m (48 ft. lbs.).

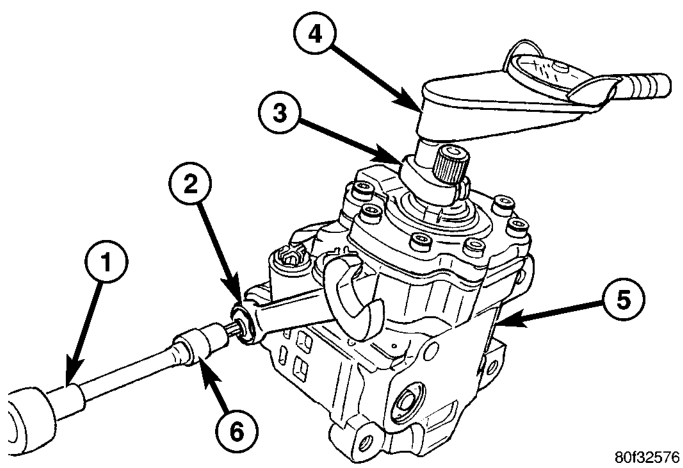


Fig. 7 OVER-CENTER ADJUSTMENT

1 - RATCHET WITH ADAPTER
2 - WRENCH
3 - CROWSFOOT WRENCH
4 - INCH POUND TORQUE WRENCH
5 - STEERING GEAR
6 - ALLEN HEAD SOCKET

GEAR (Continued)

SPECIFICATIONS

POWER STEERING GEAR

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Steering Gear Type	Recirculating Ball
Steering Gear Gear Ratio	15:24
Worm Shaft Bearing Preload	0.53–.93 N·m (3.5–8 in. lbs.)
Pitman Shaft Over-Center Drag New Gear (under 400 miles)	.133 N·m (1.17 in. lbs.) + Worm Shaft Preload
Pitman Shaft Over-Center Drag Used Gear (over 400 miles)	.133 N·m (1.17 in. lbs.) + Worm Shaft Preload

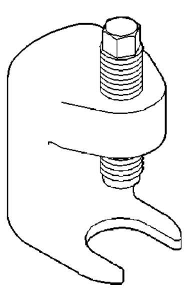
TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Gear Adjustment Screw Locknut	65	48	—
Power Steering Gear Gear to Frame Bolts	95	70	—
Power Steering Gear Pitman Shaft Nut	251	185	—
Power Steering Gear Pressure Line	28	21	—
Power Steering Gear Return Line	28	21	—

SPECIAL TOOLS

POWER STEERING GEAR



Remover, Pitman Arm C-4150A

LINKAGE

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LINKAGE

DESCRIPTION

The steering linkage consists of a pitman arm, drag link, tie rod, and steering dampener (Fig. 1). Adjustment sleeves are used on the tie rod and drag link for toe and steering wheel alignment.

The service procedures and torque specifications are the same for LHD and RHD vehicles.

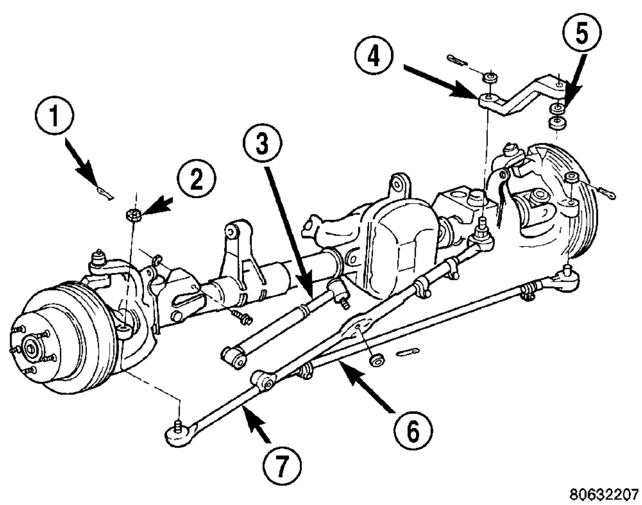


Fig. 1 Steering Linkage

1 - COTTER PIN
2 - NUT
3 - DAMPENER
4 - PITMAN ARM
5 - WASHER
6 - TIE ROD
7 - DRAG LINK

STANDARD PROCEDURE

STANDARD PROCEDURE - LUBRICATION

Periodic lubrication of the steering system components is required. Refer to Lubrication And Maintenance for the recommended maintenance schedule.

The following components must be lubricated:

- Tie rod ends
- Drag link

STANDARD PROCEDURE - STEERING LINKAGE

The tie rod end and ball stud seals should be inspected during all oil changes. If a seal is damaged, it should be replaced. Before installing a new seal, inspect ball stud at the throat opening. Check for lubricant loss, contamination, ball stud wear or corrosion. If these conditions exist, replace the tie rod. A replacement seal can be installed if lubricant is in good condition. Otherwise, a complete replacement ball stud end should be installed.

CAUTION: If any steering components are replaced or serviced an alignment must be performed, to ensure the vehicle meets all alignment specifications.

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

LINKAGE (Continued)

SPECIFICATIONS

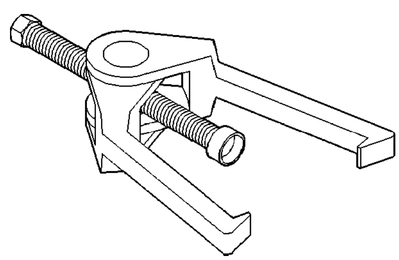
TORQUE CHART

TORQUE SPECIFICATIONS

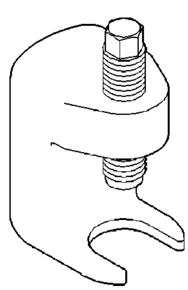
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pitman Arm Shaft	251	185	—
Drag Link Ball Studs	74	55	—
Drag Link Clamp	49	36	—
Tie Rod Ends Ball Studs	74	55	—
Tie Rod Ends Clamp	27	20	—
Tie Rod Ball Stud	88	65	—
Steering Damper Frame	74	55	—
Steering Damper Drag Link	74	55	—

SPECIAL TOOLS

STEERING LINKAGE



Puller C-3894–A



Remover Pitman C-4150A

DAMPER

REMOVAL

(1) Place the front wheels in a straight ahead position.

(2) Remove the steering dampener retaining nut and bolt from the axle bracket (Fig. 1).

(3) Remove the cotter pin and nut from the ball stud at the drag link.

(4) Remove the steering dampener ball stud from the drag link using C-3894-A puller.

INSTALLATION

(1) Install the steering dampener to the axle bracket and drag link.

(2) Install the steering dampener bolt in the axle bracket and tighten nut to 74 N·m (55 ft. lbs.).

(3) Install the ball stud nut at the drag link and tighten nut to 74 N·m (55 ft. lbs.). Install a new cotter pin.

DRAG LINK

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 1).

(2) Remove the steering dampener ball stud from the drag link with a puller tool.

(3) Remove the drag link from the steering knuckle with a puller tool. Remove the same for tie rod and pitman arm.

(4) If necessary, loosen the end clamp bolts and remove the tie rod end from the link.

INSTALLATION

(1) Install the drag link adjustment sleeve and tie rod end. Position clamp bolts (Fig. 3).

(2) Position the drag link at the steering linkage. Install the drag link to the steering knuckle nut. Do the same for the tie rod and pitman arm.

(3) Tighten the nut at the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the pitman nut to 81 N·m (60 ft. lbs.) and tie rod ball stud nut to 47 N·m (35 ft. lbs.). Install new cotter pins and bend end 60°.

(4) Install the steering dampener onto the drag link and tighten the nut to 74 N·m (55 ft. lbs.). Install a new cotter pin and bend end 60°.

PITMAN ARM

REMOVAL

(1) Remove the cotter pin and nut from the drag link at the pitman arm.

(2) Remove the drag link ball stud from the pitman arm with a puller.

(3) Remove the nut and washer from the steering gear shaft. Mark the pitman shaft and pitman arm for installation reference. Remove the pitman arm from steering gear with Puller C-4150A (Fig. 2).

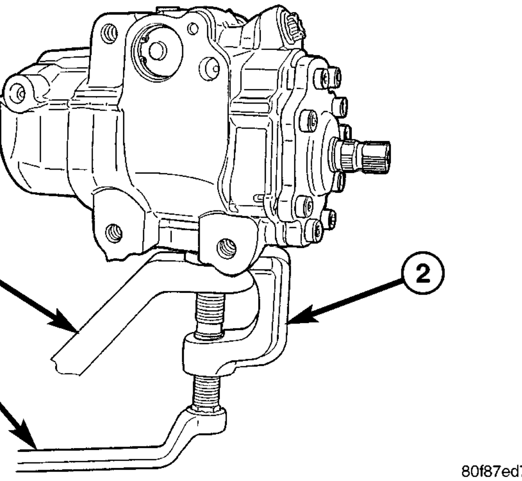


Fig. 2 PITMAN ARM PULLER

1 - PITMAN ARM
2 - SPECIAL TOOL C-4150-A
3 - WRENCH

INSTALLATION

(1) Align and install the pitman arm on steering gear shaft.

(2) Install the washer and nut on the shaft and tighten the nut to 251 N·m (185 ft. lbs.).

(3) Install drag link ball stud to pitman arm. Install nut and tighten to 81 N·m (60 ft. lbs.). Install a new cotter pin.

TIE ROD END

REMOVAL

(1) Remove the cotter pins and nuts at the steering knuckle and drag link (Fig. 1).

(2) Remove the ball studs with puller tool C-4150R.

(3) If necessary, loosen the end clamp bolts and remove the tie rod ends from the tube.

INSTALLATION

(1) If necessary, install the tie rod ends in the tube. Position the tie rod clamp (Fig. 3) and tighten to 27 N·m (20 ft. lbs.).

(2) Install the tie rod on the drag link and steering knuckle.

(3) Tighten the ball stud nut on the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the ball stud nut to drag link to 47 N·m (35 ft. lbs.) torque. Install new cotter pins.

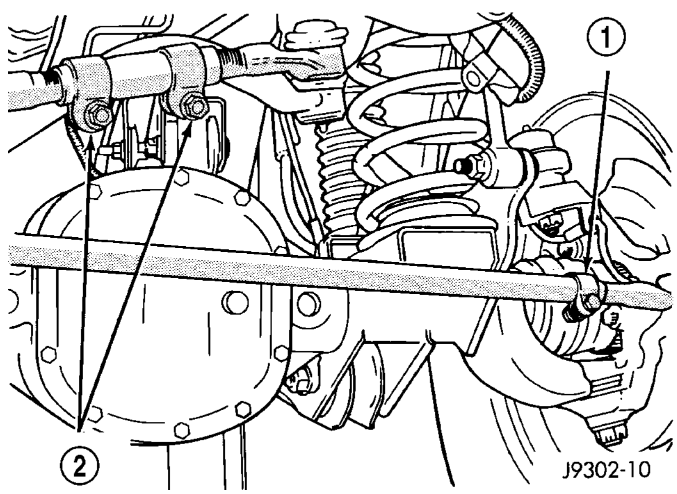


Fig. 3 Tie Rod

1 - TIE ROD CLAMP
2 - DRAG LINK CLAMPS

PUMP

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PUMP

DESCRIPTION

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (Fig. 1). The pump shaft has a pressed-on high strength plastic drive pulley that is belt driven by the crankshaft pulley. The reservoir is attached to the pump body with spring clips on the 4.0L engine. A remote pump reservoir is used on the 2.4L engine mounted to the fan shroud. The power steering pump is connected to the steering gear by the pressure and return hoses.

OPERATION

The power steering pump is a constant flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure.

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.

DIAGNOSIS AND TESTING - PUMP LEAKAGE

(1) Possible areas of pump leakage (Fig. 2).

STANDARD PROCEDURE - POWER STEERING PUMP - INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

(2) Start the engine and let run for a few seconds then turn engine off.

PUMP (Continued)

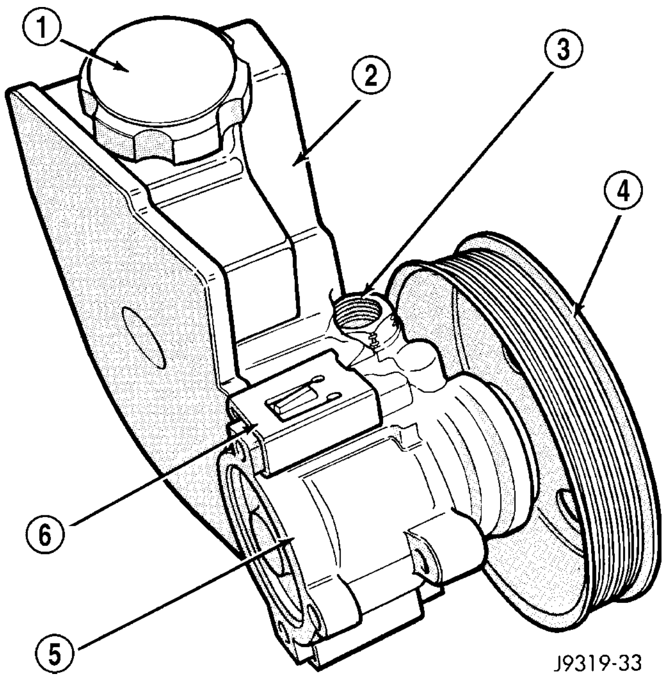


Fig. 1 Pump With Integral Reservoir

1 - CAP
2 - FLUID RESERVOIR (TYPICAL)
3 - HIGH-PRESSURE FITTING
4 - DRIVE PULLEY
5 - PUMP BODY
6 - RESERVOIR CLIP

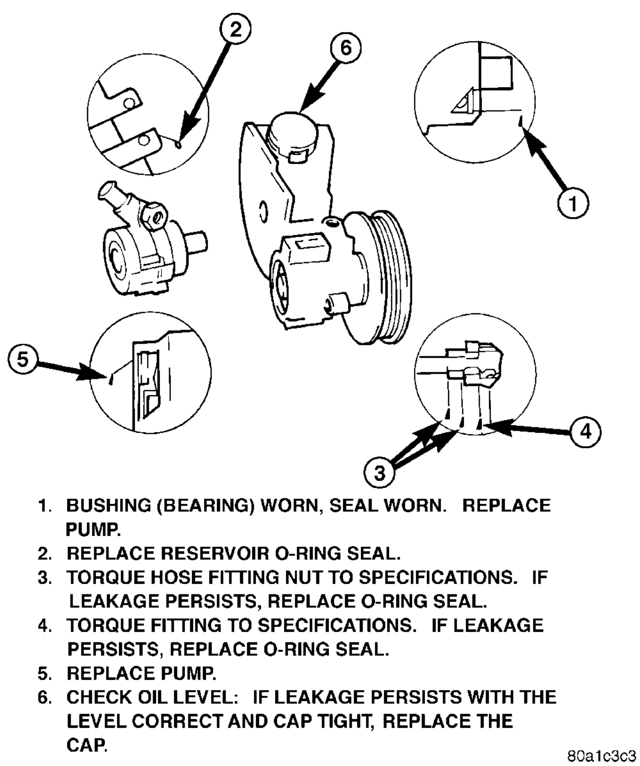


Fig. 2 Power Steering Pump

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.

(8) Stop the engine and check the fluid level and refill as required.

(9) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL

REMOVAL - 4.0L

(1) Remove serpentine drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove pressure and return hoses from pump and drain the pump.

(3) Loosen the pump bracket bolt at the engine block.

(4) Remove 3 pump mounting bolts (Fig. 3) through pulley access holes.

(5) Tilt pump downward and remove from engine.

(6) Remove pulley from pump. (Refer to 19 - STEERING/PUMP/PULLEY - REMOVAL).

REMOVAL - 2.4L

(1) Remove serpentine drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove pressure and return hoses from pump and drain the pump.

(3) Remove 3 pump mounting bolts (Fig. 4) through pulley access holes.

(4) Loosen the 3 pump bracket bolts.

(5) Tilt pump downward and remove from engine.

(6) Remove pulley from pump. (Refer to 19 - STEERING/PUMP/PULLEY - REMOVAL).

INSTALLATION

INSTALLATION - 4.0L

(1) Install pulley on pump. (Refer to 19 - STEERING/PUMP/PULLEY - INSTALLATION).

(2) Install pump on the engine mounting bracket.

(3) Install 3 pump mounting bolts and tighten to 27 N·m (20 ft. lbs.).

PUMP (Continued)

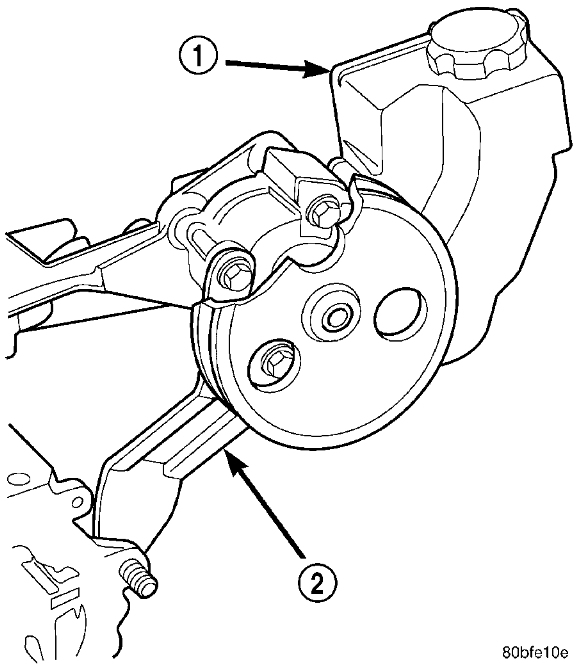


Fig. 3 Pump Mounting – 4.0L

1 - PUMP ASSEMBLY
2 - PUMP BRACKET

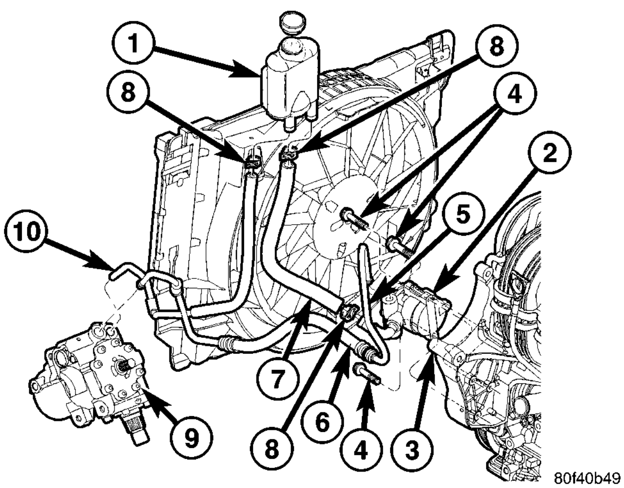


Fig. 4 POWER STEERING GEAR & PUMP - 2.4L

1 - REMOTE RESERVOIR
2 - POWER STEERING PUMP
3 - PUMP MOUNT BRACKET
4 - MOUNTING BOLTS (3)
5 - PRESSURE SWITCH LOCATION
6 - PRESSURE OUTLET HOSE (GEAR TO PUMP)
7 - RETURN HOSE (RESERVOIR TO PUMP)
8 - CLAMPS
9 - STEERING GEAR
10 - INLET HOSE (RESERVOIR TO GEAR)

(4) Tighten pump bracket bolt to 57 N·m (42 ft. lbs.).

(5) Install the pressure line on the pump and tighten to 28 N·m (21 ft. lbs.).

(6) Install return hoses on pump.

(7) Install drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(8) Add power steering fluid, refer to Power Steering Pump Initial Operation. (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 2.4L

(1) Install pulley on pump. (Refer to 19 - STEERING/PUMP/PULLEY - INSTALLATION).

(2) Install pump on the engine mounting bracket.

(3) Tighten pump bracket bolts to 47 N·m (35 ft. lbs.).

(4) Install 3 pump mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(5) Install the pressure line on the pump and tighten to 28 N·m (21 ft. lbs.).

(6) Install return hoses on pump.

(7) Install drive belt, (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(8) Add power steering fluid, refer to Power Steering Pump Initial Operation. (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

PUMP (Continued)

SPECIFICATIONS

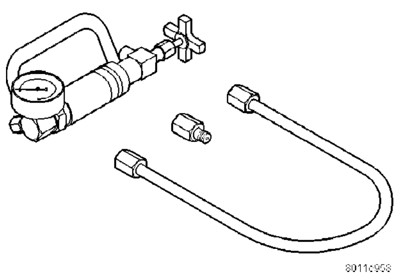
TORQUE CHART

TORQUE SPECIFICATIONS

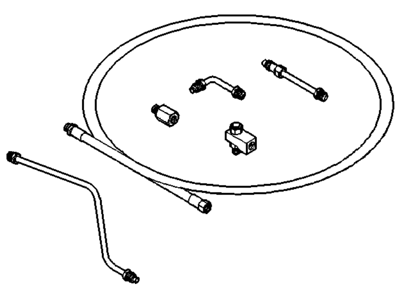
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump Bracket to Pump	28	21	—
Power Steering Pump Bracket to 4.0L Engine	57	42	—
Power Steering Pump Bracket to 2.4L Engine	28	21	—
Power Steering Pump Flow Control Valve	75	55	—
Power Steering Pump Pressure Line	28	21	—

SPECIAL TOOLS

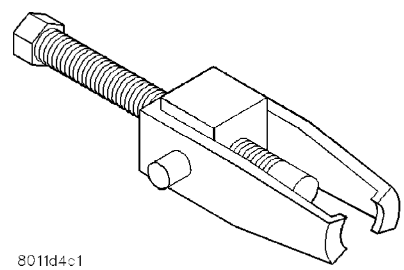
POWER STEERING PUMP



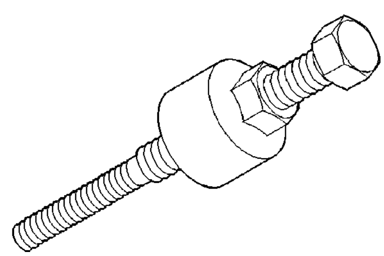
Analyzer Set, Power Steering Flow/Pressure 6815



Adapters, Power Steering Flow/Pressure Tester 6893



Puller C-4333



Installer, Power Steering Pulley C-4063B

HOSES

DESCRIPTION

DESCRIPTION - PRESSURE LINE

The hose consists of two metal ends and rubber center section that contains a tuning cable.

DESCRIPTION - RETURN LINE

Power steering return line is a hose which is clamped at the pump and the gear.

OPERATION

OPERATION - PRESSURE LINE

Power steering pressure line, is used to transfer high pressure power steering fluid, from the power steering pump to the power steering gear.

OPERATION - RETURN LINE

Power steering return line, is used to transfer low pressure power steering fluid, from the power steering gear to the power steering pump.

FLUID

DESCRIPTION

The recommended fluid for the power steering system is Mopar® ATF +4.

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

STANDARD PROCEDURE - POWER STEERING FLUID LEVEL CHECKING

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH THE ENGINE OFF TO PREVENT PERSONAL INJURY FROM MOVING PARTS.

CAUTION: MOPAR® ATF+4 is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The power steering fluid level can be viewed on the dipstick attached to the filler cap. There are two ranges listed on the dipstick, COLD and HOT. Before opening power steering system, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dipstick. When the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F), the fluid level should read between the minimum and maximum area of the cold range. When the fluid is hot, fluid level is allowed to read up to the highest end of the HOT range. Only add fluid when the vehicle is cold.

Use only Mopar® ATF+4 Do not overfill the power steering system.

POWER STEERING PRESSURE SWITCH

DESCRIPTION

A pressure sensing switch (Fig. 5) is included in the power steering system (mounted on the high-pressure line). This switch will be used only on vehicles equipped with a 2.4L engine and power steering.

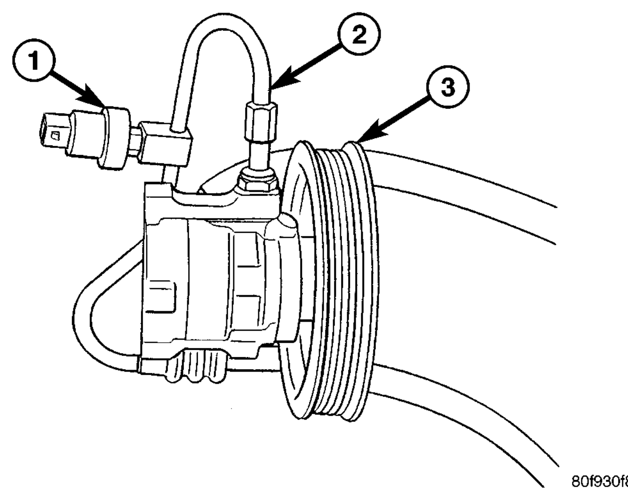


Fig. 5 2.4L POWER STEERING PRESSURE SWITCH

1 - PRESSURE SWITCH
2 - PRESSURE HOSE
3 - POWER STEERING PUMP AND PULLEY ASSEMBLY

OPERATION

The power steering pressure switch provides an input to the Powertrain Control Module (PCM). This input is provided during periods of high pump load and low engine rpm; such as during parking maneuvers. The PCM will then increase the idle speed through the Idle Air Control (IAC) motor. This is done to prevent the engine from stalling under the increased load.

POWER STEERING PRESSURE SWITCH (Continued)

When steering pump pressure exceeds 5860 kPa ± 690 kPa (850 psi ± 100 psi), the normally closed switch will open and the PCM will increase the engine idle speed. This will prevent the engine from stalling.

When pump pressure drops to approximately 1379 kPa (200 psi), the switch circuit will re-close and engine idle speed will return to its previous setting.

REMOVAL

This switch is not used with 4.0L six-cylinder engines.

The power steering pressure switch is installed in the power steering high-pressure hose (Fig. 5).

(1) Disconnect electrical connector from power steering pressure switch.

(2) Place a small container or shop towel beneath switch to collect any excess fluid.

(3) Remove switch. Use back-up wrench on power steering line to prevent line bending.

INSTALLATION

This switch is not used with 4.0L six-cylinder engines.

(1) Install power steering switch into power steering line.

(2) Tighten to 14–22 N·m (124–195 in. lbs.) torque.

(3) Connect electrical connector to switch.

(4) Check power steering fluid and add as necessary.

(5) Start engine and again check power steering fluid. Add fluid if necessary.

PULLEY

REMOVAL

CAUTION: On vehicles equipped with the 4.0L, Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

(1) Remove pump assembly.

(2) Remove pulley from pump with Puller C-4333 or equivalent puller (Fig. 6).

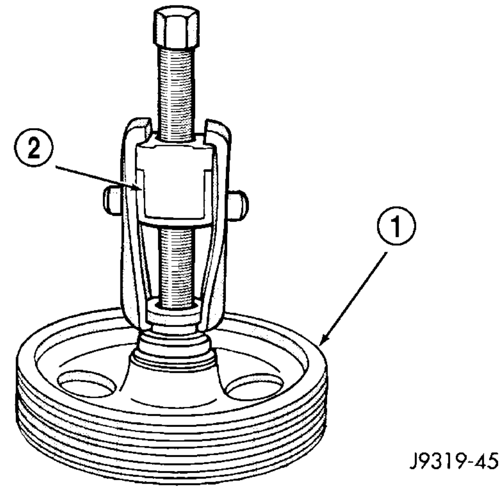


Fig. 6 Pulley Removal

1 - POWER STEERING PUMP DRIVE PULLEY
2 - SPECIAL TOOL C-4333

INSTALLATION

NOTE: The pulley is marked front for installation.

CAUTION: On vehicles equipped with the 4.0L, Do not reuse the old power steering pump pulley it is not intended for reuse. A new pulley must be installed if removed.

(1) Replace pulley if bent, cracked, or loose.

(2) Install pulley on pump with Installer C-4063-B or equivalent installer (Fig. 7). The pulley must be flush with the end of the shaft. Ensure the tool and pulley are aligned with the pump shaft.

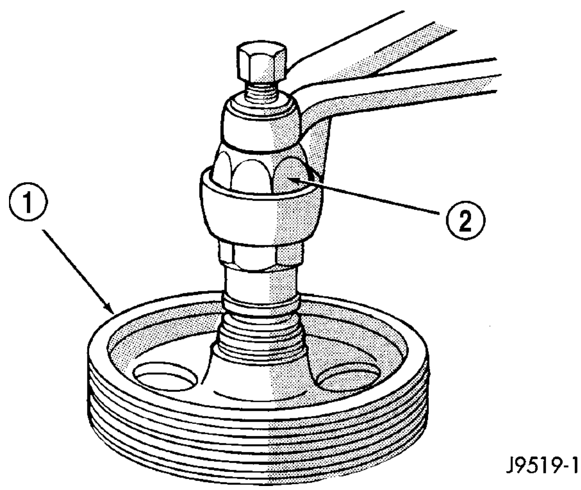


Fig. 7 Pulley Installation

1- POWER STEERING PUMP DRIVE PULLEY
2 - SPECIAL TOOL C-4063-B

(3) Install pump assembly.

(4) With Serpentine Belt, run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

RESERVOIR

REMOVAL

REMOVAL - 4.0L

(1) Remove power steering pump. (Refer to 19 - STEERING/PUMP - REMOVAL).

(2) Clean exterior of pump.

(3) Clamp the pump body in a soft jaw vice.

(4) Pry up tab and slide the retaining clips off (Fig. 8).

NOTE: Use new retaining clips for installation.

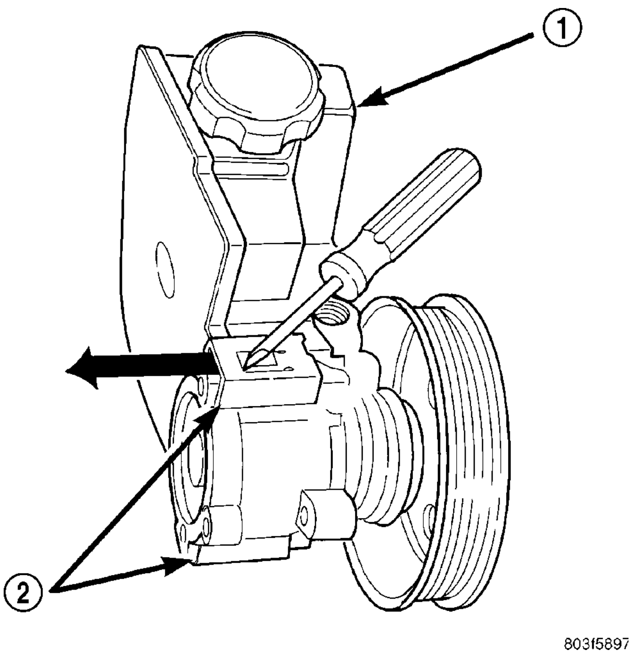


Fig. 8 Pump Reservoir Clips

1 - RESERVOIR
2 - RETAINING CLIPS

(5) Remove fluid reservoir from pump body. Remove and discard O-ring seal.

REMOVAL - 2.4L

(1) Remove the pump return hoses from the reservoir and drain the reservoir.

(2) Remove the push-in fastener from the reservoir (Fig. 9).

(3) Slide the reservoir up out of the fan shroud mount.

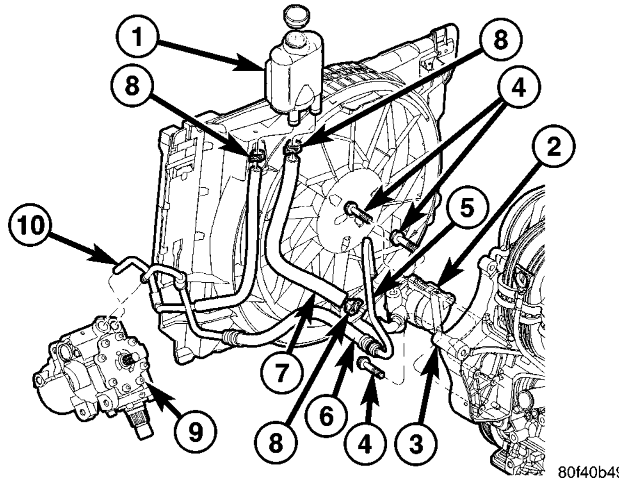


Fig. 9 POWER STEERING GEAR & PUMP - 2.4L

1 - REMOTE RESERVOIR
2 - POWER STEERING PUMP
3 - PUMP MOUNT BRACKET
4 - MOUNTING BOLTS (3)
5 - PRESSURE SWITCH LOCATION
6 - PRESSURE OUTLET HOSE (GEAR TO PUMP)
7 - RETURN HOSE (RESERVOIR TO PUMP)
8 - CLAMPS
9 - STEERING GEAR
10 - INLET HOSE (RESERVOIR TO GEAR)

INSTALLATION

INSTALLATION - 4.0L

(1) Lubricate new O-ring Seal with Mopar Power Steering Fluid or equivalent.

(2) Install O-ring seal in housing.

(3) Install reservoir onto housing.

(4) Slide and tap in **new** reservoir retainer clips until tab locks to housing.

(5) Install power steering pump. (Refer to 19 - STEERING/PUMP - INSTALLATION).

(6) Add power steering fluid, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

INSTALLATION - 2.4L

(1) Slide reservoir down onto the fan shroud mount until it clicks in place.

(2) Install the push-in fastener.

(3) Install the hoses.

(4) Fill reservoir to proper level, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

TRANSMISSION AND TRANSFER CASE

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MANUAL - NV1500

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MANUAL - NV1500

DESCRIPTION

The NV1500 is a 5-speed, constant mesh, fully synchronized manual transmission. The transmission is available in vehicles equipped with a 2.4L engine.

The transmission gear case consists of two aluminum gear housings and a detachable clutch housing.

The mainshaft is supported by two sealed ball bearings, and the countershaft is supported by two tapered roller bearings. The transmission gears all rotate on caged type needle bearings. A roller bearing is used between the input and output shaft.

The Transmission has a single shaft shift mechanism with three shift forks all mounted on the shaft. The shaft is supported in the front and rear housings by bushings. Internal shift components consist of the forks, shaft, shift lever socket, and detent components.

The drain plug in on the bottom of the transmission and fill plug is on the side.

OPERATION

The driver selects a particular gear by moving the shift lever to the desired gear position. As the shift lever moves the selected shift rail, the shift fork attached to that rail begins to move. The fork is positioned in a groove in the outer circumference of the synchronizer sleeve. As the shift fork moves the synchronizer sleeve, the synchronizer begins to speed-up or slow down the selected gear (depending on whether we are up-shifting or down-shifting). The synchronizer does this by having the synchronizer hub splined to the mainshaft, or the countershaft in some cases, and moving the blocker ring into contact with the gear's friction cone. As the blocker ring and friction cone come together, the gear speed is brought up or down to the speed of the synchronizer. As the two speeds match, the splines on the inside of the synchronizer sleeve become aligned with the teeth on the blocker ring and the friction cone and eventually will slide over the teeth, locking the gear to the mainshaft, or countershaft, through the synchronizer.

MANUAL - NV1500 (Continued)

DIAGNOSIS AND TESTING

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

Leaks can occur at the mating surfaces of the gear case, intermediate plate and adaptor or extension housing, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at the rear of the extension or adapter housing will be from the housing oil seals. Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non–recommended sealer.

A leak at the front of the transmission will be from either the front bearing retainer or retainer seal. Lubricant may be seen dripping from the clutch housing after extended operation. If the leak is severe, it may also contaminate the clutch disc causing the disc to slip, grab, and/or chatter.

A correct lubricant level check can only be made when the vehicle is level. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an underfill or overfill condition. Always check the lubricant level after any addition of fluid to avoid an incorrect lubricant level condition.

HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper, or contaminated lubricants. The consequence of using non–recommended lubricants is noise, excessive wear, internal bind, and hard shifting. Substantial lubricant leaks can result in gear, shift rail, synchro, and bearing damage. If a leak goes undetected for an extended period, the first indications of component damage are usually hard shifting and noise.

Shift component damage, incorrect clutch adjustment, or a damaged clutch pressure plate or disc are additional probable causes of increased shift effort. Incorrect adjustment or a worn/damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result. Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears generate a mild whine that is audible, but generally only at extreme speeds.

Severe, highly audible transmission noise is generally the initial indicator of a lubricant problem. Insufficient, improper, or contaminated lubricant will promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also leads to gear and bearing damage.

REMOVAL

(1) With vehicle in neutral, position vehicle on hoist.

(2) Support engine with jack stand. Position wood block between jack and oil pan to avoid damaging pan.

(3) Remove skid plate/crossmember.

(4) Support transmission with a trans jack.

(5) Remove transmission mount from transmission and exhaust.

(6) Remove propeller shafts.

(7) Remove transfer case shift linkage and vent hose.

(8) Remove wiring connectors from transmission and transfer case.

(9) Remove transfer case.

(10) Remove slave cylinder from clutch housing.

(11) Remove starter.

(12) Remove transmission dust shield.

(13) Lower trans jack enough to remove shift tower bolts.

(14) Lower transmission jack and remove transmission from under vehicle.

(15) Pull transmission jack rearward (Fig. 1) until input shaft clears clutch.

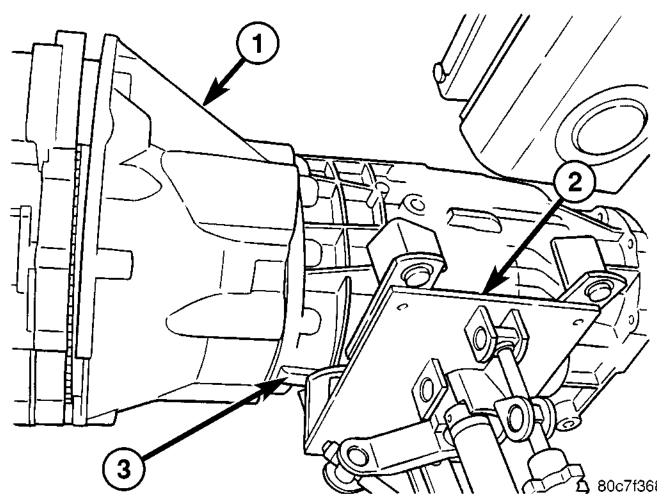


Fig. 1 TRANSMISSION ASSEMBLY

1 - CLUTCH HOUSING
2 - TRANSMISSION JACK
3 - TRANSMISSION

MANUAL - NV1500 (Continued)

(16) Remove clutch release bearing, release fork and retainer clip (Fig. 2).

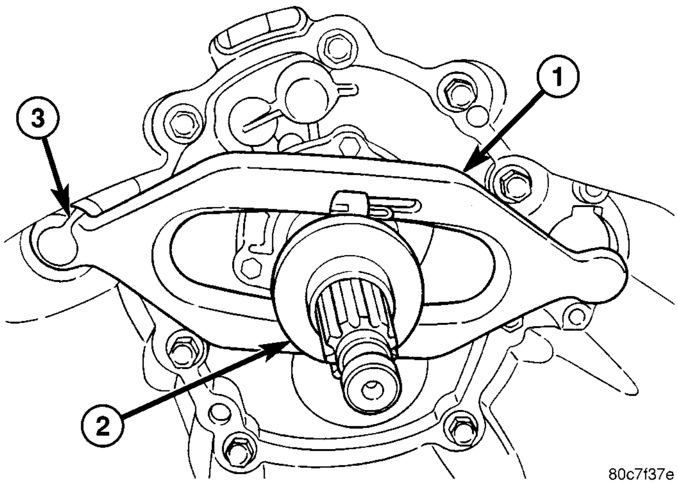


Fig. 2 CLUTCH RELEASE BEARING

1 - FORK
2 - BEARING
3 - CLIP

(17) Remove clutch housing from transmission.

DISASSEMBLY

FRONT HOUSING

(1) Shift transmission into Neutral.
(2) Remove drain plug and drain lubricant into a container.
(3) Remove backup light switch (Fig. 3).

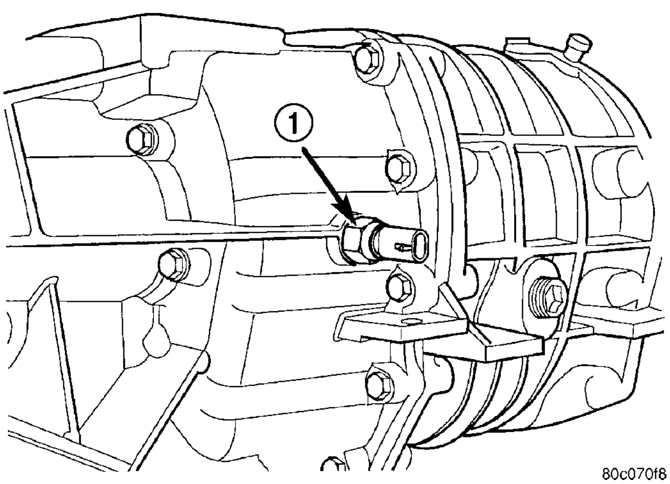


Fig. 3 BACKUP LIGHT SWITCH

1 - BACKUP LAMP SWITCH

(4) Remove shift tower bolts and remove tower and lever assembly (Fig. 4).

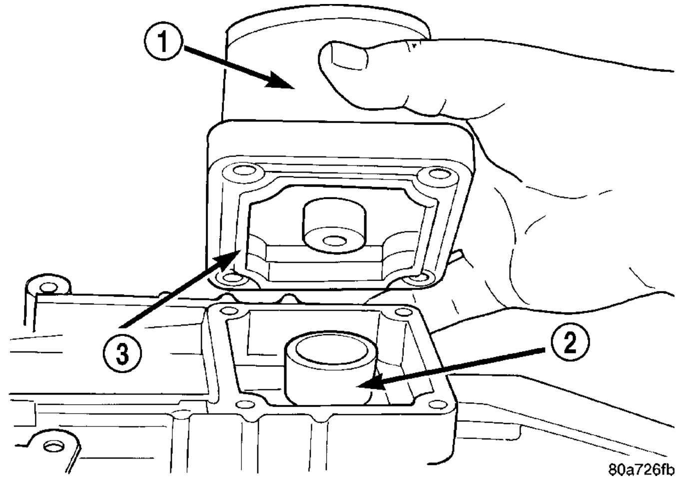


Fig. 4 SHIFT TOWER

1 - SHIFT TOWER AND LEVER ASSEMBLY
2 - SHIFT SOCKET
3 - SEAL

(5) Remove shift shaft lock bolt (Fig. 5). Bolt secures the shift shaft bushing and lever.

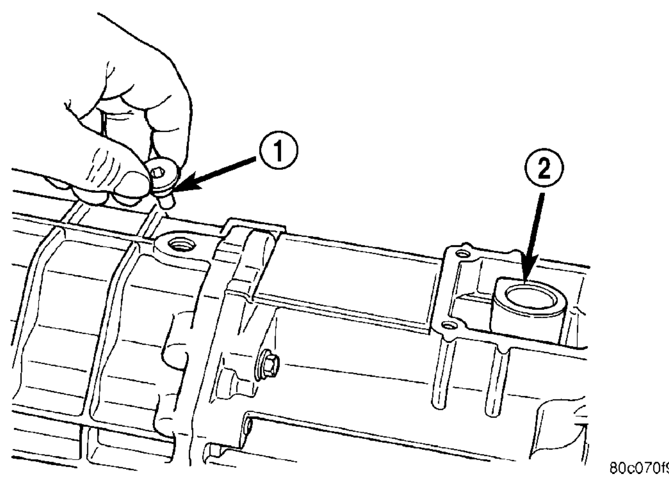


Fig. 5 SHIFT SHAFT BUSHING LOCK BOLT

1 - SHIFT SHAFT LOCK BOLT
2 - SHAFT SOCKET

MANUAL - NV1500 (Continued)

(6) Remove shift shaft detent plug with Remover 8117A (Fig. 6).

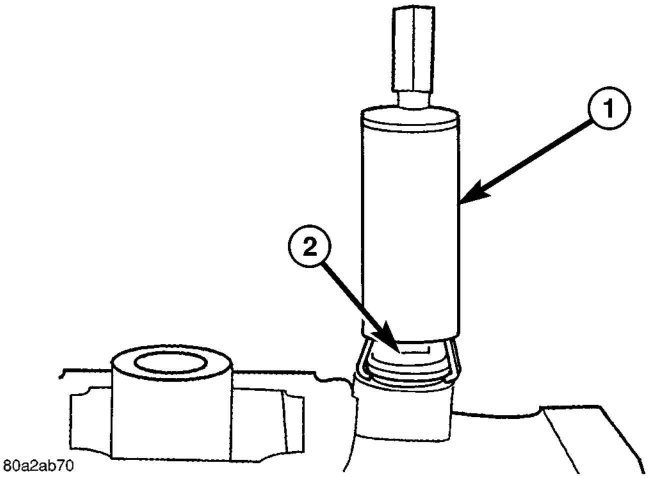


Fig. 6 DETENT PULLER

1 - REMOVER
2 - DETENT PLUG

(7) Remove shift shaft detent plunger and spring with a pencil magnet.

(8) Remove input shaft bearing retainer bolts (Fig. 7).

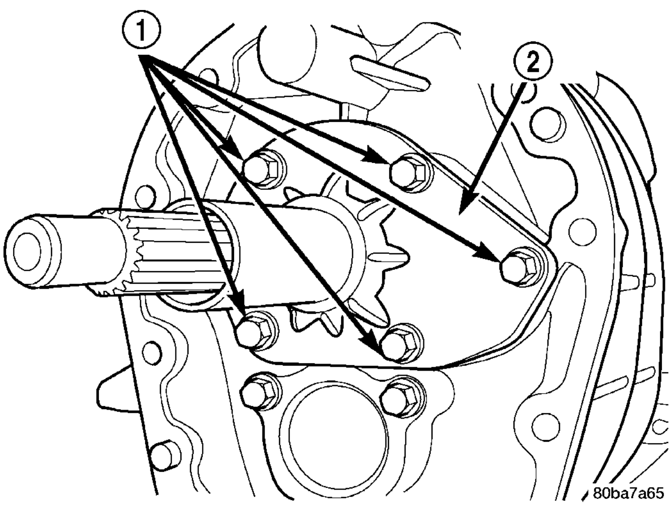


Fig. 7 BEARING RETAINER BOLTS

1 - BOLTS (5)
2 - BEARING RETAINER

(9) Remove bearing retainer from input shaft with a pry tool (Fig. 8).

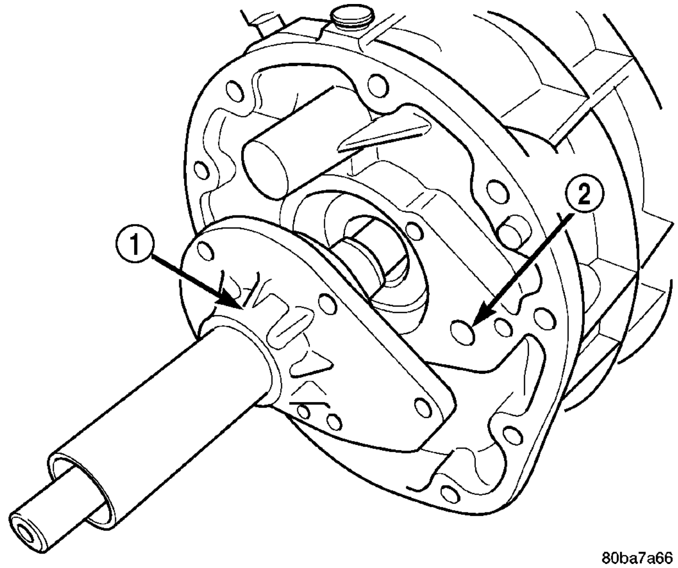


Fig. 8 INPUT SHAFT BEARING RETAINER

1 - BEARING RETAINER
2 - OIL FEED

(10) Remove snap ring securing input shaft in front bearing (Fig. 9).

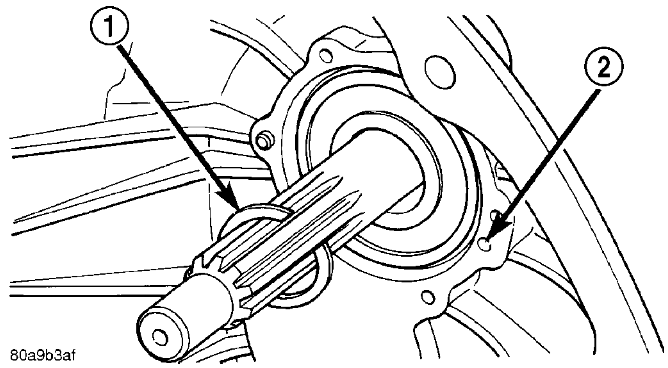


Fig. 9 INPUT SHAFT SNAP RING

1 - INPUT SHAFT SNAP RING
2 - OIL FEED

MANUAL - NV1500 (Continued)

(11) Remove front housing bolts (Fig. 10). Leave one bolt in place until geartrain is ready to be removed from case. Three bolts at the rear of housing are for the output shaft bearing retainer.

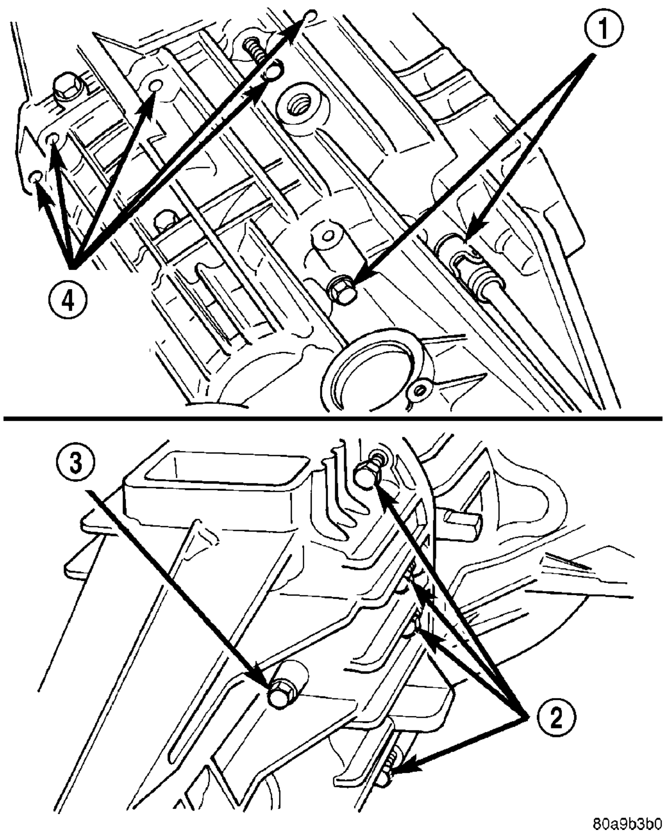


Fig. 10 HOUSING AND BEARING RETAINER BOL

1 - RETAINER BOLTS
2 - HOUSING BOLTS
3 - RETAINER BOLT
4 - HOUSING BOLT LOCATIONS

(12) Tap front housing off alignment dowels with a plastic mallet and separate the housing.

(13) Remove input shaft bearing (Fig. 11).

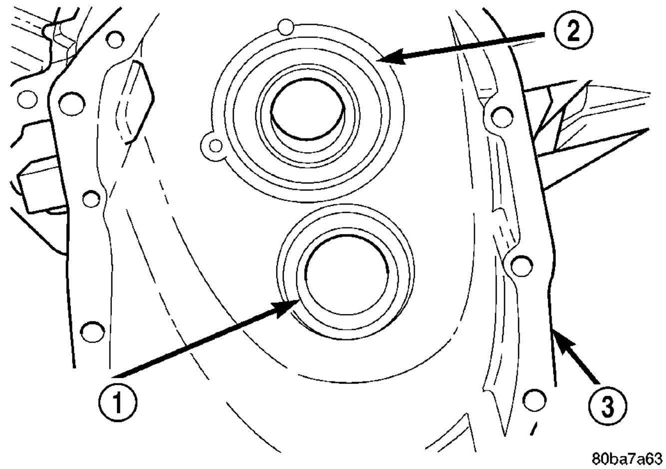


Fig. 11 INPUT SHAFT/COUNTERSHAFT BEARING

1 - COUNTERSHAFT FRONT BEARING RACE
2 - INPUT SHAFT BEARING
3 - FRONT HOUSING

(14) Note position of input shaft, shift shaft, forks, and geartrain components in housing (Fig. 12).

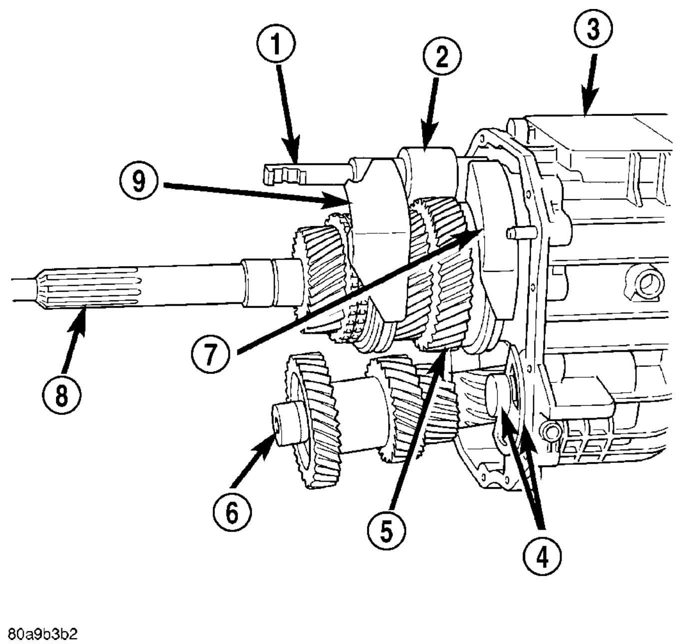


Fig. 12 GEARTRAIN AND SHIFT COMPONENT

1 - SHIFT SHAFT
2 - BUSHING
3 - REAR HOUSING
4 - REVERSE IDLER AND SUPPORT
5 - OUTPUT SHAFT AND GEARS
6 - COUNTERSHAFT
7 - 1-2 FORK
8 - INPUT SHAFT
9 - 3-4 FORK

MANUAL - NV1500 (Continued)

SHIFT SHAFT, SHIFT FORKS AND REVERSE IDLER

(1) Drive out roll pin that secures shift bushing and lever to shift shaft with a hammer and punch (Fig. 13).

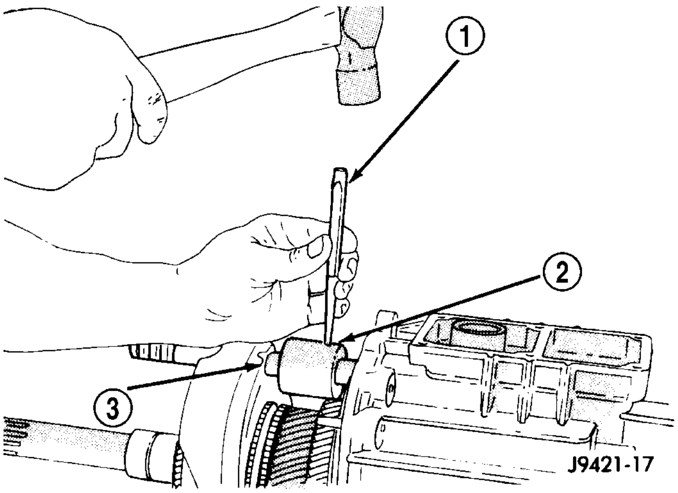


Fig. 13 SHIFT SHAFT LEVER & BUSHING ROLL PIN

1 - PIN PUNCH
2 - BUSHING AND LEVER
3 - SHIFT SHAFT

(2) Position shift socket off to the side so roll pin removal does not interfere with gears.

(3) Drive out shift socket roll pin with a hammer and punch.

NOTE: Use proper size punch to prevent damage to the shift shaft.

(4) Pull shift shaft straight out of rear housing and shift forks (Fig. 14).

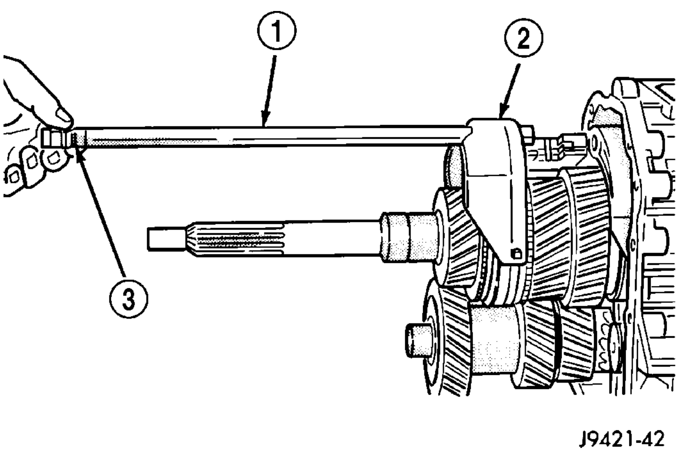


Fig. 14 SHIFT SHAFT

1 - SHIFT SHAFT
2 - 3-4 FORK
3 - SHAFT DETENT NOTCHES

(5) Remove shift socket from rear housing (Fig. 15).

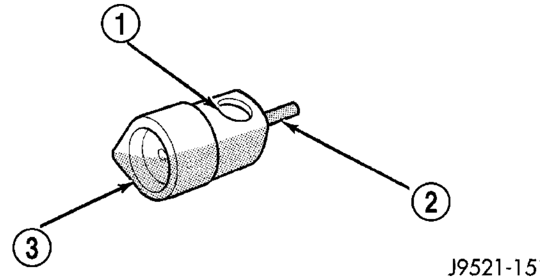


Fig. 15 SHIFT SOCKET AND ROLL PIN

1 - SHAFT BORE
2 - ROLL PIN
3 - SHIFT SOCKET

(6) Remove lever and bushing (Fig. 16).

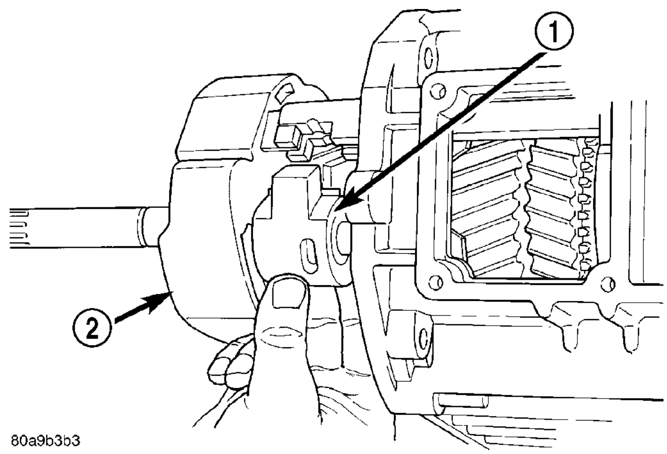


Fig. 16 SHIFT SHAFT LEVER AND BUSHING

1 - SHAFT LEVER AND BUSHING
2 - 3-4 FORK

(7) Rotate 3-4 fork around synchro sleeve until fork clears shift arms on 1-2 and fifth-reverse forks, then remove 3-4 fork (Fig. 17).

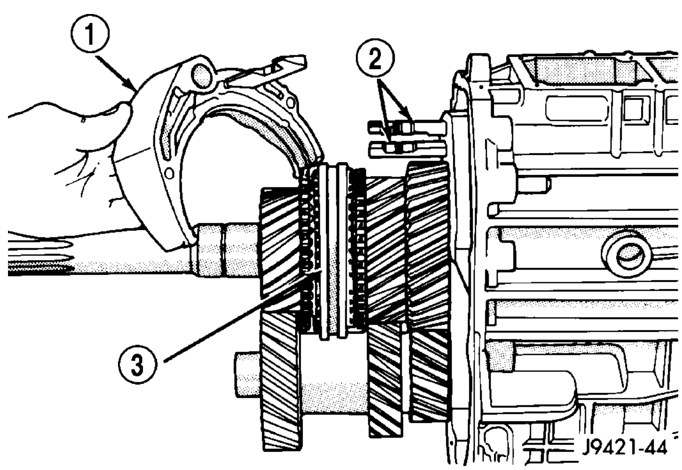


Fig. 17 3-4 SHIFT FORK

1 - 3-4 FORK
2 - 1-2 AND 5TH-REVERSE FORK ARMS
3 - 3-4 SYNCHRO SLEEVE

MANUAL - NV1500 (Continued)

(8) Remove front reverse idler shaft support bolt and loosen rear bolt (Fig. 18).

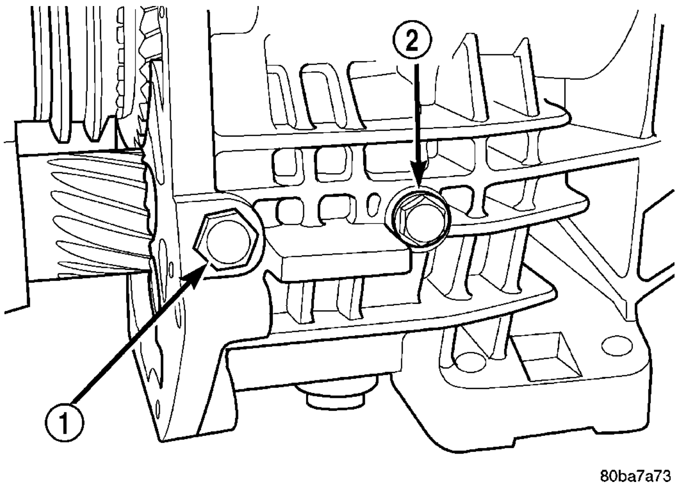


Fig. 18 REVERSE IDLER SHAFT/SUPPORT BOLT

1 - SUPPORT BOLT
2 - SHAFT BOLT

(9) Remove reverse idler shaft support by sliding it straight out of housing.

(10) Remove rear reverse idler shaft bolt.

(11) Remove reverse idler shaft, idler gear, bearing and thrust washer (Fig. 19).

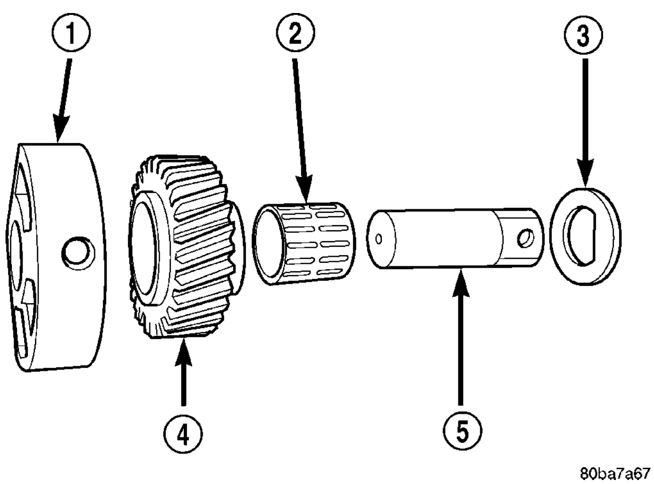


Fig. 19 REVERSE IDLER ASSEMBLY

1 - SUPPORT
2 - BEARING
3 - WASHER
4 - GEAR
5 - SHAFT

GEARTRAIN

(1) Remove output shaft bearing retainer bolts (Fig. 20).

(2) Hold the geartrain while lifting the rear housing off (Fig. 21).

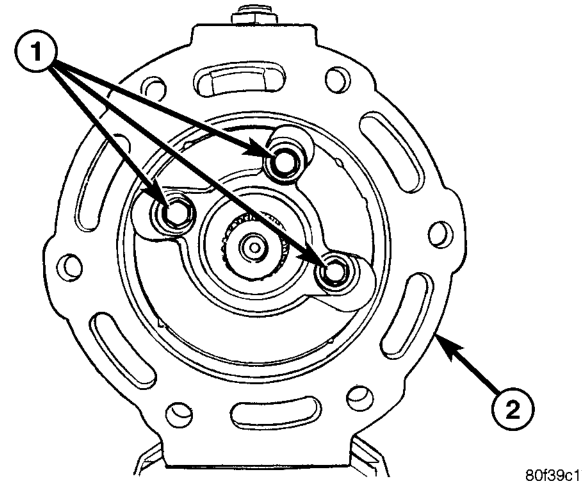


Fig. 20 BEARING RETAINER BOLTS

1 - BEARING RETAINER BOLT
2 - REAR HOUSING

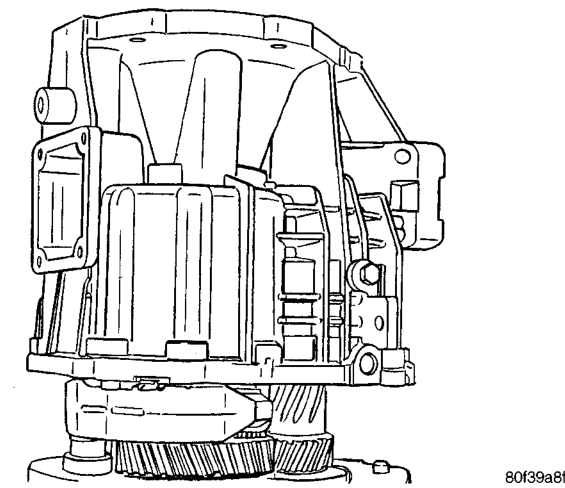


Fig. 21 REAR HOUSING

GEARTRAIN

(1) Remove 1-2 and fifth-reverse forks from synchro sleeves.

(2) Separate countershaft from mainshaft.

(3) Separate input shaft from output shaft.

COUNTERSHAFT

(1) Remove countershaft front and rear bearing with Puller 8356.

(2) Remove rear bearing race (in rear housing) with Bearing Race Remover L-4454. Install new race with Driver C-4656 and Driver Handle C-4171.

(3) Remove bearing shim cap from front housing (below input shaft bearing retainer). Remove shim. Drive race through and out of housing with Driver C-4656 and Driver Handle C-4171. Install new race into housing from outside. **Do not drive all the way into position. Tightening the shim cap will install the race to the proper position.** Install shim and shim cap and torque cap bolts to 28.5 N·m (21 ft. lbs.).

MANUAL - NV1500 (Continued)

OUTPUT SHAFT

NOTE: Synchronizer hubs and sleeves are different. Remove synchronizer unit as an assembly to avoid intermixing parts. Mark each synchro hub and sleeve for assembly reference.

(1) Remove snap ring that secures 3-4 synchro hub on output shaft.

(2) Remove 3-4 synchro assembly, third gear synchro ring and third gear with a shop press and Splitter 1130. Position splitter between second and third gears.

(3) Remove third gear needle bearing (Fig. 22).

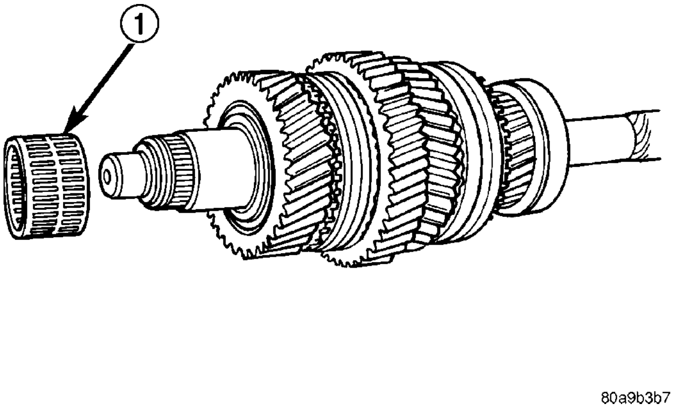


Fig. 22 THIRD GEAR NEEDLE BEARING

1 - THIRD GEAR NEEDLE BEARING

(4) Remove retaining ring that secures two-piece thrust washer on shaft.

(5) Remove two-piece thrust washer (Fig. 23). Note position of washer locating lugs in shaft notches for installation reference.

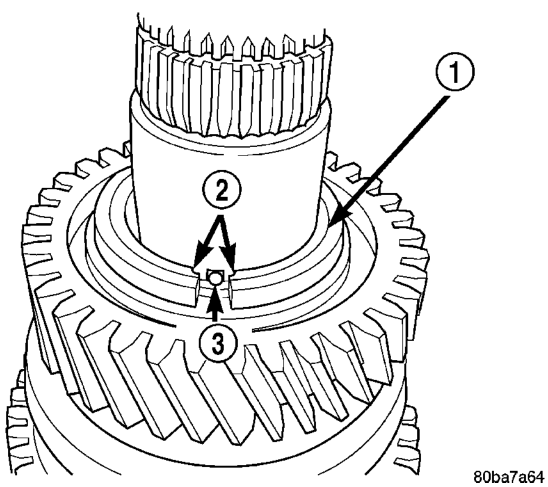


Fig. 23 TWO-PIECE THRUST WASH

1 - WASHER (2 HALVES)
2 - PIN RELIEF
3 - PIN

(6) Remove second gear and needle bearing (Fig. 24).

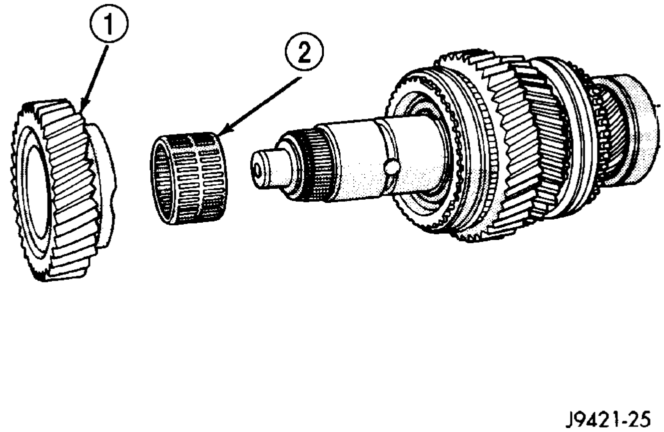


Fig. 24 SECOND GEAR AND NEEDLE BEARING

1 - SECOND GEAR
2 - SECOND GEAR NEEDLE BEARING

(7) Remove 2nd-3rd gear thrust washer locating pin.

(8) Remove second gear synchro ring and synchro cone.

(9) Remove 1-2 synchro hub snap ring.

(10) Remove 1-2 synchro hub and sleeve and first gear from output shaft with shop press and Splitter 1130 (Fig. 25). Position splitter between first and reverse gears.

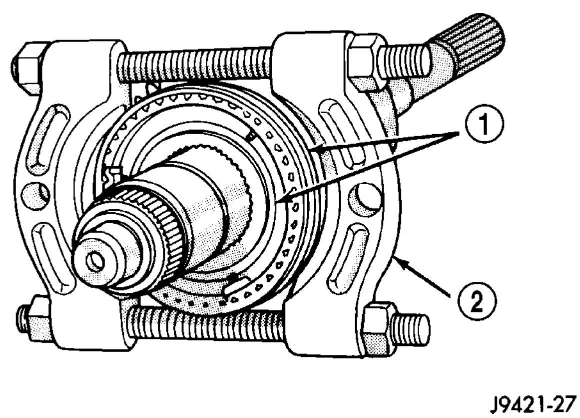


Fig. 25 1-2 SYNCHRO HUB AND SLEEVE

1 - 1-2 SYNCHRO HUB AND SLEEVE
2 - BEARING SPLITTER

MANUAL - NV1500 (Continued)

(11) Remove first gear needle bearing (Fig. 26).

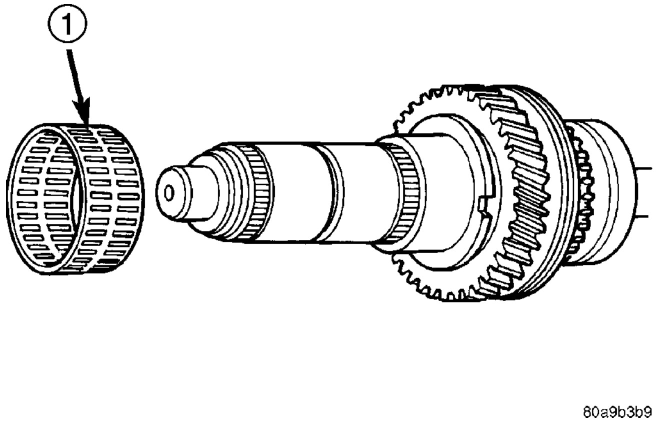


Fig. 26 FIRST GEAR NEEDLE BEARING

1 - FIRST GEAR NEEDLE BEARING

(12) Remove output shaft bearing snap ring (Fig. 27).

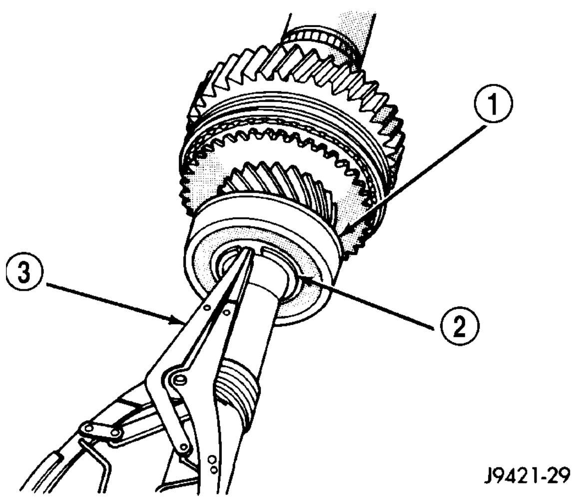


Fig. 27 OUTPUT SHAFT BEARING SNAP RING

1 - OUTPUT SHAFT BEARING
2 - BEARING SNAP RING
3 - SNAP RING PLIERS

(13) Remove output shaft bearing from shaft with shop press and Splitter 1130. Position splitter between bearing and fifth gear.

(14) Remove fifth gear (Fig. 28).

(15) Remove fifth gear needle bearing. Spread bearing apart just enough to clear shoulder on output shaft (Fig. 29).

(16) Remove fifth-reverse synchro hub snap ring (Fig. 30).

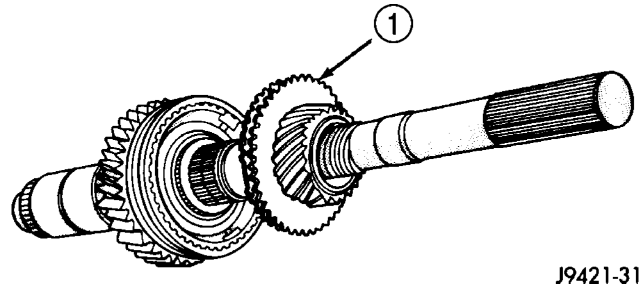


Fig. 28 FIFTH GEAR

1 - FIFTH GEAR AND SYNCHRO RING

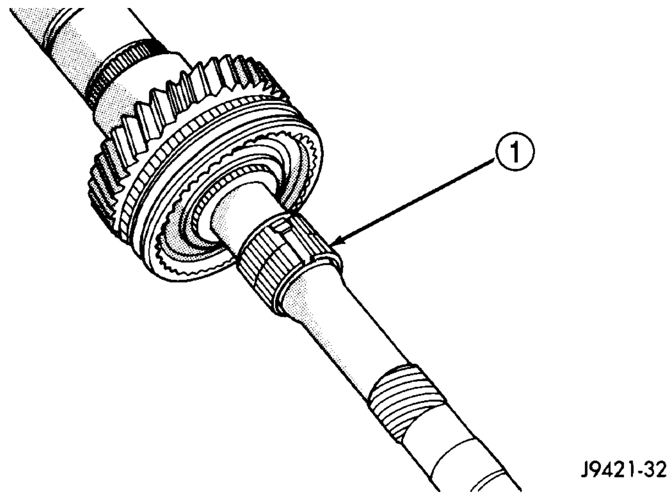


Fig. 29 FIFTH GEAR NEEDLE BEARING

1 - FIFTH GEAR NEEDLE BEARING

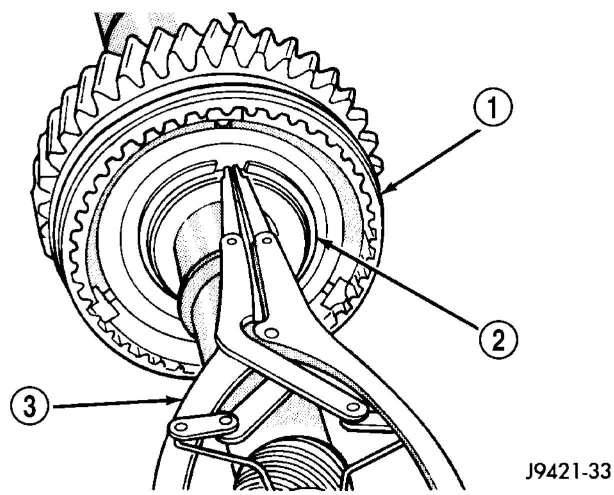


Fig. 30 FIFTH REVERSE SYNCHRO HUB SNAP RING

1 - FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
2 - SYNCHRO HUB SNAP RING
3 - SNAP RING PLIERS

MANUAL - NV1500 (Continued)

(17) Remove fifth-reverse synchro hub and sleeve with shop press (Fig. 31).

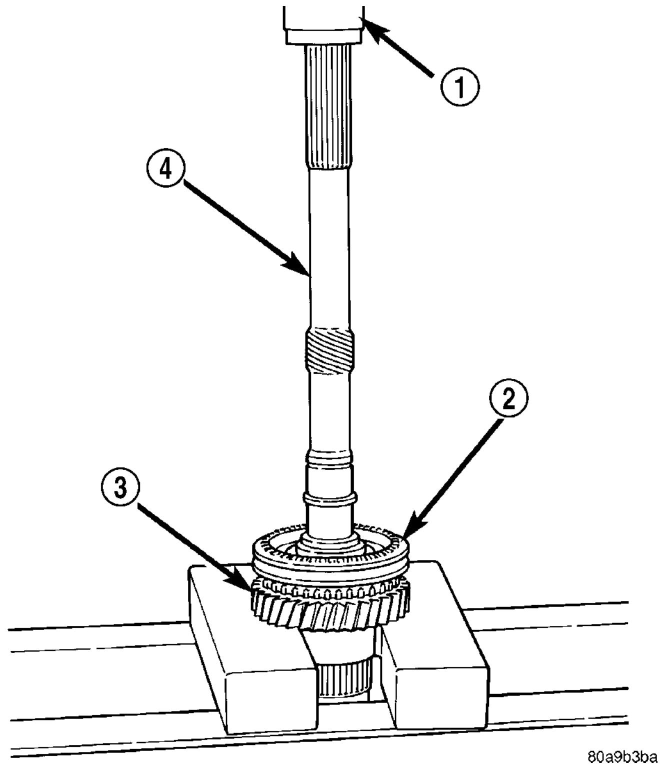


Fig. 31 FIFTH-REVERSE SYNCHRO HUB AND SLEEVE

1 - PRESS
2 - FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
3 - REVERSE GEAR
4 - OUTPUT SHAFT

(18) Remove reverse gear and needle bearing (Fig. 32).

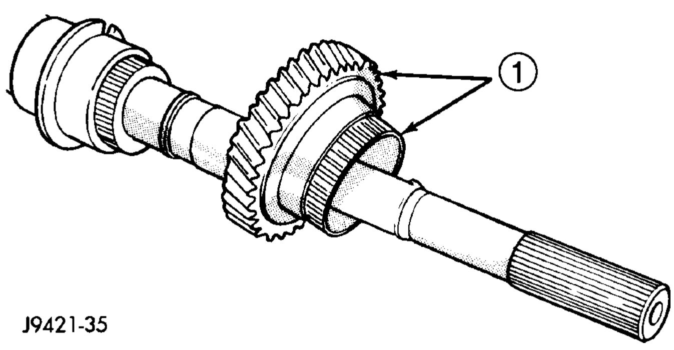


Fig. 32 REVERSE GEAR AND NEEDLE BEARING

1 - REVERSE GEAR AND NEEDLE BEARING

CLEANING

Clean the gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean the shaft bearings with a mild solvent such as Mopar® degreasing solvent, Gunk, or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry, or wipe them dry with clean shop towels.

INSPECTION

NOTE: Minor nicks on the surface can be smoothed off with 320/420 grit emery cloth and final polished with oil coated crocus cloth.

SHIFT LEVER ASSEMBLY

The shift lever assembly is not serviceable. Replace the lever and shift tower as an assembly if the tower, lever, lever ball or internal components are worn or damaged.

SHIFT SHAFT AND FORKS

Inspect the shift fork interlock arms and synchro sleeve contact surfaces (Fig. 33). Replace any fork exhibiting wear or damage in these areas. Do not attempt to salvage shift forks.

Check condition of the shift shaft detent plunger and spring. The plunger should be smooth and free of nicks or scores. Replace the plunger and spring if in doubt about condition. Check condition of detent plunger bushings. Replace if damaged.

Inspect the shift shaft, shift shaft bushing and bearing. The shaft lever and the lever bushing that fits over the lever. Replace the shaft if bent, cracked or severely scored. Replace the shift shaft bushing or bearing if damaged.

Replace the shaft lever and bushing if either part is deformed or worn. Do not attempt to salvage these parts as shift fork binding will occur. Replace the roll pin that secures the lever to the shaft.

FRONT/REAR HOUSINGS AND BEARING RETAINERS

Clean the gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean the shaft bearings with a mild solvent such as Mopar degreasing solvent, Gunk or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry or wipe them dry with clean shop towels.

Inspect the housings carefully for cracks, stripped threads, scored mating surfaces, damaged bearing bores or worn dowel pin holes.

MANUAL - NV1500 (Continued)

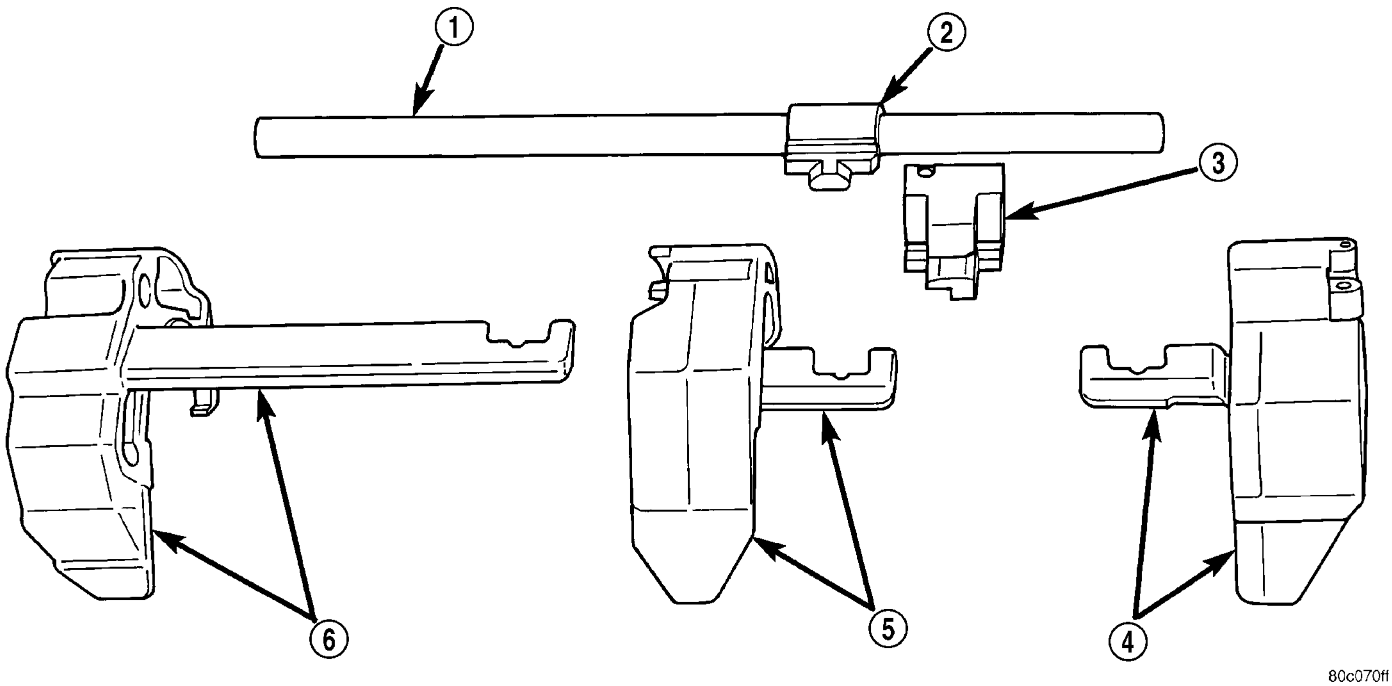


Fig. 33 SHIFT FORKS AND SHAFT

1 - SHIFT SHAFT
2 - SHAFT LEVER
3 - SHAFT LEVER BUSHING
4 - 3-4 SHIFT FORK
5 - 1-2 SHIFT FORK
6 - FIFTH-REVERSE SHIFT FORK

NOTE: The front housing contains the countershaft front bearing race. The rear housing contains the countershaft rear bearing race. If a countershaft bearing failure results, the bearing races must be replaced also.

Inspect input shaft bearing retainer. Be sure the release bearing slide surface of the retainer is in good condition. Replace the retainer seal if necessary.

Inspect output shaft bearing retainer. Be sure the U-shaped retainer is flat and free of distortion. Replace the retainer if the threads are damaged or if the retainer is bent or cracked.

COUNTERSHAFT BEARINGS AND RACES

The countershaft bearings are standard tapered roller bearings with matching races. The races are pressed into the front and rear housings. Inspect countershaft bearings and races for abnormal wear or damage.

REVERSE IDLER COMPONENTS

Inspect idler gear, bearing, shaft, thrust washer and support for excessive wear or failure (Fig. 34). Replace bearing if any of the needle bearing rollers are worn, chipped, cracked, flat-spotted or brinnelled. Also replace the bearing if the plastic bearing cage is damaged or distorted.

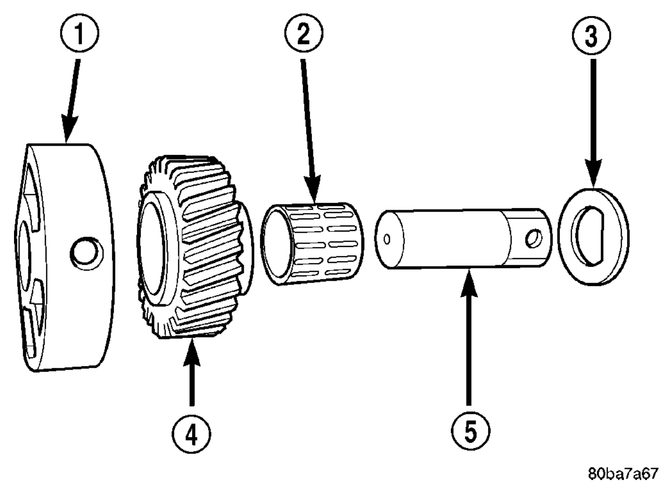


Fig. 34 REVERSE IDLER ASSEMBLY

1 - SUPPORT
2 - BEARING
3 - WASHER
4 - GEAR
5 - SHAFT

Replace thrust washer, if cracked, chipped or worn. Replace idler gear if the teeth are chipped, cracked or worn thin. Replace shaft if worn, scored or the bolt threads are damaged beyond repair. Replace support segment if cracked or chipped and replace the idler attaching bolts if the threads are damaged.

MANUAL - NV1500 (Continued)

Shift Socket

Inspect shift socket for wear or damage. Replace socket if the roll pin or shift shaft bores are damaged. Replace socket if the ball seat is worn, or cracked. Do not reuse the original shift socket roll pin. The socket roll pin is approximately is approximately 33 mm (1-1/4 in.) long.

Output Shaft And Geartrain

Inspect all gears for worn, cracked, chipped or broken teeth. Check condition of the bearing bore in each gear. The bores should be smooth and free of surface damage. Discoloration of the gear bores is a normal occurrence and is not a reason for replacement. Replace gears only when tooth damage has occurred or if the bores are brinnelled or severely scored.

Inspect shaft splines and bearings surfaces. Replace the shaft if the splines are damaged or bearing surfaces are deeply scored, worn or brinnelled.

ASSEMBLY

SYNCHRONIZER

NOTE: The easiest method of assembling each synchro is to install the springs, struts and detent balls one at a time.

(1) Slide the sleeve part way onto the hub. Leave enough room to install the spring in the hub and the strut in the hub groove.

(2) Install first spring in the hub and then install a strut over the spring. Verify spring is seated in the spring bore in the strut.

(3) Slide the sleeve onto the hub just far enough to hold the first strut and spring in place.

(4) Place detent ball in the top of the strut. Then work the sleeve over the ball to hold it in place. Use a small flat blade screwdriver to press the ball into place while moving the sleeve over it.

(5) Repeat procedure for the remaining springs, struts and balls. Tape or rubber band each strut and ball temporarily as they are installed.

(6) Verify the three springs, struts and detent balls are all in place (Fig. 35).

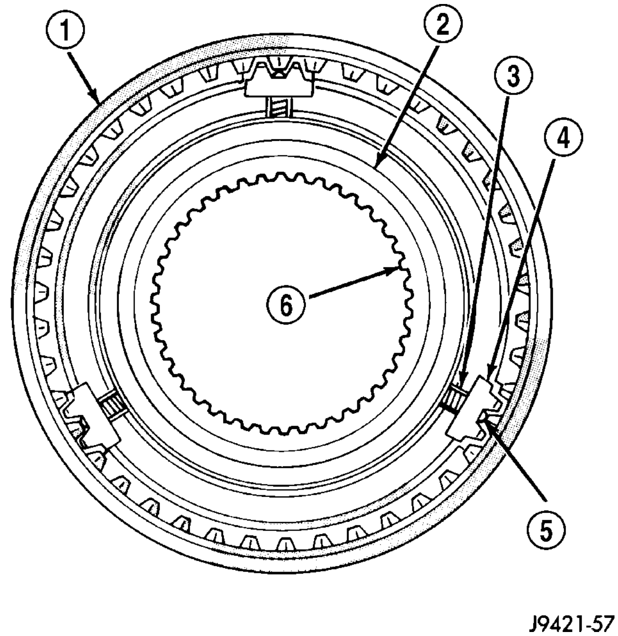


Fig. 35 ASSEMBLED SYNCHRO COMPONENTS

1 - SLEEVE
2 - HUB SHOULDER
3 - SPRING (3)
4 - STRUT (3)
5 - DETENT BALL (3)
6 - HUB

OUTPUT SHAFT

NOTE: Lubricate shaft, gears and bearings with recommended lubricant and immerse each synchro ring in lubricant before installation. Petroleum jelly can be used to hold parts in place.

(1) Install reverse gear needle bearing on shaft (Fig. 36). Slide bearing up against shoulder on output shaft.

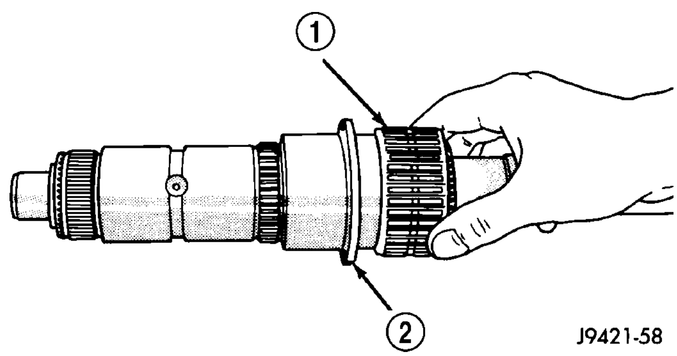


Fig. 36 REVERSE GEAR BEARING

1 - REVERSE GEAR BEARING
2 - SHOULDER

MANUAL - NV1500 (Continued)

(2) Install reverse gear over needle bearing (Fig. 37).

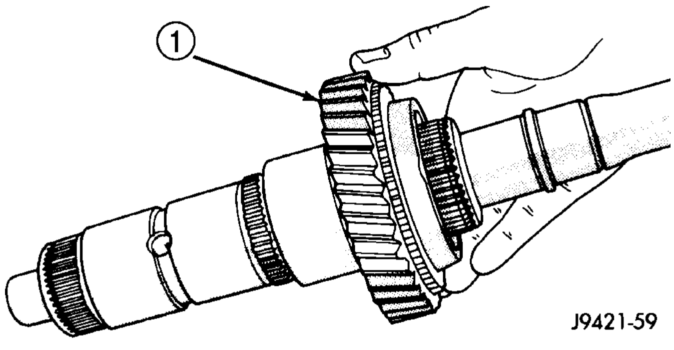


Fig. 37 REVERSE GEAR

1 - REVERSE GEAR

(3) Install solid brass synchro ring on reverse gear (Fig. 38).

NOTE: This synchro ring is different than all the rest. The angle on the friction face is 9° versus the 6.5° of all the other synchro rings.

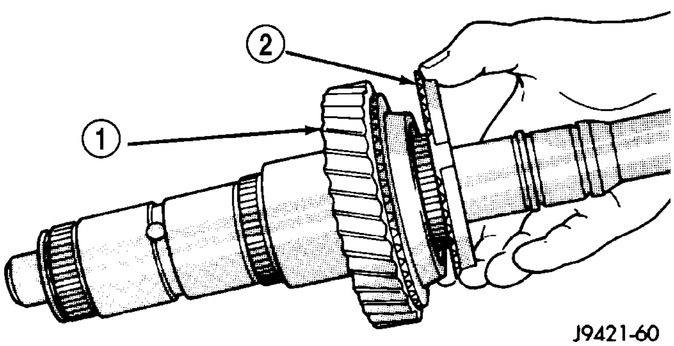


Fig. 38 REVERSE GEAR SYNCHRO RING

1 - REVERSE GEAR
2 - SYNCHRO RING (SOLID BRASS)

(4) Start fifth-reverse synchro assembly on output shaft splines by hand. Then seat synchro onto shaft with shop press and Cup 6310-1 (Fig. 39).

CAUTION: Fifth-reverse synchro hub and sleeve can be installed backwards. One side of the sleeve has double grooves and offset teeth. This side must be installed away from reverse gear (towards 5th).

NOTE: The synchro hub is a press fit design. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

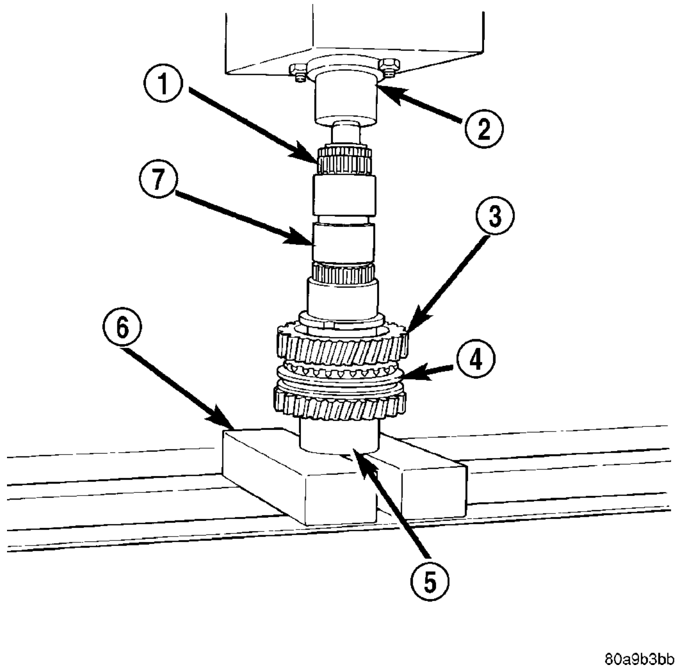


Fig. 39 FIFTH-REVERSE SYNCHRO ASSEMBLY

1 - SPACER
2 - PRESS RAM
3 - REVERSE GEAR
4 - FIFTH-REVERSE SYNCHRO ASSEMBLY
5 - CUP
6 - PRESS BLOCKS
7 - OUTPUT SHAFT

(5) Install **new** fifth-reverse hub snap ring (Fig. 40) and verify snap ring is seated in the shaft groove.

NOTE: Install thickest snap ring that will fit in shaft groove.

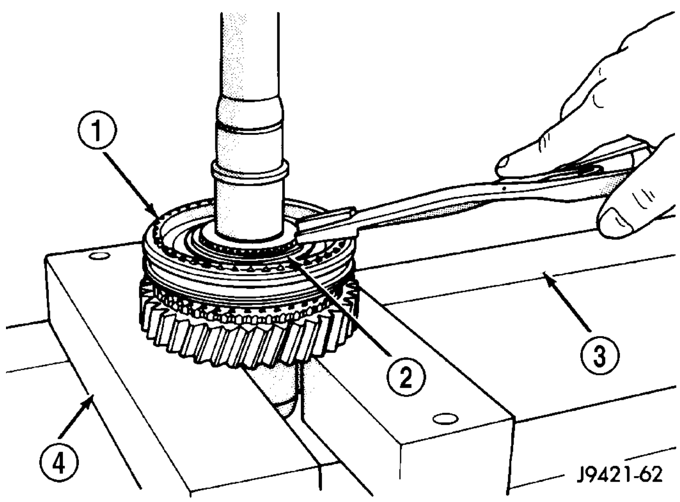


Fig. 40 FIFTH-REVERSE SYNCHRO HUB SNAP RING

1 - FIFTH-REVERSE SYNCHRO ASSEMBLY
2 - SNAP RING
3 - PRESS BED
4 - PRESS BLOCKS

MANUAL - NV1500 (Continued)

(6) Install fifth gear synchro ring in synchro hub and sleeve (Fig. 41).

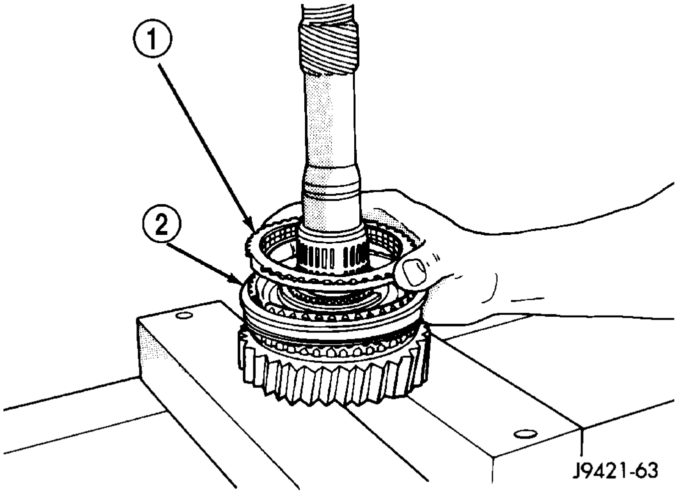


Fig. 41 FIFTH GEAR SYNCHRO RING

1 - FIFTH-SPEED SYNCHRO RING
2 - FIFTH-REVERSE SYNCHRO ASSEMBLY

(7) Install fifth gear bearing, spreading bearing only enough to clear shoulder on output shaft (Fig. 42). Verify bearing is seated.

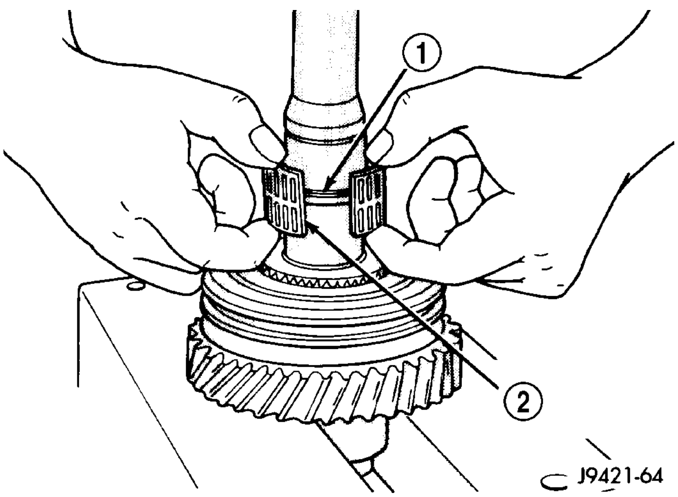


Fig. 42 FIFTH GEAR BEARING

1 - SHAFT SHOULDER
2 - FIFTH GEAR BEARING

(8) Install fifth gear on shaft and onto bearing (Fig. 43).

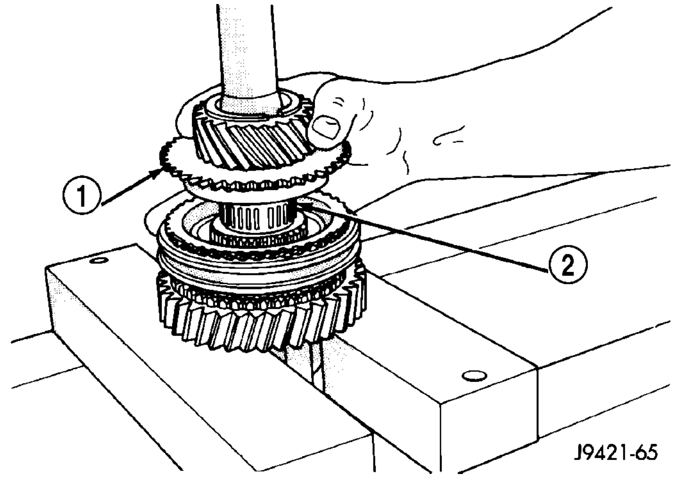


Fig. 43 FIFTH GEAR

1 - FIFTH GEAR
2 - BEARING

(9) Install output shaft bearing.

(10) Install output shaft bearing snap ring, spread snap ring only enough to install it (Fig. 44). Verify snap ring is seated in shaft groove.

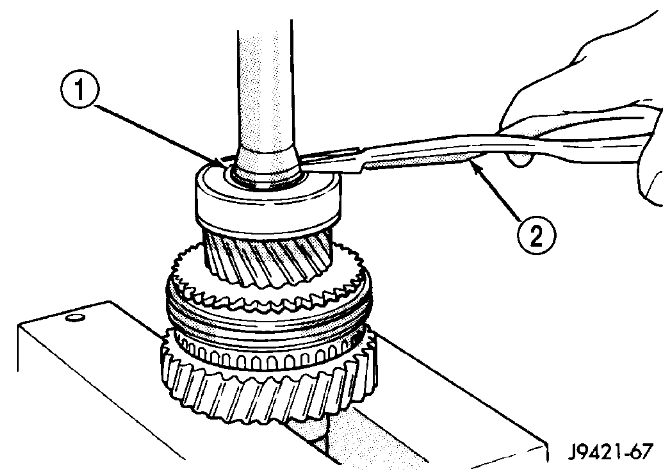


Fig. 44 OUTPUT SHAFT BEARING

1 - BEARING SNAP RING
2 - HEAVY DUTY SNAP RING PLIERS

MANUAL - NV1500 (Continued)

(11) Invert output shaft and set the shaft in Cup 6310-1 so that fifth gear is seated on the tool (Fig. 45).

(12) Install first gear bearing on output shaft (Fig. 45). Verify bearing is seated on shaft shoulder and is properly joined.

(13) Install synchro cone onto first gear. Verify synchro cone locating tabs are properly located to the recesses in first gear.

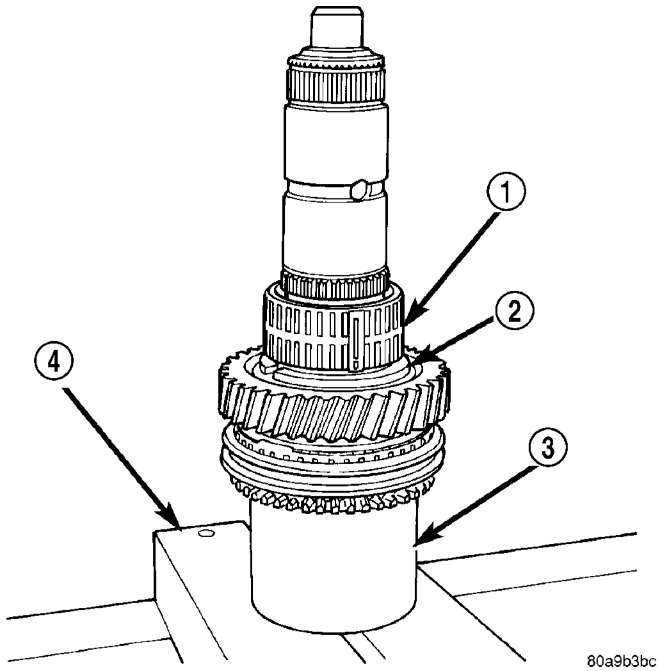


Fig. 45 FIRST GEAR BEARING

1 - FIRST GEAR BEARING
2 - SHAFT SHOULDER
3 - CUP
4 - PRESS BLOCKS

(14) Install first gear on shaft and over bearing with bearing synchro cone facing up (Fig. 46).

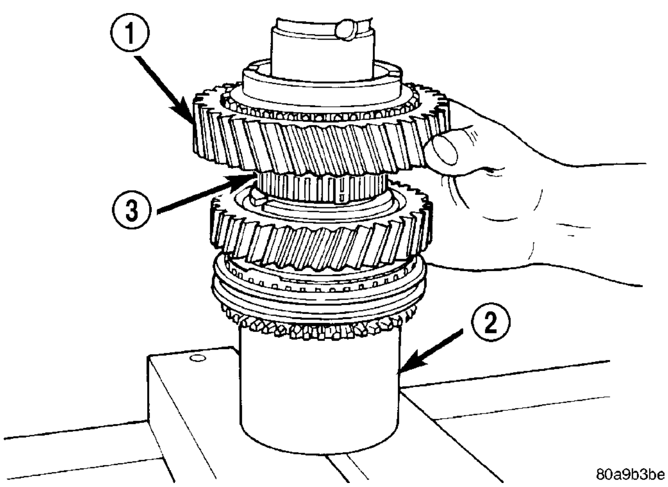


Fig. 46 FIRST GEAR

1 - FIRST GEAR
2 - CUP
3 - BEARING

(15) Install first gear synchro ring (Fig. 47).

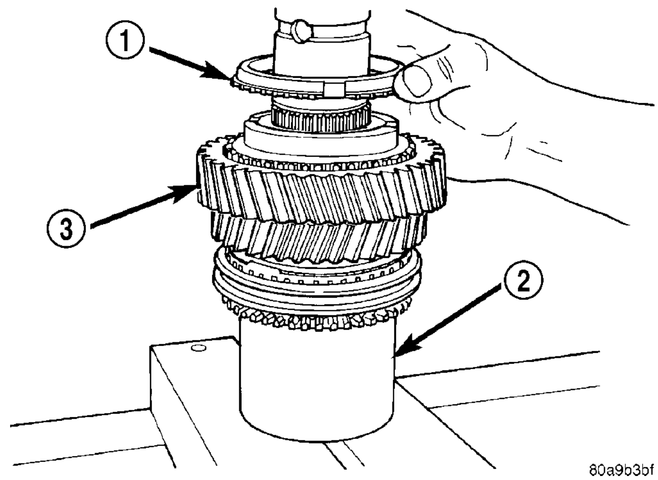


Fig. 47 FIRST GEAR SYNCHRO RING

1 - FIRST GEAR SYNCHRO RING
2 - CUP
3 - FIRST GEAR

(16) Start 1-2 synchro assembly on shaft by hand (Fig. 48). Be sure synchro sleeve is properly positioned.

CAUTION: The 1-2 synchro hub and sleeve can be installed backwards. One side of the sleeve has a groove and offset teeth. This side must be installed towards 1st gear (away from 2nd gear).

NOTE: The synchro hub is a press fit design. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

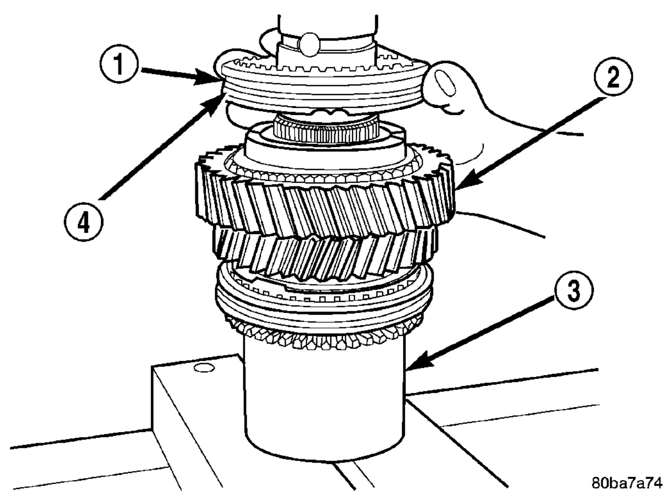


Fig. 48 START 1-2 SYNCHRO ON SHAFT

1 - 1-2 SYNCHRO ASSEMBLY
2 - FIRST GEAR
3 - CUP
4 - SINGLE GROOVE SIDE OF SYNCHRO SLEEVE

MANUAL - NV1500 (Continued)

(17) Press 1-2 synchro onto output shaft with suitable size pipe and shop press (Fig. 49).

CAUTION: Align synchro ring and sleeve as hub is being pressed onto the shaft. The synchro ring can be cracked if it becomes misaligned.

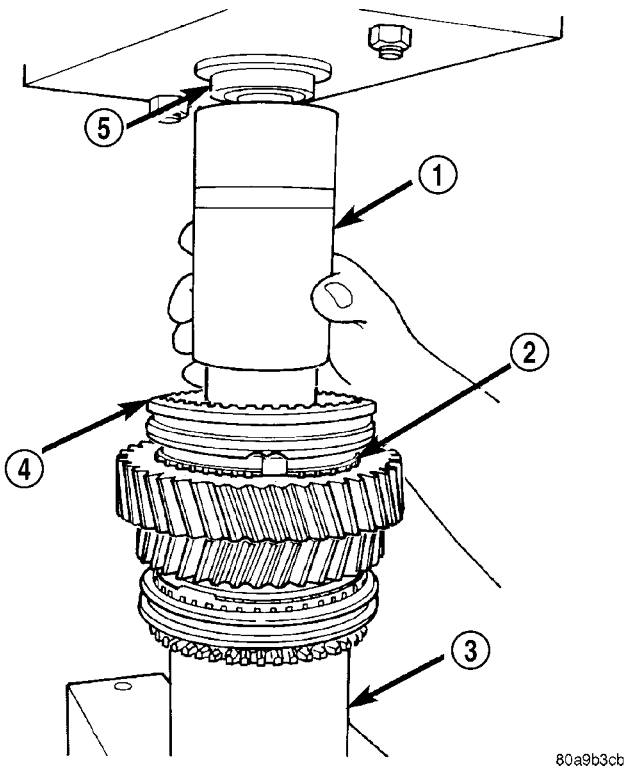


Fig. 49 PRESS 1-2 SYNCHRO ASSEMBLY

1 - SUITABLE SIZE PIPE TOOL
2 - SYNCHRO RING
3 - CUP
4 - 1-2 SYNCHRO ASSEMBLY
5 - PRESS RAM

(18) Install **new** 1-2 synchro hub snap ring (Fig. 50) with the thickest snap ring that will fit in shaft groove. Verify snap ring is seated in shaft groove.

(19) Install second gear synchro ring in 1-2 synchro hub and sleeve (Fig. 51). Verify synchro ring is seated in sleeve.

(20) Install synchro cone into synchro ring.

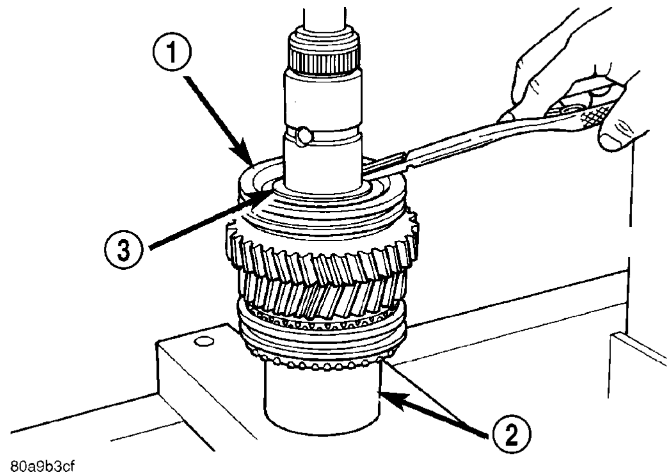


Fig. 50 1-2 SYNCHRO HUB SNAP RING

1 - 1-2 SYNCHRO
2 - CUP
3 - SYNCHRO SNAP RING

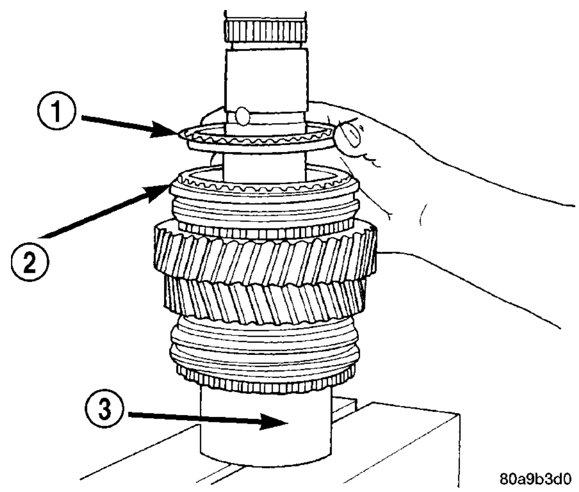


Fig. 51 SECOND GEAR SYNCHRO RING

1 - SECOND GEAR SYNCHRO RING
2 - 1-2 SYNCHRO
3 - CUP

MANUAL - NV1500 (Continued)

(21) Install second gear needle bearing on shaft (Fig. 52).

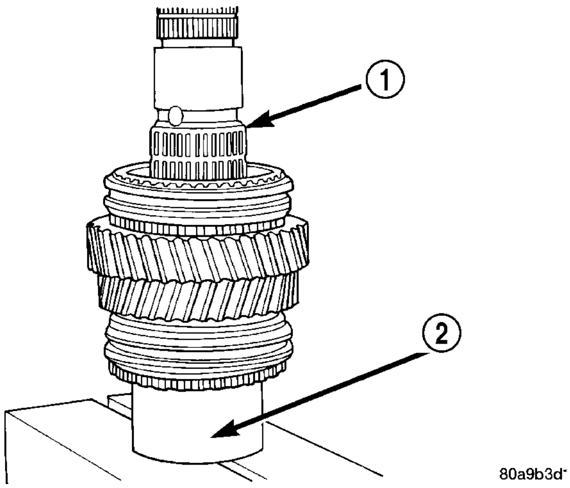


Fig. 52 SECOND GEAR BEARING

1 - SECOND GEAR BEARING
2 - CUP

(22) Install second gear onto shaft and bearing (Fig. 53). Verify second gear is seated on synchro components.

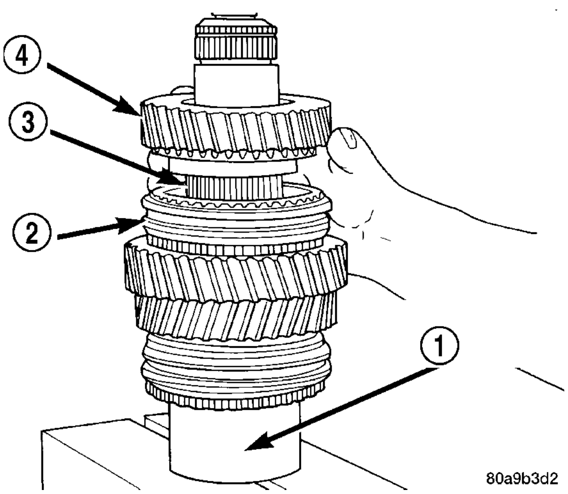


Fig. 53 SECOND GEAR

1 - CUP
2 - 1-2 SYNCHRO ASSEMBLY
3 - BEARING
4 - SECOND GEAR

(23) Install thrust washer pin to shaft and install two-piece thrust washer (Fig. 54). Verify washer halves are seated in shaft groove and pin reliefs are positioned at washer locating pin.

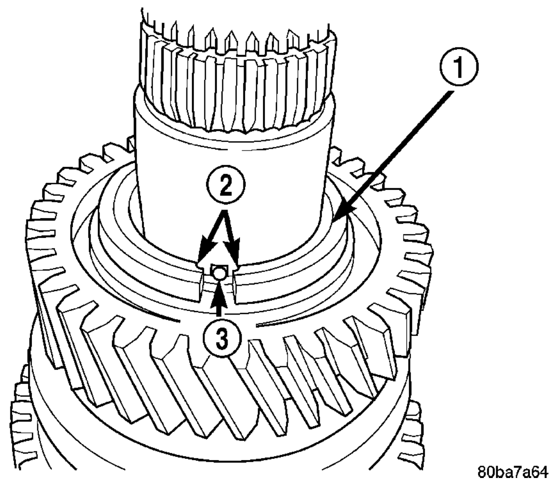


Fig. 54 TWO-PIECE THRUST WASH

1 - WASHER (2 HALVES)
2 - PIN RELIEF
3 - PIN

(24) Seat retaining ring around two-piece thrust washer.

(25) Install third gear needle bearing on shaft (Fig. 55).

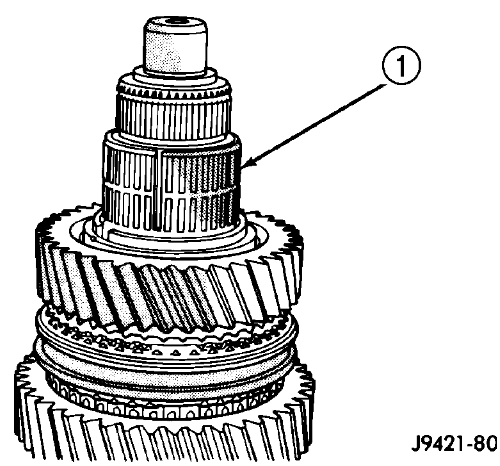


Fig. 55 THIRD GEAR BEARING

1 - THIRD GEAR BEARING

MANUAL - NV1500 (Continued)

(26) Install third gear on shaft and bearing (Fig. 56).

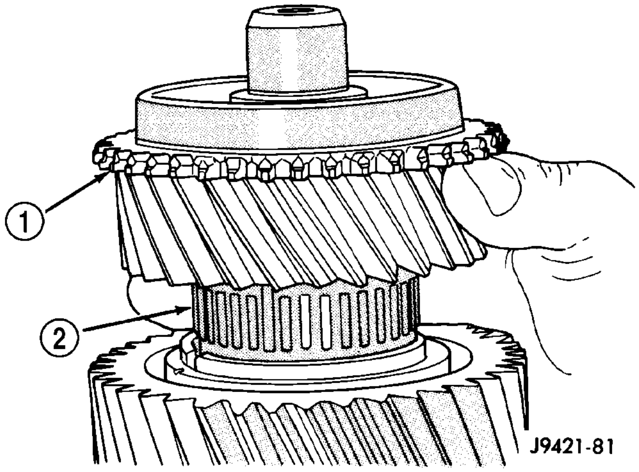


Fig. 56 THIRD GEAR

1 - THIRD GEAR
2 - BEARING

(27) Install third speed synchro ring on third gear (Fig. 57).

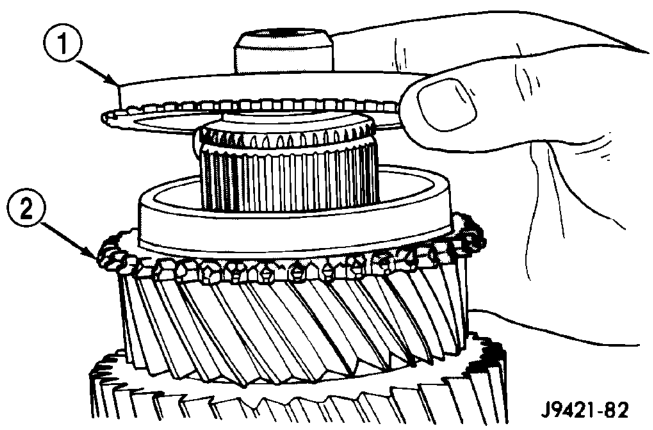


Fig. 57 THIRD SPEED SYNCHRO RING

1 - THIRD SPEED SYNCHRO RING
2 - THIRD GEAR

(28) Start 3-4 synchro hub on output shaft splines by hand (Fig. 58).

CAUTION: The 3-4 synchro hub and sleeve can be installed backwards. One side of the sleeve has two grooves and offset teeth. This side must be installed towards 3rd gear (away from 4th gear).

NOTE: The synchro hub is a press fit design. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

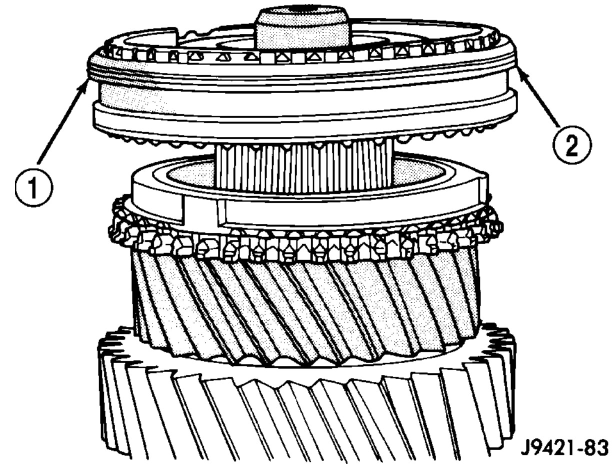


Fig. 58 START 3-4 SYNCHRO HUB ON OUTPUT SHAFT

1 - GROOVED SIDE OF SLEEVE (TO FRONT)
2 - 3-4 SYNCHRO ASSEMBLY

(29) Press 3-4 synchro assembly onto output shaft with shop press and suitable size pipe tool (Fig. 59). Press tool must be as close to the hub center as possible but not contacting the shaft splines.

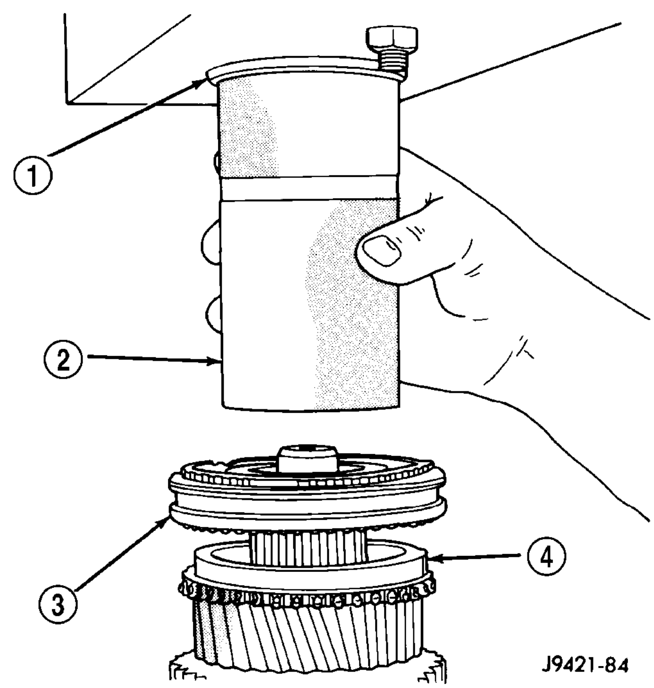


Fig. 59 3-4 SYNCHRO ASSEMBLY ON SHAFT

1 - PRESS RAM
2 - PIPE TOOL
3 - 3-4 SYNCHRO
4 - THIRD SPEED SYNCHRO RING

MANUAL - NV1500 (Continued)

(30) Install 3-4 synchro hub **new** snap ring (Fig. 60) with thickest snap ring that will fit in shaft groove. Verify snap ring is seated in groove.

(31) Verify position of synchro sleeves before proceeding (Fig. 61).

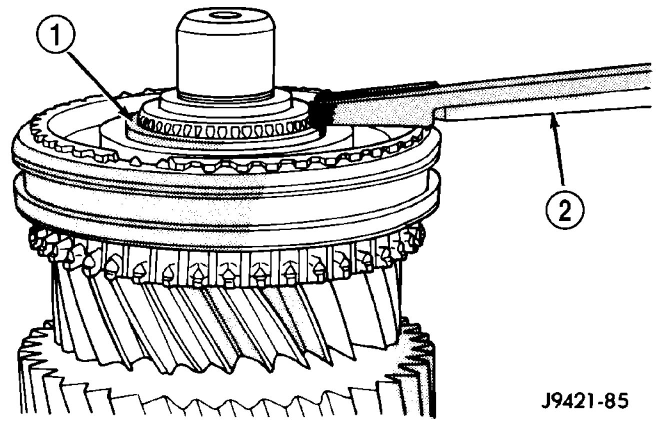


Fig. 60 3-4 SYNCHRO HUB SNAP RING

1 - 3-4 SYNCHRO HUB SNAP RING
2 - HEAVY DUTY SNAP RING PLIERS

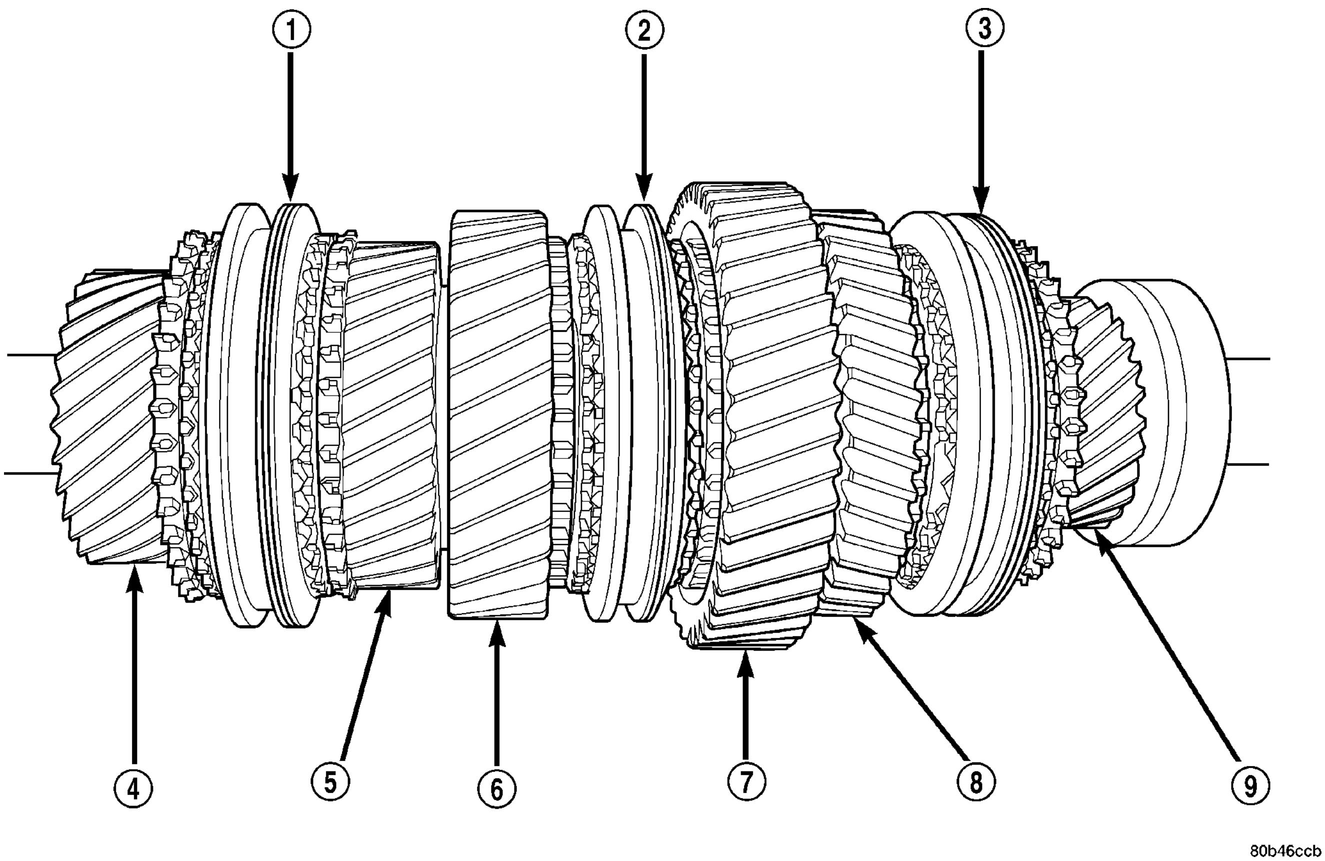


Fig. 61 SYNCHRO SLEEVE POSITION

1 - 2 GROOVES
2 - 1 GROOVE
3 - 2 GROOVES
4 - FOURTH GEAR
5 - THIRD GEAR
6 - SECOND GEAR
7 - FIRST GEAR
8 - REVERSE GEAR
9 - FIFTH GEAR

MANUAL - NV1500 (Continued)

GEARTRAIN

(1) Install input shaft into Support Stand 8355 (Fig. 62).

(2) Install pilot bearing in input shaft (Fig. 62).

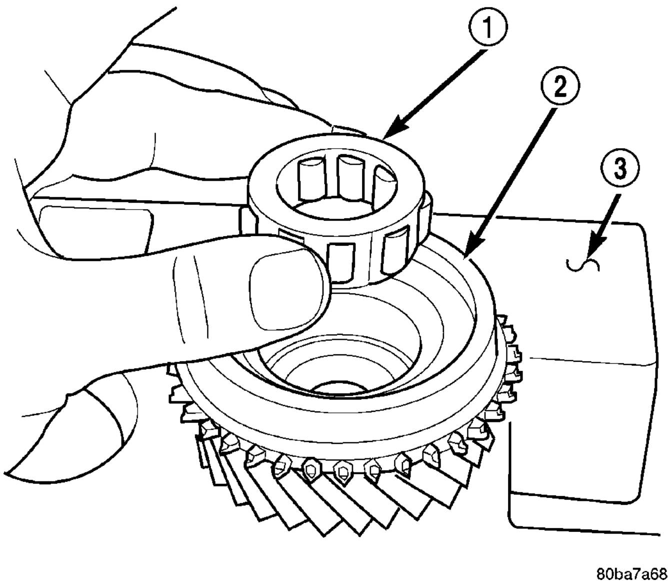


Fig. 62 INPUT SHAFT AND PILOT BEARING

1 - PILOT BEARING
2 - INPUT SHAFT
3 - STAND

(3) Install fourth gear synchro ring on input shaft (Fig. 63).

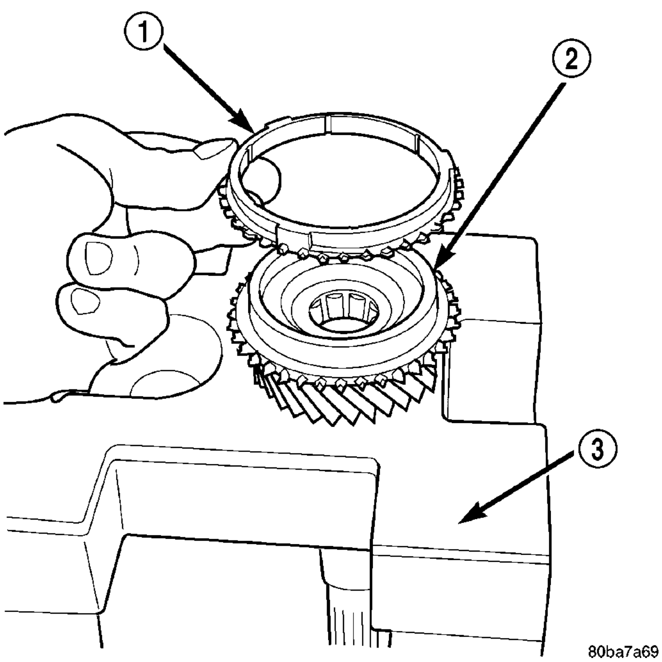


Fig. 63 FOURTH GEAR SYNCHRO RING ON INPUT SHAFT

1 - FOURTH GEAR SYNCHRO RING
2 - INPUT SHAFT
3 - STAND

(4) Install assembled output shaft and geartrain in input shaft (Fig. 64). Rotate output shaft until the 3-4 synchro ring seats in synchro hub and sleeve.

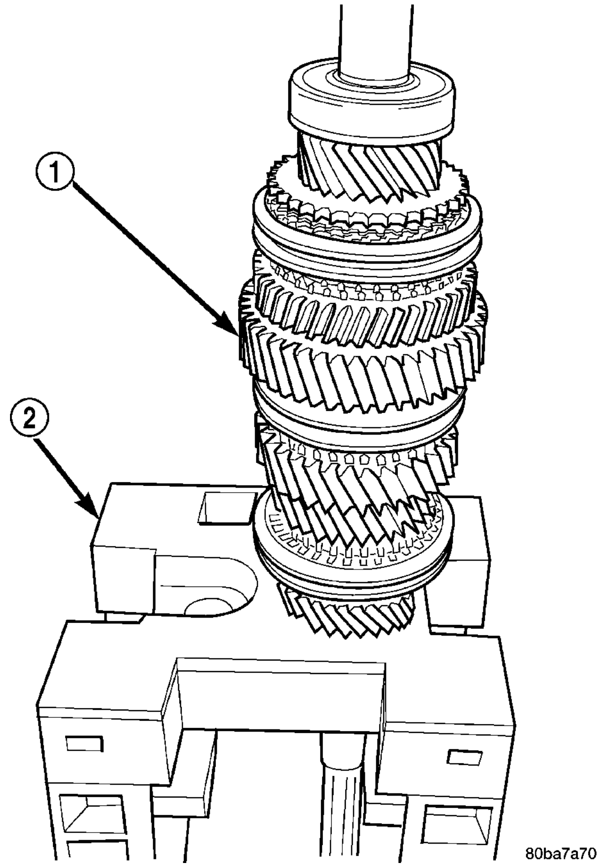


Fig. 64 MAINSHAFT ON SUPPORT STAND

1 - MAIN SHAFT
2 - SUPPORT STAND

MANUAL - NV1500 (Continued)

(5) Slide countershaft into fixture slot. Verify countershaft and output shaft gears are fully meshed with the mainshaft gears (Fig. 65).

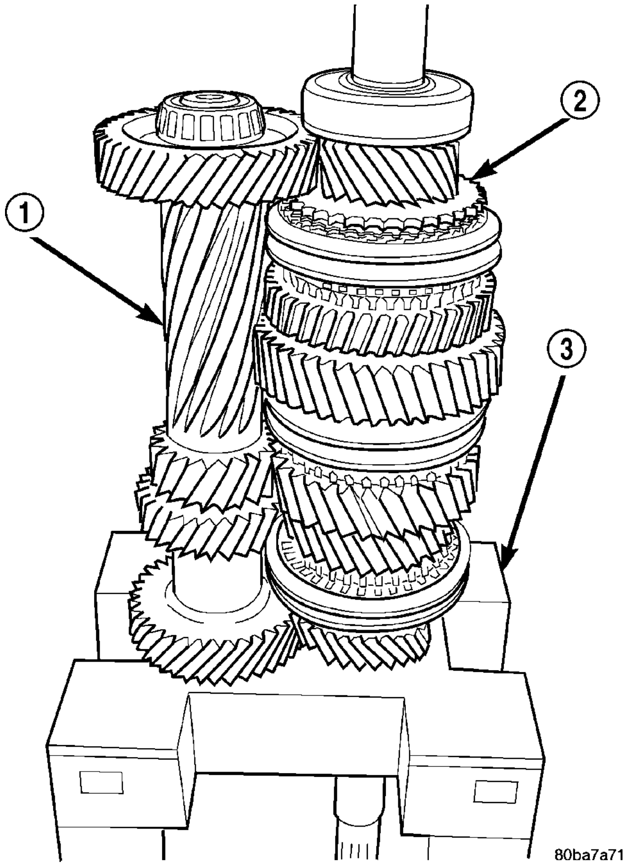


Fig. 65 COUNTERSHAFT ON SUPPORT STAND

1 - COUNTER SHAFT
2 - MAIN SHAFT
3 - SUPPORT STAND

(6) Thread one Pilot Stud 8120 in center or passenger side hole of output shaft bearing retainer. Then position retainer on fifth gear.

(7) Assemble 1-2 and fifth reverse-shift forks (Fig. 66). Arm of fifth-reverse fork goes through slot in 1-2 fork.

(8) Install assembled shift forks in synchro sleeves (Fig. 67). Verify forks are seated in sleeves.

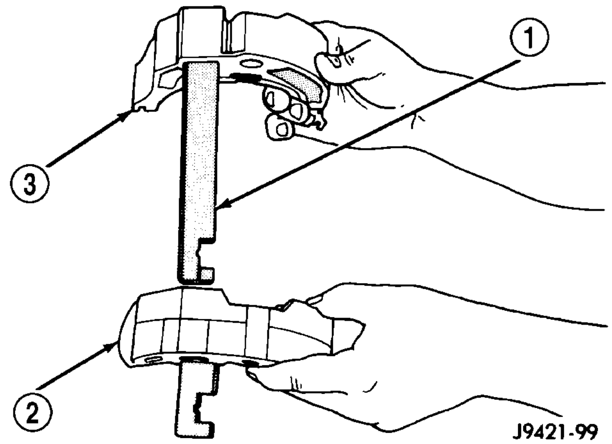


Fig. 66 1-2 AND FIFTH-REVERSE SHIFT FORKS

1 - FIFTH-REVERSE FORK ARM
2 - 1-2 FORK
3 - FIFTH-REVERSE FORK

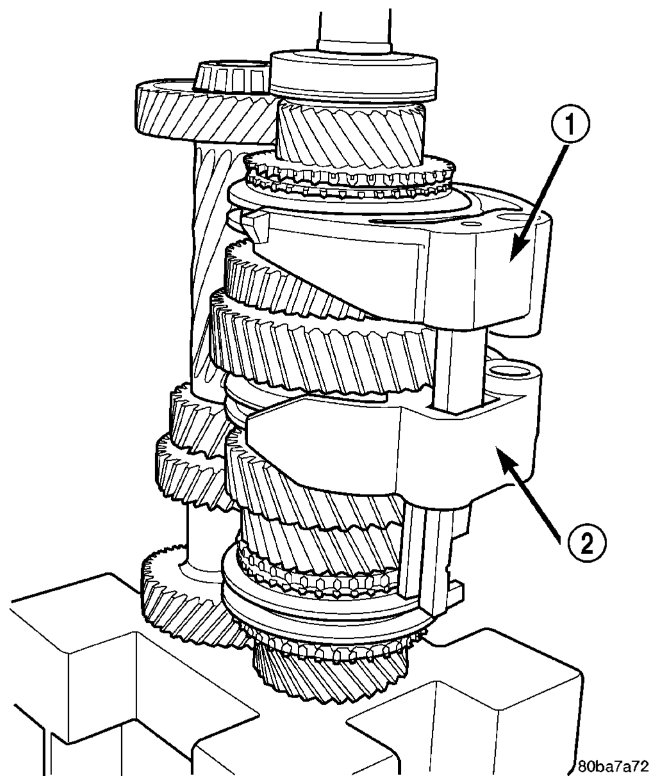


Fig. 67 SHIFT FORKS AND SYNCHROS

1 - FIFTH REVERSE SHIFT FORK
2 - 1-2 SHIFT FORK

MANUAL - NV1500 (Continued)

REAR HOUSING

(1) Lubricate countershaft rear bearing race.

(2) Install rear housing onto geartrain (Fig. 68). Verify bearing retainer pilot stud is in correct bolt hole and countershaft and output shaft bearings are aligned in housing and on countershaft.

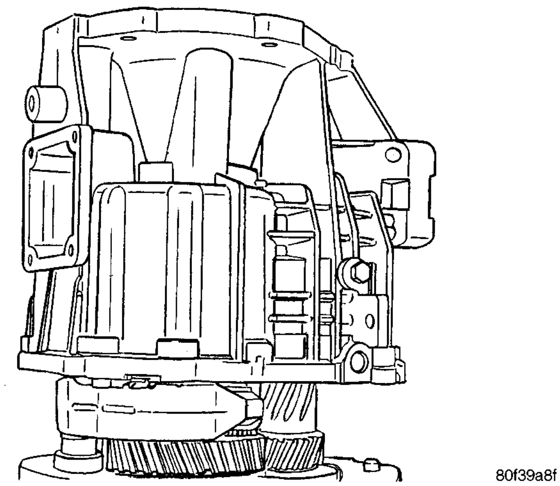


Fig. 68 REAR HOUSING

(3) Seat rear housing on output shaft rear bearing and countershaft. Tap housing into place with plastic or rawhide hammer.

(4) Apply Mopar® Gasket Maker or equivalent to bolt threads, bolt shanks and under bolt heads (Fig. 69).

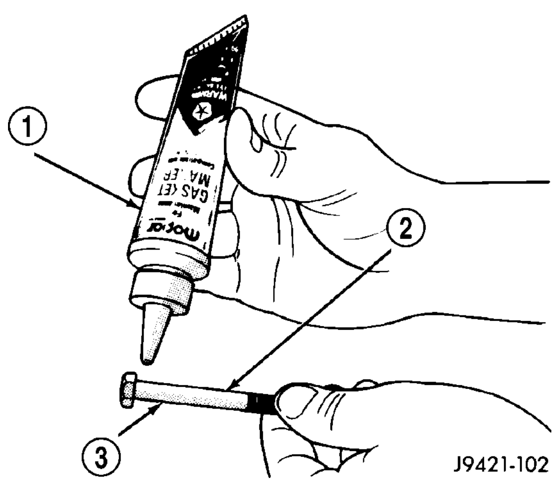


Fig. 69 RETAINER AND HOUSING BOLTS

1 - MOPAR GASKET MAKER
2 - RETAINER AND HOUSING BOLTS
3 - APPLY SEALER TO UNDERSIDE OF BOLT HEAD, SHANK AND THREADS

(5) Start first two bolts in retainer (Fig. 70). It may be necessary to move retainer rearward (with pilot stud) in order to start bolts.

(6) Remove Pilot Stud 8120 and install last retainer bolt (Fig. 70).

(7) Tighten all three retainer bolts to 22 N·m (16 ft. lbs.).

NOTE: All bolts except the reverse idler shaft bolts have o-rings to seal the bolts to the transmission case. Inspect the o-rings to ensure that they are in good condition.

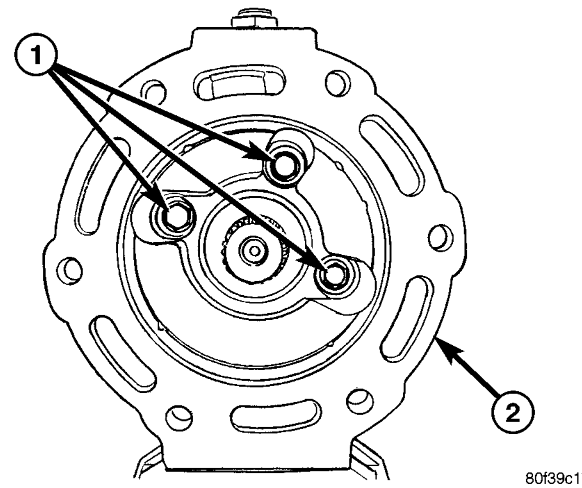


Fig. 70 PILOT STUD AND RETAINER BOLTS

1 - BEARING RETAINER BOLT
2 - REAR HOUSING

REVERSE IDLER

(1) Remove geartrain and housing assembly from support stand with aid of helper.

(2) Assemble shaft, gear and washer (without bearing or support) and install into housing (Fig. 71).

NOTE: The small shoulder on the reverse idler gear goes toward the front of the transmission.

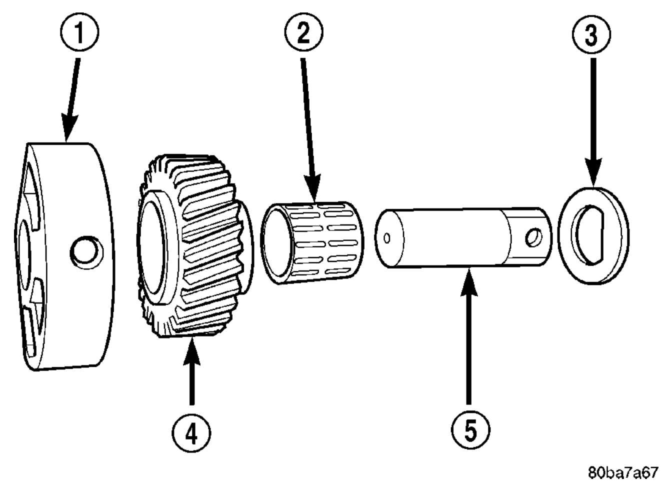


Fig. 71 REVERSE IDLER ASSEMBLY

1 - SUPPORT
2 - BEARING
3 - WASHER
4 - GEAR
5 - SHAFT

MANUAL - NV1500 (Continued)

(3) Apply Mopar® Gasket Maker or equivalent sealer to underside of idler shaft and support bolt heads, bolt shanks and bolt threads (Fig. 69).

(4) Align hole in housing with threaded hole in shaft and start shaft rear bolt a few threads.

(5) Install bearing into position.

(6) Install segment (Fig. 71), align housing hole with segment threaded hole, and start support bolt a few threads.

(7) Tighten large idler shaft bolt to 43 N·m (31.7 ft. lbs.). Tighten small idler shaft bolt to 22 N·m (16.2 ft. lbs.).

CAUTION: Verify idler shaft and support segment are properly seated and firmly in place while tightening the shaft bolts. The segment, housing or shaft threads can be damaged if the idler shaft is allowed to shift out of position.

SHIFT SHAFT, SHAFT LEVER AND BUSHING AND SHIFT SOCKET

(1) Verify all synchro sleeves are in Neutral position (centered on hub).

CAUTION: Synchros must all be in Neutral position to prevent damage to the housings, shift forks and gears during installation of the two housings.

(2) Install 3-4 shift fork in synchro sleeve (Fig. 72). Verify groove in fork arm is aligned with grooves in 1-2 and fifth-reverse fork arms.

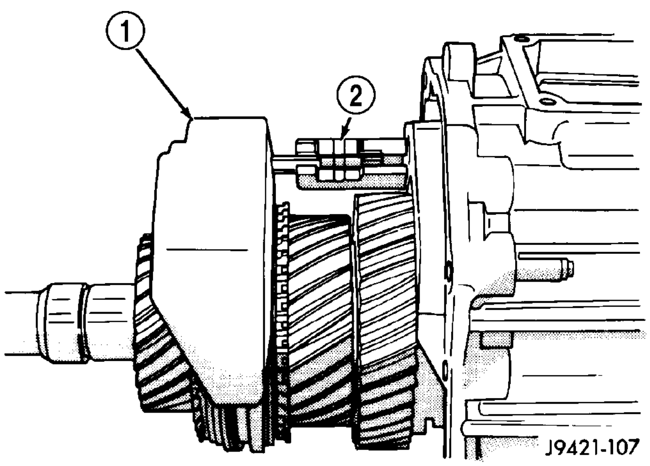


Fig. 72 3-4 SHIFT FORK

1 - 3-4 FORK
2 - ALIGN GROOVES IN FORK ARMS

(3) Slide shift shaft through the shift forks (Fig. 73).

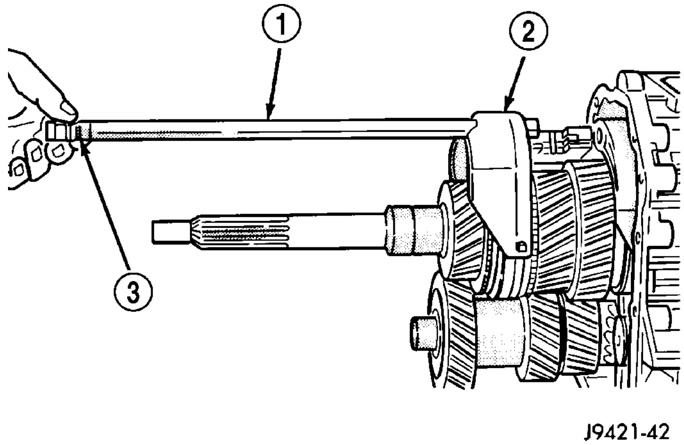


Fig. 73 SHIFT SHAFT

1 - SHIFT SHAFT
2 - 3-4 FORK
3 - SHAFT DETENT NOTCHES

(4) Assemble shift shaft shift lever and bushing (Fig. 74). Slot in bushing must face up and roll pin hole for lever to align with hole in shaft.

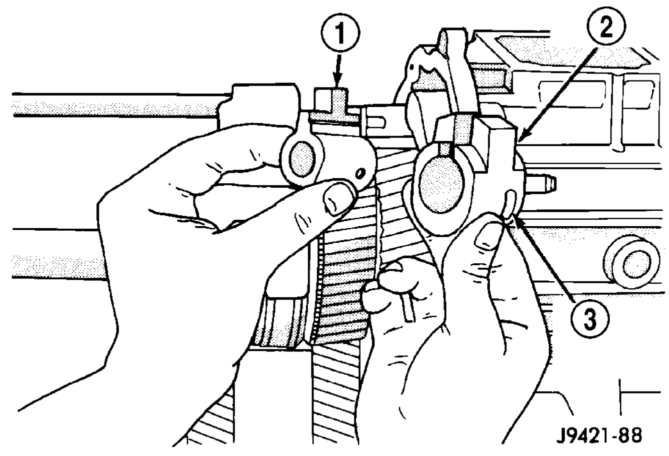


Fig. 74 SHIFT SHAFT LEVER AND BUSHING

1 - SHAFT LEVER
2 - LEVER BUSHING
3 - BUSHING LOCK PIN SLOT

MANUAL - NV1500 (Continued)

(5) Install assembled lever and bushing on shift shaft (Fig. 75).

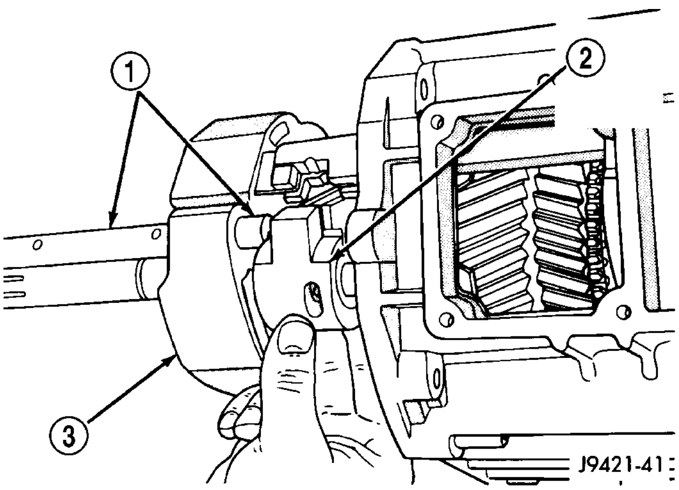


Fig. 75 SHIFT SHAFT LEVER AND BUSHING

1 - SHIFT SHAFT
2 - SHAFT LEVER AND BUSHING
3 - 3-4 FORK

(6) Slide shift shaft through 1-2 and fifth-reverse fork and into shift lever opening in rear housing (Fig. 76).

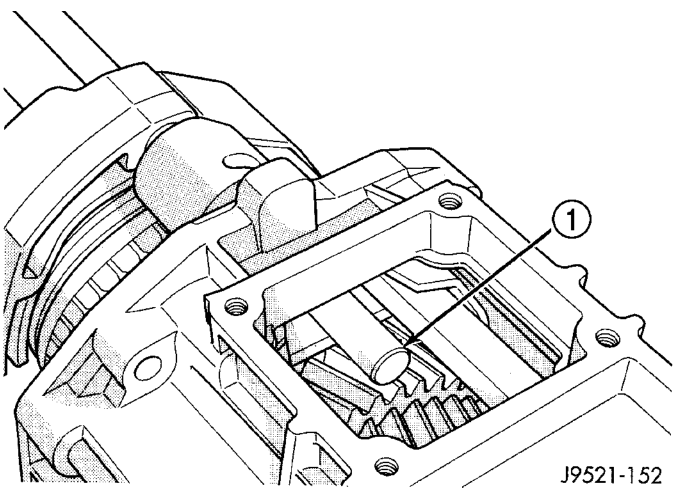


Fig. 76 LEVER OPENING IN HOUSING

1 - SHIFT SHAFT

(7) Align shift socket with shaft and slide shaft through socket and into shift shaft bearing in rear housing (Fig. 77).

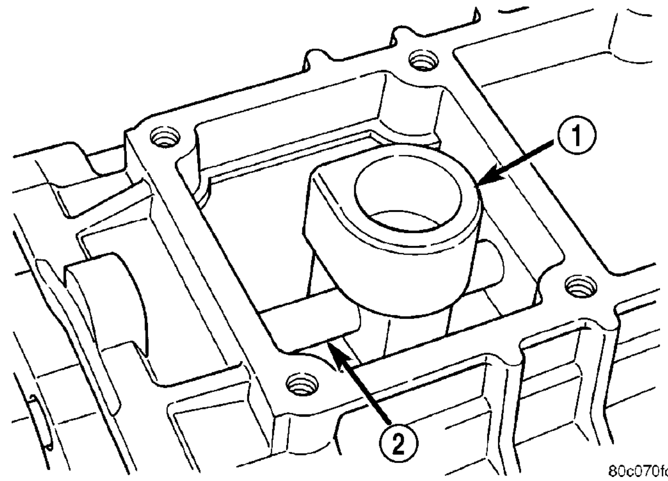


Fig. 77 SHIFT SOCKET AND SHAFT

1 - SHIFT SOCKET
2 - SHIFT SHAFT

(8) Rotate shift shaft so detent notches in shaft are facing the TOP of the transmission housing.

CAUTION: Positioning of the shift shaft detent notch is important. Both of the shaft roll pins can be installed even when the shaft is 180° off. If this occurs, transmission will have to be disassembled to correct shaft alignment.

(9) Select correct new roll pin for shift shaft lever (Fig. 78). Shaft lever roll pin is approximately 22 mm (7/8 in.) long. Shift socket roll pin is approximately 33 mm (1-1/4 in.) long.

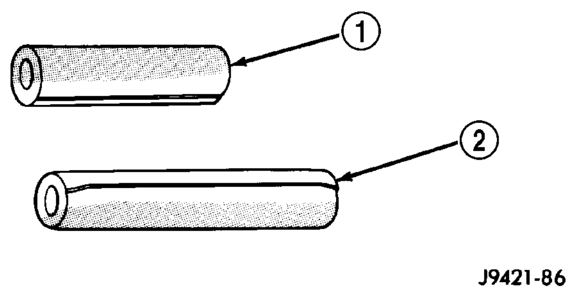


Fig. 78 SHAFT LEVER AND SOCKET ROLL PINS

1 - SHAFT LEVER ROLL PIN
2 - SHIFT SOCKET ROLL PIN

MANUAL - NV1500 (Continued)

(10) Align roll pin holes in shift shaft, lever and bushing, then start roll pin into shaft lever by hand (Fig. 79).

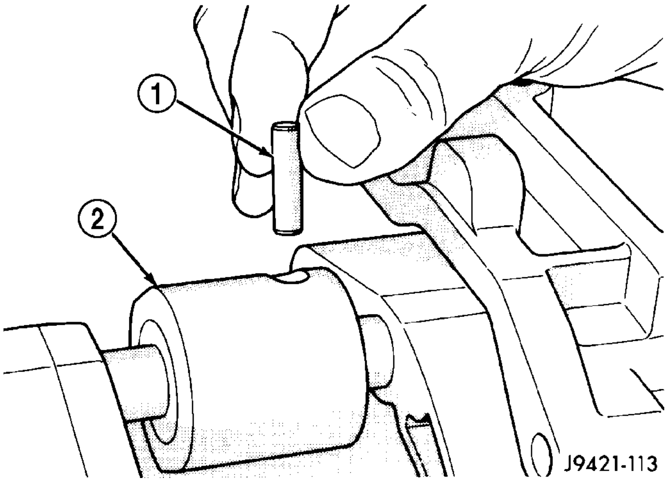


Fig. 79 STARTING ROLL PIN IN SHIFT SHAFT LEVER

1 - SHAFT LEVER ROLL PIN
2 - LEVER AND BUSHING

(11) Seat shaft lever roll pin with pin punch (Fig. 80).

CAUTION: Shaft lever roll pin must be flush with the surface of the lever. The lever bushing will bind on the roll pin if the pin is not seated flush.

(12) Verify lock pin slot in lever bushing is positioned as shown (Fig. 80).

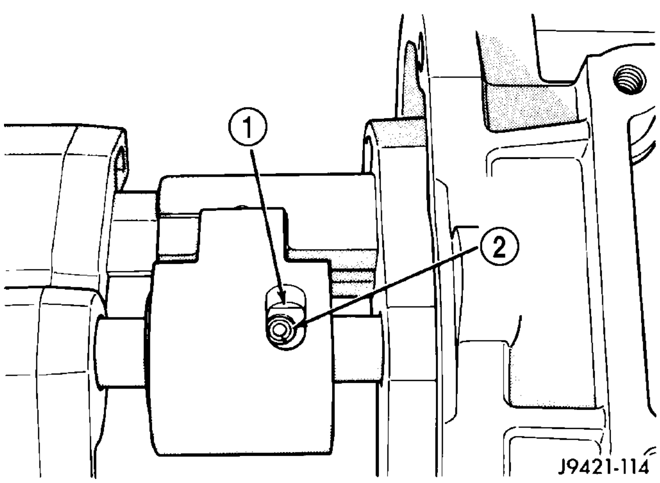


Fig. 80 SEATING SHIFT SHAFT LEVER ROLL PIN

1 - BUSHING LOCK PIN SLOT
2 - SEAT ROLL PIN FLUSH WITH LEVER

(13) Align roll pin holes in shift socket and shift shaft. Then start roll pin into shift shaft by hand (Fig. 81).

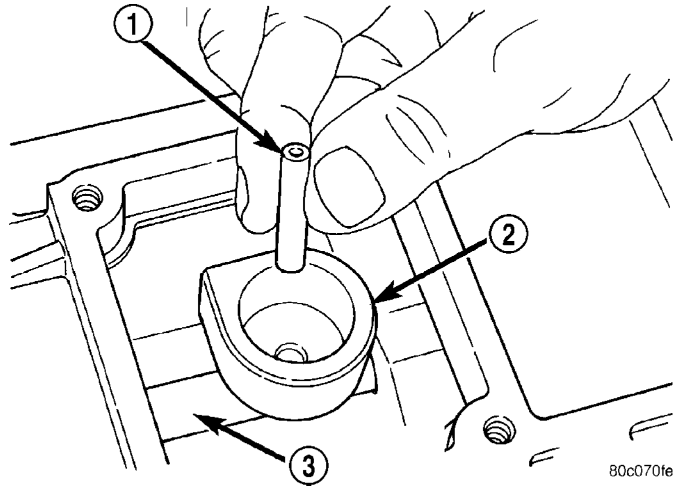


Fig. 81 STARTING ROLL PIN IN SHIFT SOCKET

1 - ROLL PIN
2 - SHIFT SOCKET
3 - SHIFT SHAFT

(14) Seat roll pin in shift socket with pin punch. Roll pin must be instaled flush with socket (Fig. 82).

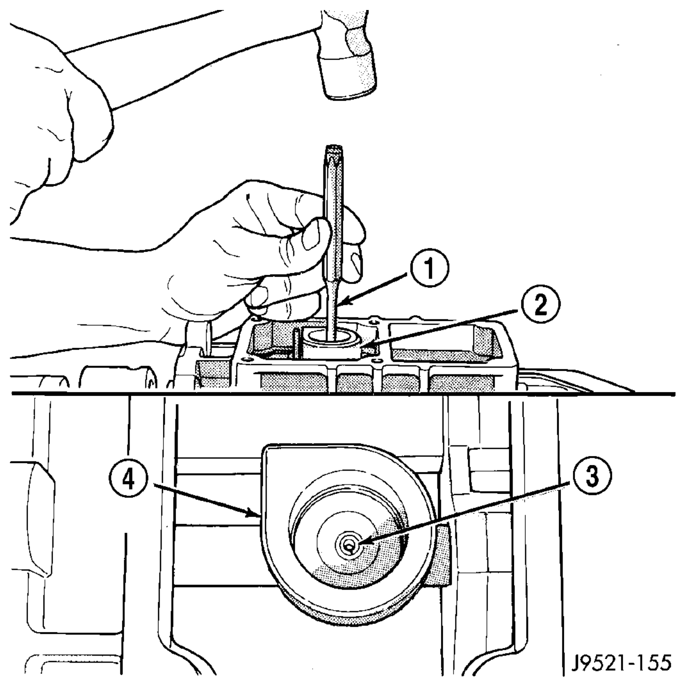


Fig. 82 SEATING SHIFT SOCKET ROLL PIN

1 - PIN PUNCH
2 - SHIFT SOCKET
3 - SEAT ROLL PIN FLUSH
4 - SHIFT SOCKET

(15) Verify notches in shift fork arms are aligned.

MANUAL - NV1500 (Continued)

FRONT HOUSING AND INPUT SHAFT BEARING RETAINER

(1) If previously removed, install input shaft bearing in front housing bore (Fig. 83). Install snap ring and use plastic mallet to seat bearing. Bearing goes in from front side of housing only.

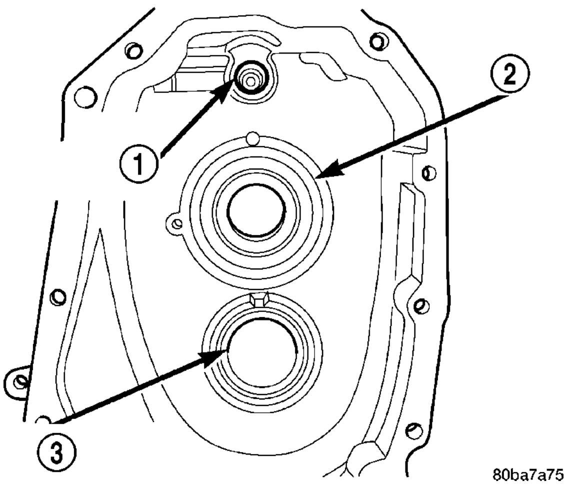


Fig. 83 INPUT SHAFT AND COUNTERSHAFT BEARING

1 - SHIFT SHAFT BUSHING
2 - INPUT SHAFT BEARING
3 - COUNTERSHAFT FRONT BEARING RACE

(2) Apply small amount of petroleum jelly to shift shaft bushing in front housing (Fig. 84).

(3) Apply 1/8 in. wide bead of Mopar® Gasket Maker or equivalent to mating surfaces of front and rear housings (Fig. 84).

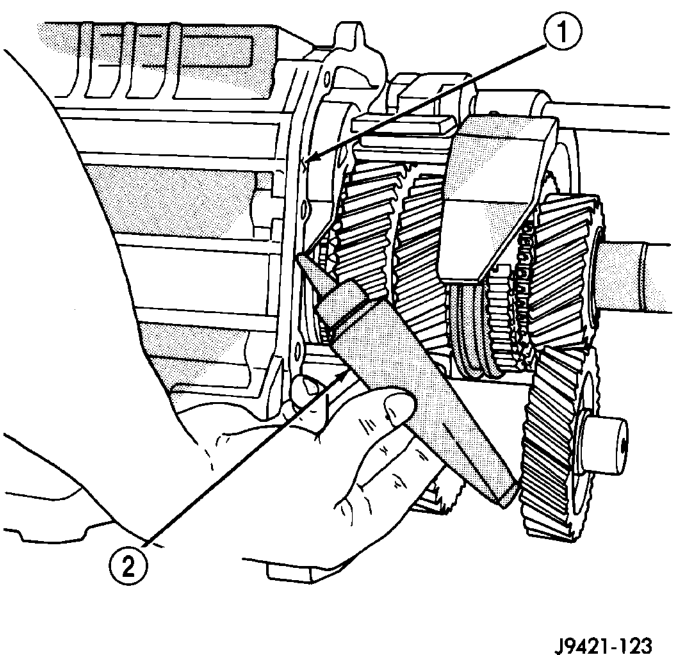


Fig. 84 SEALER TO FRONT/REAR HOUSING

1 - HOUSING FLANGE SURFACE
2 - MOPAR GASKET MAKER (OR LOCTITE 518)

(4) Have helper hold rear housing and geartrain in upright position. Then install front housing on rear housing and geartrain.

(5) Work front housing downward onto geartrain until seated on rear housing.

CAUTION: If the front housing will not seat on the rear housing, the shift components are not in Neutral, or one or more components are misaligned. Do not force the front housing into place.

(6) Place transmission in horizontal position.

(7) Apply Mopar® Gasket Maker or equivalent to housing attaching bolts. Apply sealer material sealer to underside of bolt heads and to bolt shanks and threads (Fig. 85).

(8) Install and start housing attaching bolts by hand (Fig. 85). Then tighten bolts to 34 N·m (25 ft. lbs.).

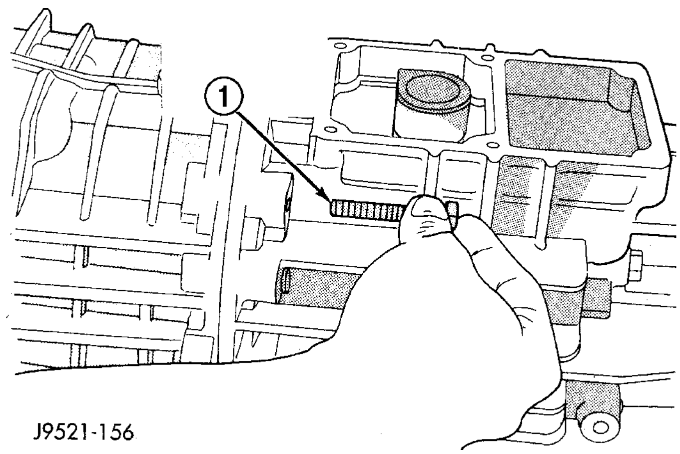


Fig. 85 HOUSING ATTACHING BOLTS

1 - HOUSING ATTACHING BOLTS (APPLY SEALER BEFOREHAND)

(9) Install shift shaft bushing lock bolt (Fig. 86). Apply Mopar® Gasket Maker or equivalent to bolt threads, shank and underside of bolt head before installation.

CAUTION: If the lock bolt cannot be fully installed, do not try to force it into place. Either the shift shaft is not in Neutral, or the shaft bushing (or lever) is misaligned.

(10) Remove countershaft bearing shim cap and shim. Attach a dial indicator and move countershaft front and back to measure shaft end play. The required countershaft pre-load 0.001-0.003 inches. Add this amount to the measured amount of countershaft end-play. This gives the amount of shims necessary to correctly pre-load the front and rear countershaft bearings.

MANUAL - NV1500 (Continued)

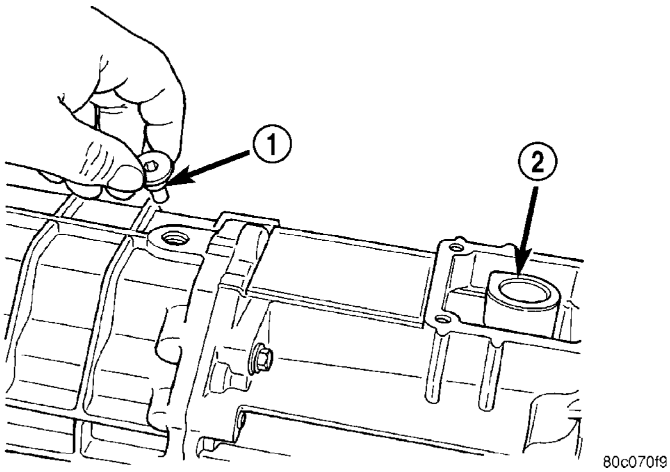


Fig. 86 SHIFT SHAFT BUSHING LOCK BOLT

1 - SHIFT SHAFT LOCK BOLT
2 - SHAFT SOCKET

(11) Install the selected shims and the shim cap. Tighten shim cap bolts to 29 N·m (21.4 ft. lbs.). Verify the shim selection by rotating the input shaft by hand with the transmission in neutral. The proper torque required to rotate the input shaft and the countershaft is approximately 5-7 in.lbs.. The input shaft should therefore be easily rotated by hand. If the input shaft cannot be rotated by hand or is not smooth through several rotations, re-check the countershaft pre-load.

(12) Lubricate then install shift shaft detent plunger in housing bore. **Verify plunger is fully seated in detent notch in shift shaft.**

NOTE: Lubricate plunger with Valvoline Dura blend® Semi-Synthetic or Synthetic grease or equivalent.

(13) Install detent plug in end of Installer 8123. Position plug on detent spring and compress spring until detent plug pilots in detent plunger bore. Drive detent plug into transmission case until plug seats.

(14) Install backup light switch (Fig. 87).

(15) Install input shaft snap ring (Fig. 88).

(16) Install **new** oil seal in front bearing retainer with Installer 6448 (Fig. 89).

(17) Apply bead of Mopar® Silicone Sealer or equivalent to flange surface of front bearing retainer.

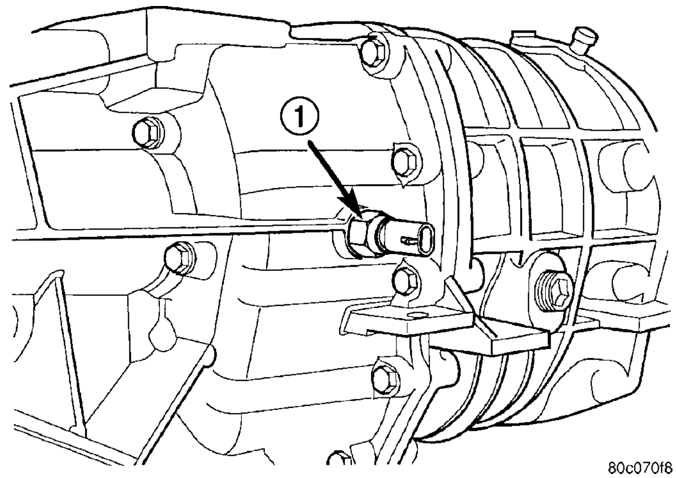


Fig. 87 BACKUP LIGHT SWITCH

1 - BACKUP LAMP SWITCH

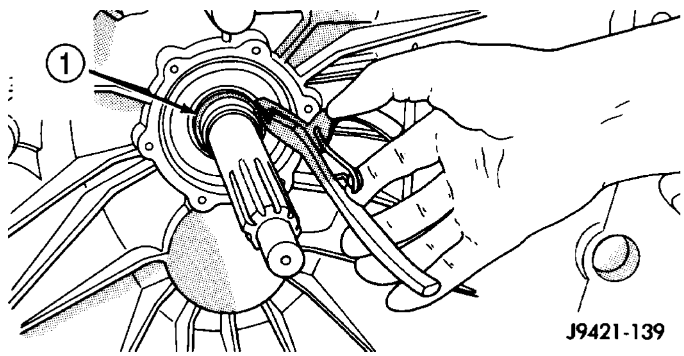


Fig. 88 INPUT SHAFT SNAP RING

1 - INPUT SHAFT SNAP RING

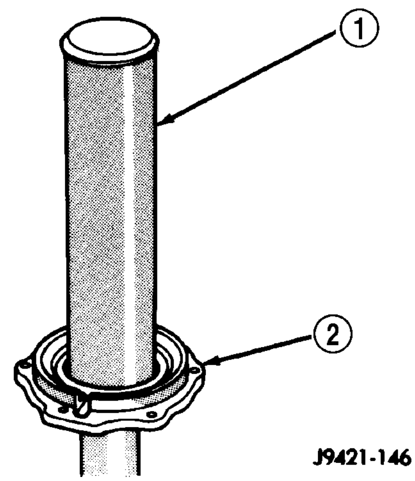


Fig. 89 BEARING RETAINER OIL SEAL

1 - INSTALLER
2 - FRONT BEARING RETAINER

MANUAL - NV1500 (Continued)

(18) Align and install front bearing retainer over input shaft and onto housing mounting surface (Fig. 90). Although retainer is one-way fit on housing, be sure bolt holes are aligned before seating retainer.

NOTE: Be sure that no sealer gets into the oil feed hole in the transmission case or bearing retainer.

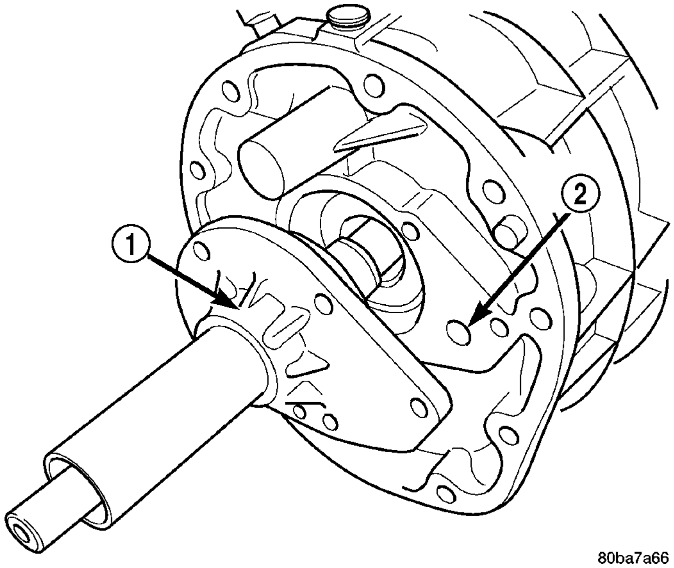


Fig. 90 INPUT SHAFT BEARING RETAINER

1 - BEARING RETAINER
2 - OIL FEED

(19) Install and tighten bearing retainer bolts to 29 N·m (21.4 ft. lbs.) (Fig. 91).

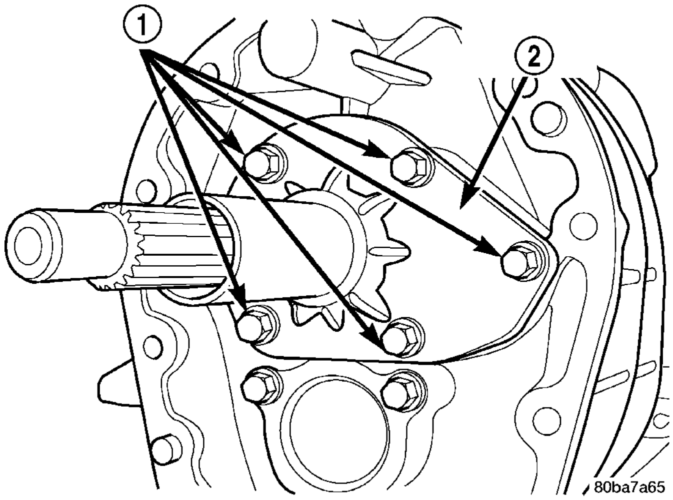


Fig. 91 INPUT SHAFT BEARING RETAINER BOLTS

1 - BOLTS (5)
2 - BEARING RETAINER

SHIFT TOWER AND LEVER

(1) Apply petroleum jelly to ball end of shift lever and interior of shift socket.

(2) Shift the transmission into third gear.

(3) Align and install shift tower and lever assembly (Fig. 92). Verify shift ball is seated in socket and offset in the tower is toward the passenger side of the vehicle before installing tower bolts.

(4) Install shift tower bolts (Fig. 93) and tighten bolts to 8.5 N·m (75.2 in. lbs.).

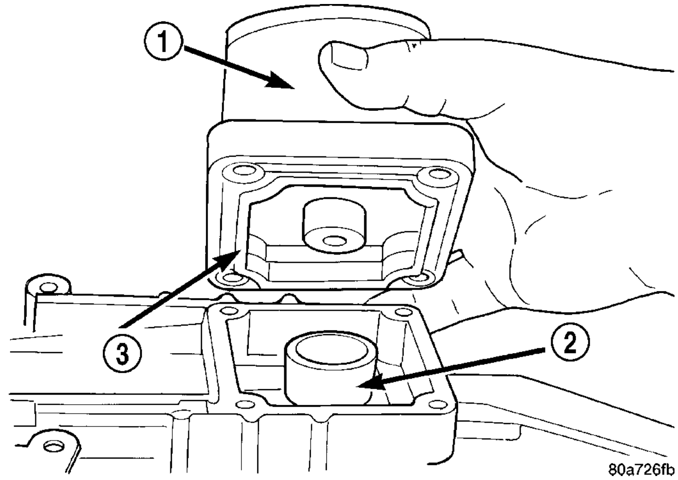


Fig. 92 SHIFT TOWER

1 - SHIFT TOWER AND LEVER ASSEMBLY
2 - SHIFT SOCKET
3 - SEAL

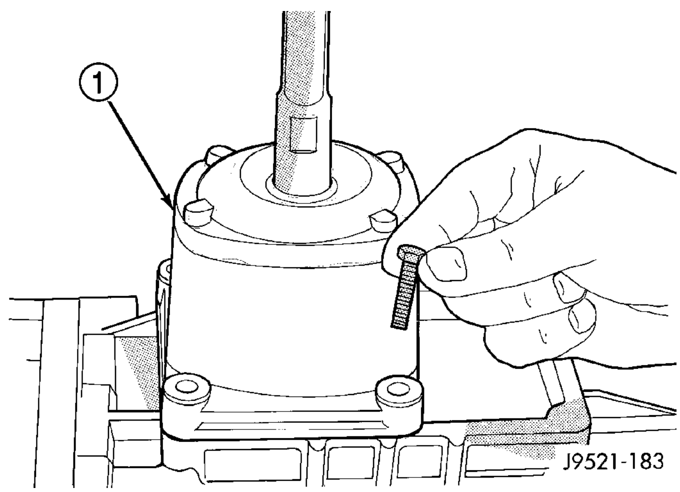


Fig. 93 SHIFT TOWER BOLT

1 - SHIFT TOWER AND LEVER ASSEMBLY

(5) Fill transmission to bottom edge of fill plug hole with Mopar® Transmission.

(6) Install and tighten fill plug to 34 N·m (25 ft. lbs.).

(7) Check transmission vent. Be sure vent is open and not restricted.

INSTALLATION

(1) Install clutch housing on transmission and tighten housing bolts to 46 N·m (34 ft. lbs.).

MANUAL - NV1500 (Continued)

(2) Lubricate contact surfaces of release fork pivot ball stud and release fork with high temp grease.

(3) Install release bearing, fork and retainer clip.

(4) Position and secure transmission on transmission jack.

(5) Lightly lubricate pilot bearing and transmission input shaft splines with Mopar high temp grease.

(6) Raise transmission and align transmission input shaft and clutch disc splines. Then slide transmission into place.

(7) Install clutch housing-to-engine bolts and tighten to 75 N·m (55 ft.lbs.) (Fig. 94).

NOTE: Be sure the housing is properly seated on engine block before tightening bolts.

(8) Install shift tower and bolts. Tighten bolts to 11 N·m (8 ft.lbs.).

(9) Install transmission mount and tighten bolts to 54 N·m (40 ft. lbs.).

(10) Install transfer case, shift linkage and vent hose.

(11) Install wire connectors to transmission and transfer case.

(12) Install skid plate/crossmember and tighten bolts to 41 N·m (31 ft. lbs.).

(13) Remove support stands from engine and transmission.

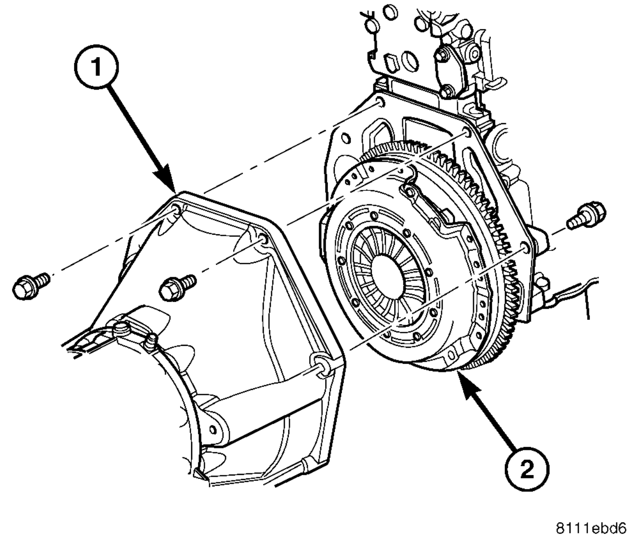


Fig. 94 NV1500 TRANSMISSION

1 - TRANSMISSION
2 - CLUTCH ASSEMBLY

(14) Install propeller shafts.

(15) Install slave cylinder in clutch housing.

(16) Install starter motor.

(17) Install transmission dust shield.

SPECIFICATIONS

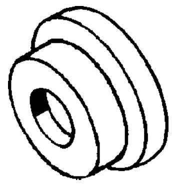
MANUAL

TORQUE SPECIFICATIONS

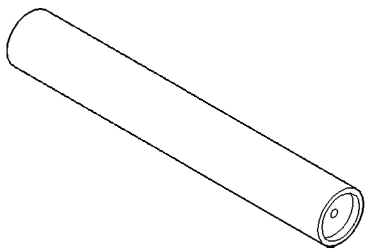
DESCRIPTION	N·m	Ft. Lbs.	In. lbs.
Back up Lamp Switch	41	30	-
Coutershaft Bearing Shim Cap	41	30	-
Bearing Retainer - Front	41	30	-
Bearing Retainer - Rear	34	25	-
Drain/Fill Plug	34	25	-
Shift Shaft Lock Bolt	27	20	-
Idler Shaft Bolts - M8	27	20	-
Idler Shaft Bolts - M10	52	40	-
Shift Tower Bolts	11	8	100
Clutch Housing Bolts	46	34	-
Transmission Bolts	75	55	-
Skid Plate Bolts	41	31	-
Transmission mount bolts	54	40	-

MANUAL - NV1500 (Continued)

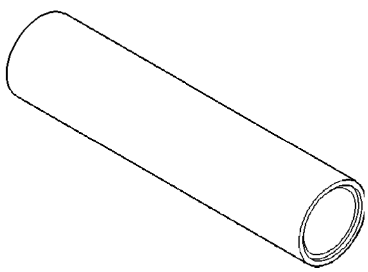
SPECIAL TOOLS



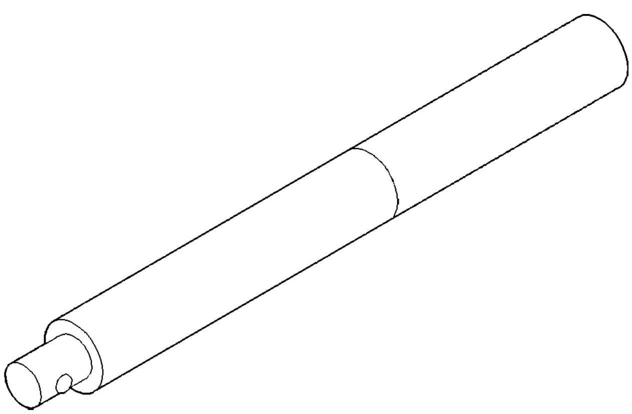
INSTALLER C-4656



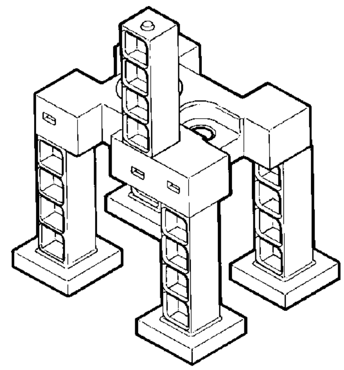
INSTALLER 8123



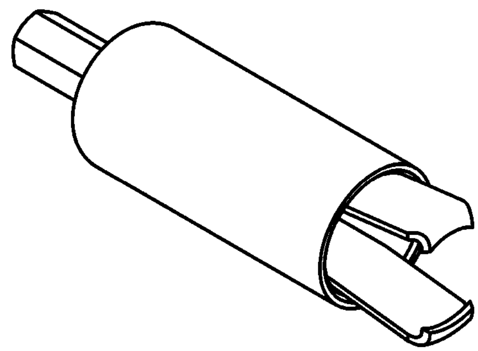
INSTALLER 6448



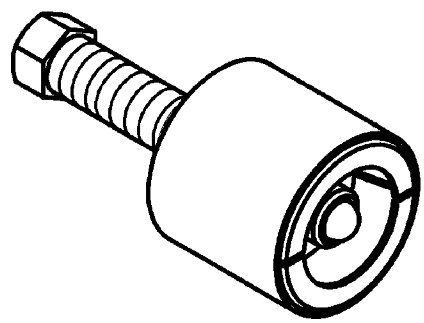
HANDLE C-4171



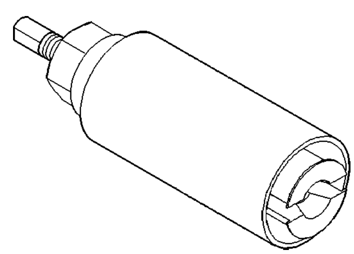
SUPPORT STAND 8355



REMOVER 8117A

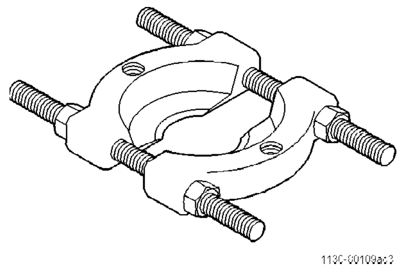


REMOVER 8356

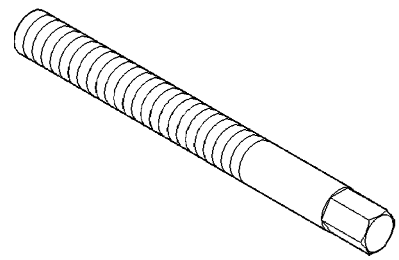


REMOVER L-4454

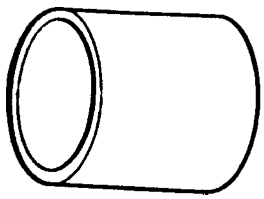
MANUAL - NV1500 (Continued)



SPLITTER BEARING 1130



STUD ALIGNMENT 8120



CUP 6310-1

MANUAL - NV3550

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MANUAL - NV3550

DESCRIPTION

The NV3550 is a medium-duty, 5-speed, constant mesh, fully synchronized manual transmission. The transmission is a four-wheel drive configurations.

The transmission gear case consists of two aluminum housings. The clutch housing is a removable component. It is not an integral part of the transmission front housing.

A combination of roller and ball bearings are used to support the transmission shafts in the two housings. The transmission gears all rotate on caged type needle bearings. A roller bearing is used between the input and output shaft.

The NV3550 has a single shaft shift mechanism with three shift forks all mounted on the shaft. The shaft is supported in the front and rear housings by bushings and one linear ball bearing. Internal shift components consist of the forks, shaft, shift lever socket and detent components.

The transmission drain plug is located on the bottom and fill plug on the side.

The NV3550 identification and part number bar code tags (Fig. 1) are located on the top of the transmission, forward of the shift tower.

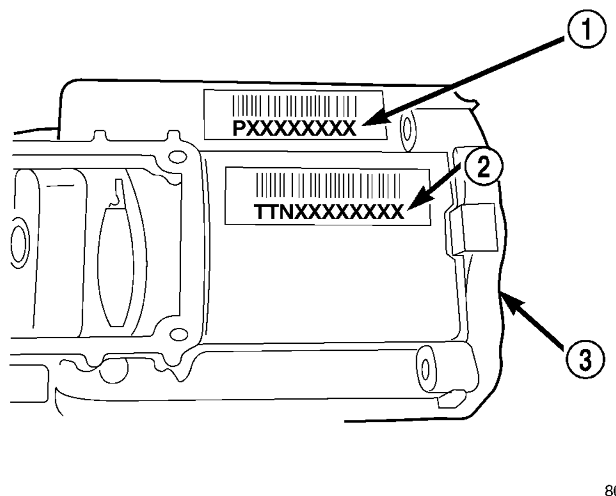


Fig. 1 NV3550 Identification

1 - PART NUMBER TAG
2 - IDENTIFICATION TAG
3 - FRONT OF REAR HOUSING

OPERATION

The driver selects a particular gear by moving the shift lever to the desired gear position. This movement moves the internal transmission shift components to begin the shift sequence. As the shift lever moves the selected shift rail, the shift fork attached to that rail begins to move. The fork is positioned in a groove in the outer circumference of the synchronizer sleeve. As the shift fork moves the synchronizer sleeve, the synchronizer begins to speed-up or slow down the selected gear (depending on whether we are up-shifting or down-shifting). The synchronizer does this by having the synchronizer hub splined to the mainshaft and moving the blocker ring into contact with the gear's friction cone. As the blocker ring and friction cone come together, the gear speed is brought up or down to the speed of the synchronizer. As the two speeds match, the splines on the inside of the synchronizer sleeve become aligned with the teeth on the blocker ring and the friction cone and eventually will slide over the teeth, locking the gear to the mainshaft through the synchronizer.

DIAGNOSIS AND TESTING

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill or an incorrect lubricant level check.

MANUAL - NV3550 (Continued)

Leaks can occur at the mating surfaces of the gear case and adaptor or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at the rear of the extension or adapter housing will be from the housing oil seals. Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non-recommended sealer.

A leak at the front of the transmission will be from either the front bearing retainer or retainer seal. Lubricant may be seen dripping from the clutch housing after extended operation. If the leak is severe, it may also contaminate the clutch disc causing the disc to slip, grab, and/or chatter.

A correct lubricant level check can only be made when the vehicle is level. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an underfill or overfill condition. Always check the lubricant level after any addition of fluid to avoid an incorrect lubricant level condition.

HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper, or contaminated lubricants. The consequence of using non–recommended lubricants is noise, excessive wear, internal bind, and hard shifting. Substantial lubricant leaks can result in gear, shift rail, synchro, and bearing damage. If a leak goes undetected for an extended period, the first indications of component damage are usually hard shifting and noise.

Shift component damage, incorrect clutch adjustment, or a damaged clutch pressure plate or disc are additional probable causes of increased shift effort. Incorrect adjustment or a worn/damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result. Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears generate a mild whine that is audible, but generally only at extreme speeds.

Severe, highly audible transmission noise is generally the initial indicator of a lubricant problem. Insufficient, improper, or contaminated lubricant will promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear and bearing damage.

REMOVAL

(1) Shift transmission into first or third gear.

(2) Remove floor console and shift boot as necessary to access the bottom of the shift lever at the shift tower attachment.

(3) Remove shift tower bolts and remove shift tower and shift lever assembly.

(4) Raise and support vehicle on suitable safety stands.

(5) Support engine with adjustable jack stand. Position wood block between jack and oil pan to avoid damaging pan.

(6) Remove skid plate, if equipped.

(7) Remove crossmember.

(8) Disconnect necessary exhaust system components.

(9) Remove slave cylinder (Fig. 2) from clutch housing.

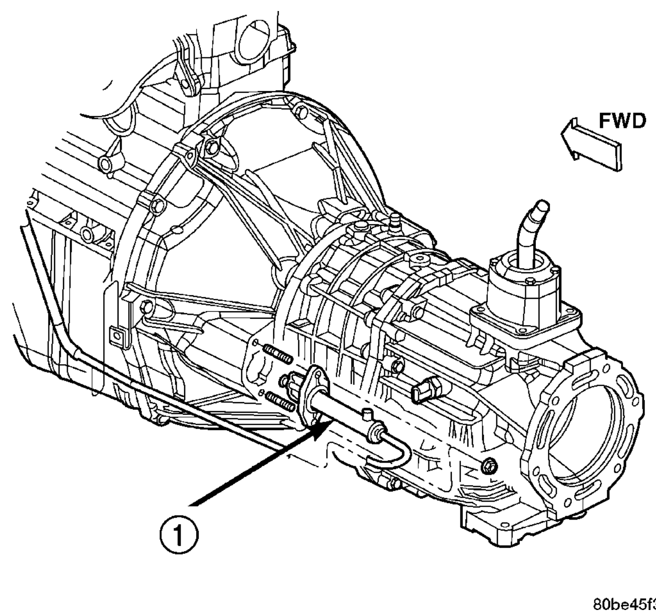


Fig. 2 SLAVE CYLINDER

1 - CLUTCH SLAVE CYLINDER

(10) Remove propeller shafts.

(11) Unclip wire harnesses from transmission and transfer case.

(12) Disconnect transfer case shift linkage at transfer case.

(13) Remove nuts attaching transfer case to transmission.

(14) Remove transfer case.

MANUAL - NV3550 (Continued)

(15) Remove crankshaft position sensor (Fig. 3).

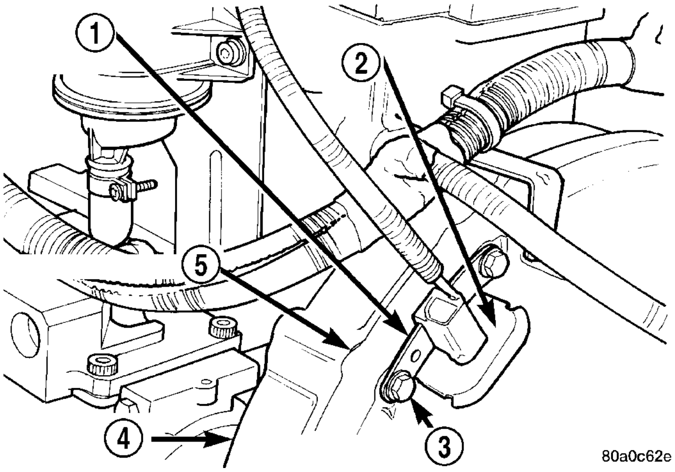


Fig. 3 CRANKSHAFT POSITION SENSOR

1 - CRANKSHAFT POSITION SENSOR
2 - GROMMET
3 - MOUNTING BOLT(S)
4 - LEFT REAR OF ENGINE
5 - TRANSMISSION

CAUTION: The crankshaft position sensor must be removed prior to transmission removal. Failure to heed caution may result in damage.

(16) Support engine with adjustable jack stand. Position wood block between jack and oil pan to avoid damaging pan.

(17) Support transmission with transmission jack.

(18) Secure transmission to jack with safety chains.

(19) Disconnect rear cushion and bracket from transmission.

(20) Remove rear crossmember.

(21) Remove clutch housing-to-engine bolts.

(22) Pull transmission jack rearward until input shaft clears clutch. Then slide transmission out from under vehicle.

(23) Remove clutch release bearing, release fork and retainer clip.

(24) Remove clutch housing from transmission.

DISASSEMBLY

FRONT HOUSING

(1) Shift transmission into Neutral.

(2) Remove drain plug and drain lubricant.

(3) Inspect drain plug magnet for debris.

(4) Remove backup light switch. Switch is located on passenger side of rear housing (Fig. 4).

(5) Remove shift tower bolts and remove tower and lever assembly (Fig. 5).

(6) Remove shift shaft lock bolt (Fig. 6) located on top of the housing just forward of shift tower.

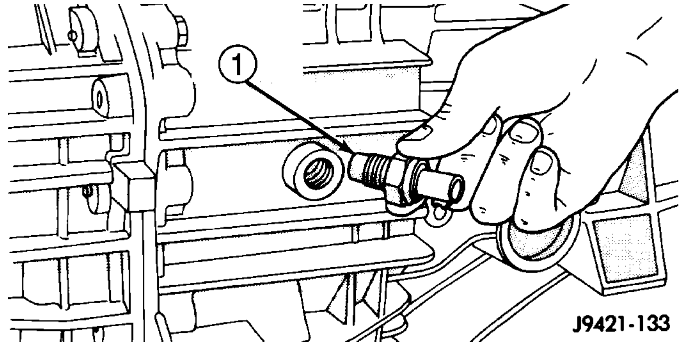


Fig. 4 BACKUP LIGHT SWITCH

1 - BACKUP LIGHT SWITCH

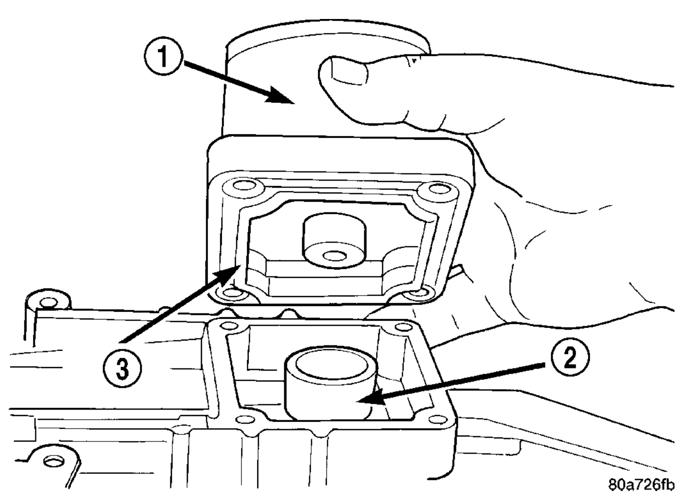


Fig. 5 SHIFT TOWER

1 - SHIFT TOWER AND LEVER ASSEMBLY
2 - SHIFT SOCKET
3 - SEAL

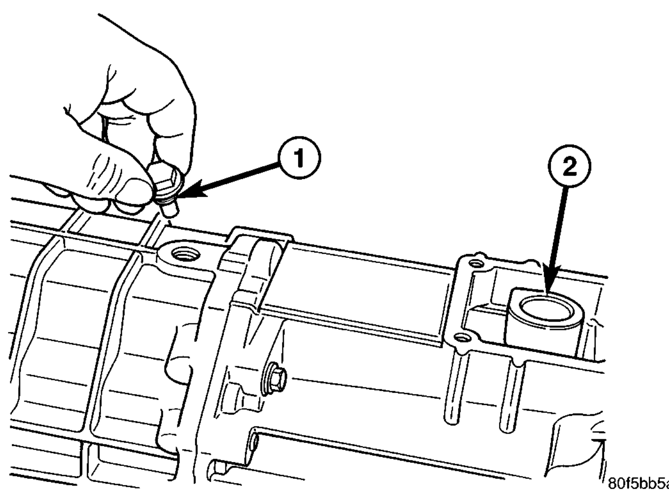


Fig. 6 SHAFT LOCK BOLT

1 - SHIFT SHAFT LOCK BOLT
2 - SHAFT SOCKET

MANUAL - NV3550 (Continued)

(7) Remove shift shaft detent plug with Remover 8117A. Attach the fingers of the remover to the detent plug (Fig. 7). Then push the cup down till it contacts the trans. Tighten the nut (Fig. 8) till it pulls the plug from the trans case.

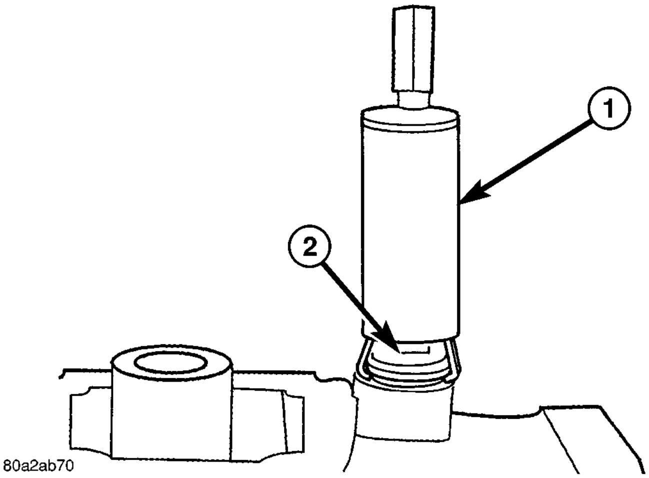


Fig. 7 DETENT PULLER

1 - REMOVER
2 - DETENT PLUG

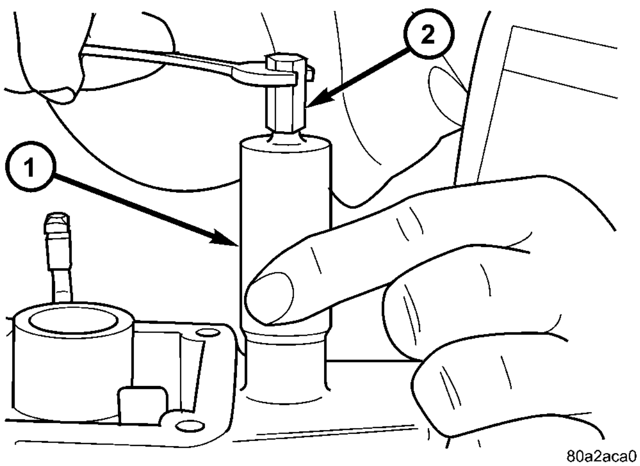


Fig. 8 PULL DETENT PLUG

1 - NUT
2 - REMOVER

(8) Remove shift shaft detent plunger and spring. Remove spring and plunger with a pencil magnet.

(9) Remove bolts attaching input shaft bearing retainer to front housing and remove retainer.

NOTE: Use pry tool to carefully lift retainer and break sealer bead (Fig. 9).

(10) Remove bearing retainer from input shaft (Fig. 10).

(11) Remove snap ring that secures input shaft in front bearing (Fig. 11).

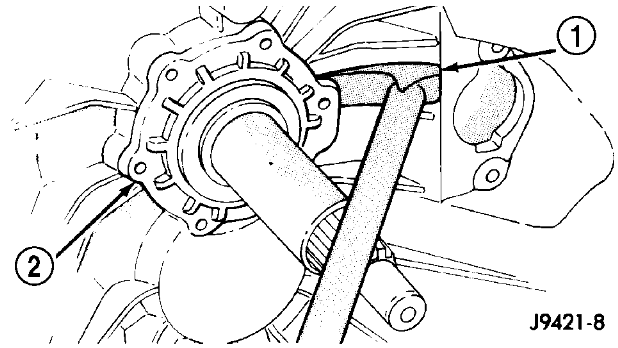


Fig. 9 BEARING RETAINER

1 - PRY TOOL
2 - BEARING RETAINER

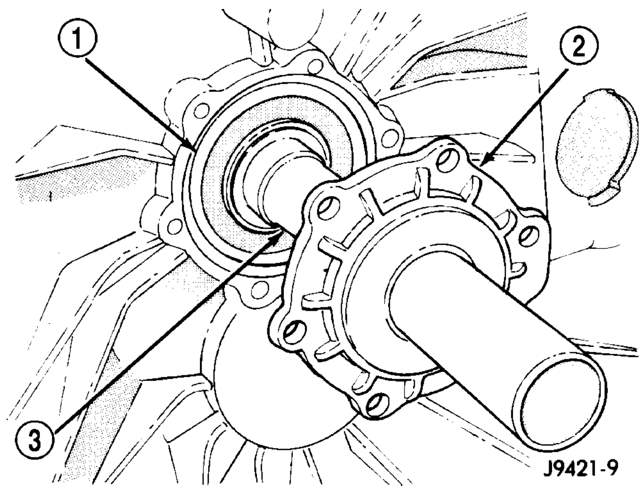


Fig. 10 INPUT SHAFT BEARING RETAINER

1 - SHAFT BEARING
2 - BEARING RETAINER
3 - INPUT SHAFT

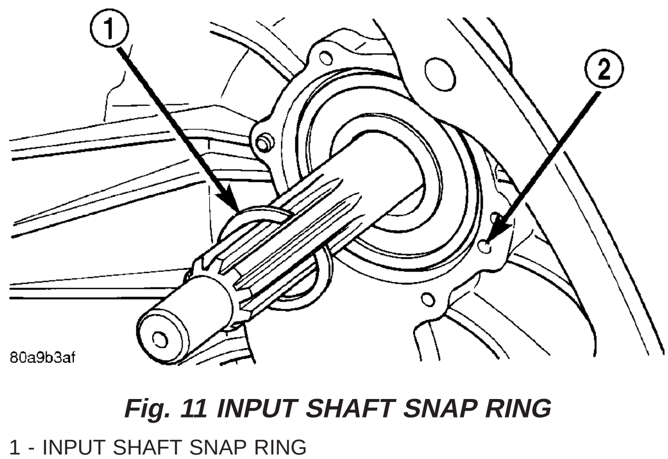


Fig. 11 INPUT SHAFT SNAP RING

1 - INPUT SHAFT SNAP RING
2 - OIL FEED

MANUAL - NV3550 (Continued)

(12) Remove bolts that attach front housing to rear housing.

(13) Separate front housing from rear housing (Fig. 12). With a plastic mallet tap the front housing off the alignment dowels.

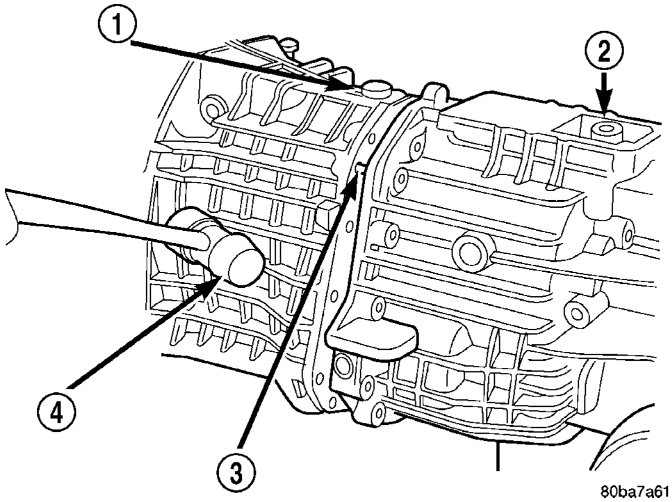


Fig. 12 FRONT HOUSING

1 - FRONT HOUSING
2 - REAR HOUSING
3 - DOWELS (2)
4 - PLASTIC MALLET

(14) Remove and inspect input shaft bearing and countershaft front bearing (Fig. 13).

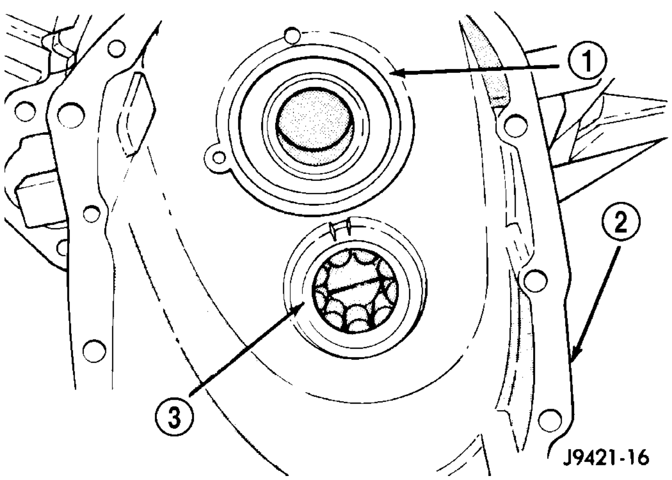


Fig. 13 INPUT AND COUNTERSHAFT BEARING RACE

1 - INPUT SHAFT BEARING
2 - FRONT HOUSING
3 - COUNTERSHAFT FRONT BEARING

(15) Remove screw from reverse blocker and remove blocker (Fig. 14) from case.

NOTE: The reverse blocker is only used on RHD vehicles.

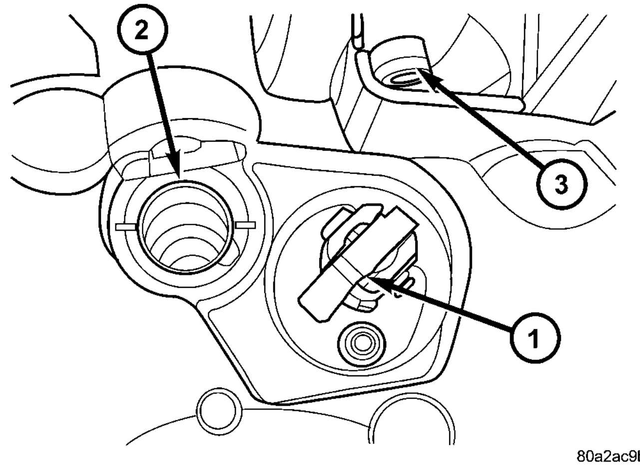


Fig. 14 REVERSE BLOCKER (RHD)

1 - REVERSE BLOCKER
2 - SHIFTER SHAFT BUSHING
3 - VENT

(16) Note the location of the input shaft, shift shaft, shift forks and geartrain (Fig. 15).

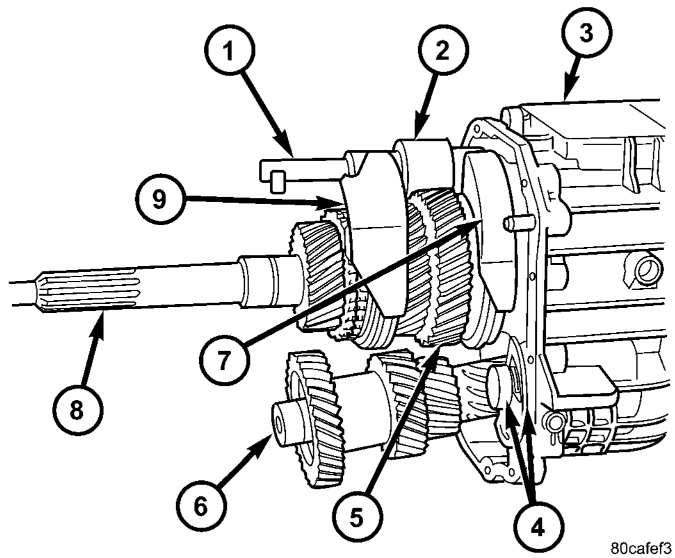


Fig. 15 GEARTRAIN AND SHIFT COMPONENTS

1 - SHIFT SHAFT
2 - BUSHING
3 - REAR HOUSING
4 - REVERSE IDLER ANSD SUPPORT
5 - OUTPUT SHAFT AND GEARS
6 - COUNTERSHAFT
7 - 1-2 SHIFT FORK
8 - INPUT SHAFT
9 - 3-4 SHIFT FORK

MANUAL - NV3550 (Continued)

SHIFT/FORK SHAFTS AND REVERSE IDLER SEGMENT

(1) Unseat the roll pin that secures the shift socket to the shift shaft with Remover 6858 as follows:

(a) Position remover on the shift shaft. Center the tool over the roll pin and verify that the tool legs are firmly seated on the shift socket (Fig. 16).

(b) Tilt the socket toward the side of the case. This positions the roll pin at a slight angle to avoid trapping the pin between the gear teeth.

(c) Tighten the tool to press the roll pin downward and out of the shift socket (Fig. 16).

NOTE: Press the roll pin just enough to clear the shift shaft. Be careful not to push the pin into the geartrain.

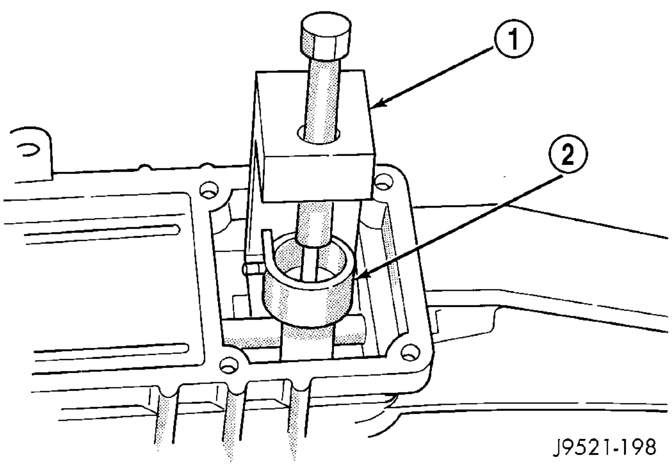


Fig. 16 SHIFT SOCKET ROLL PIN

1 - REMOVER
2 - SHIFT SOCKET

(2) Rotate lever and bushing upward and out of the shift forks and catch detent ball and spring (Fig. 17) as they exit the shaft lever.

NOTE: Place shop towel over shaft to contain detent ball and spring.

(3) With a hammer and punch drive out roll pin that secures shift bushing and lever to shift shaft (Fig. 18).

CAUTION: Use proper size punch to avoid bending the shift shaft.

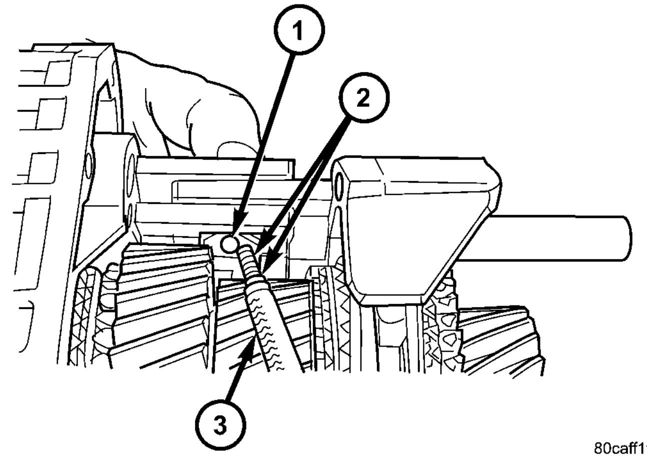


Fig. 17 DETENT SPRING AND BALL

1 - SHAFT LEVER
2 - SPRING AND BALL
3 - MAGNET

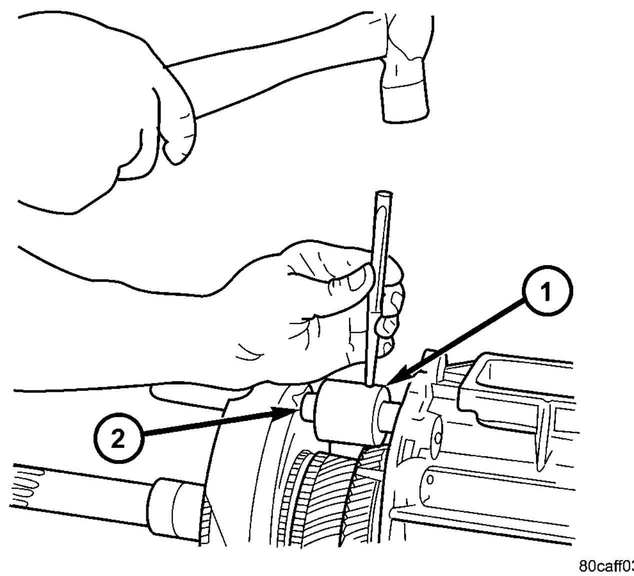


Fig. 18 SHIFT SHAFT LEVER AND BUSHING ROLL PIN

1 - LEVER AND BUSHING
2 - SHIFT SHAFT

MANUAL - NV3550 (Continued)

(4) Pull shift shaft straight (Fig. 19) out of rear housing.

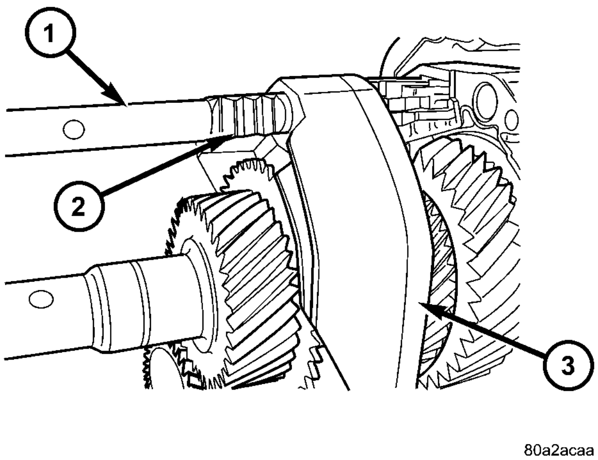


Fig. 19 SHIFT SHAFT

1 - SHIFTER SHAFT
2 - SHIFTER SHAFT DETENT
3 - 3-4 SHIFT FORK

(5) Remove shift socket from rear housing (Fig. 20).

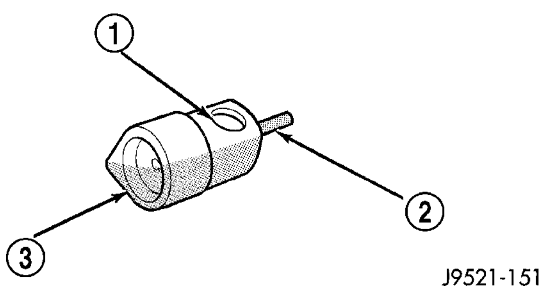


Fig. 20 SHIFT SOCKET AND ROLL PIN

1 - SHAFT BORE
2 - ROLL PIN
3 - SHIFT SOCKET

(6) Remove lever and bushing (Fig. 21).

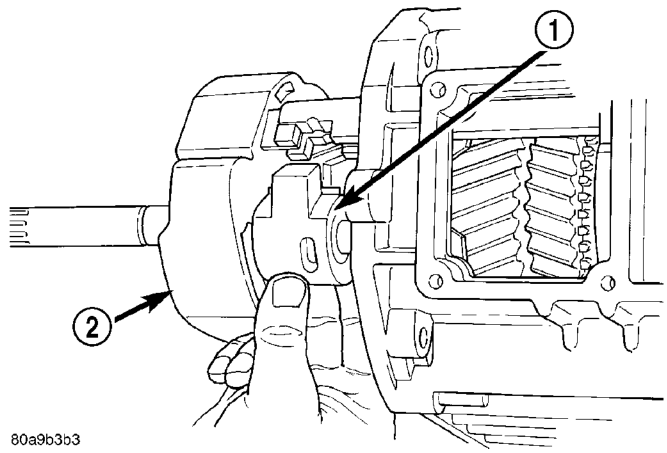


Fig. 21 SHIFT SHAFT LEVER AND BUSHING

1 - SHAFT LEVER AND BUSHING
2 - 3-4 FORK

(7) Rotate 3-4 fork around synchro sleeve until fork clears shift arms on 1-2 and fifth-reverse forks, then remove 3-4 fork (Fig. 22).

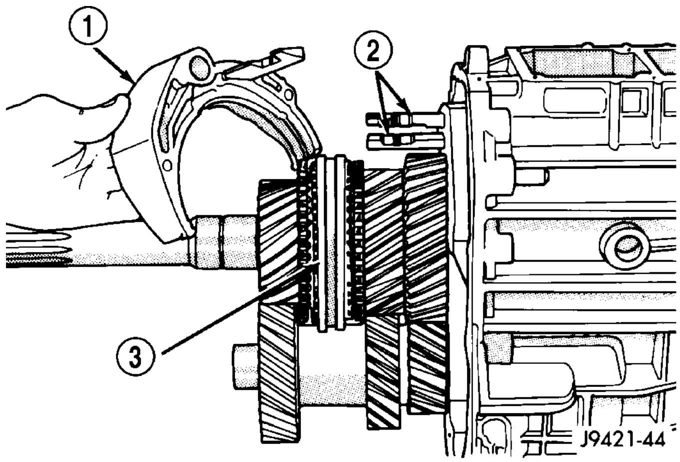


Fig. 22 3-4 SHIFT FORK

1 - 3-4 FORK
2 - 1-2 AND 5TH-REVERSE FORK ARMS
3 - 3-4 SYNCHRO SLEEVE

MANUAL - NV3550 (Continued)

(8) Remove the reverse idler shaft support bolt (front bolt) (Fig. 23).

(9) Loosen rear reverse idler shaft bolt (rear bolt) (Fig. 23).

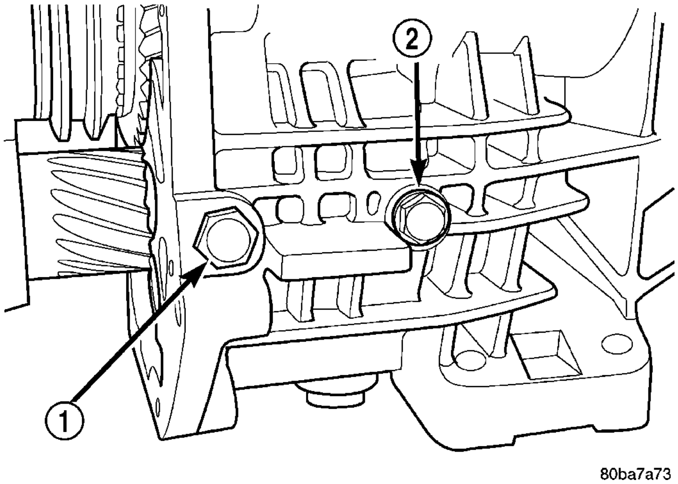


Fig. 23 REVERSE IDLER SHAFT/SUPPORT BOLT

1 - SUPPORT BOLT
2 - SHAFT BOLT

(10) Remove reverse idler shaft support (Fig. 24) segment by sliding it straight out of housing.

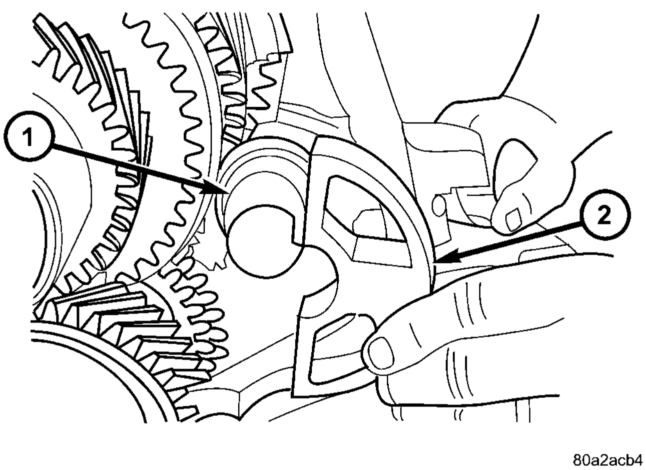


Fig. 24 IDLER SHAFT SUPPORT

1 - IDLER SHAFT
2 - IDLER SHAFT SUPPORT

(11) Support geartrain and rear housing on Fixture 6747 as follows:

(a) Adjust height of reverse idler pedestal rod until the reverse idle shaft bottoms in Cup 8115.

(b) Position Adapters 6747-1A and 6747-2A on Fixture 6747.

(c) Slide fixture tool onto input shaft, countershaft and idler gear (Fig. 25).

(d) Stand geartrain and rear housing upright on fixture (Fig. 26). Have helper hold fixture tool in place while housing and geartrain is being rotated into upright position.

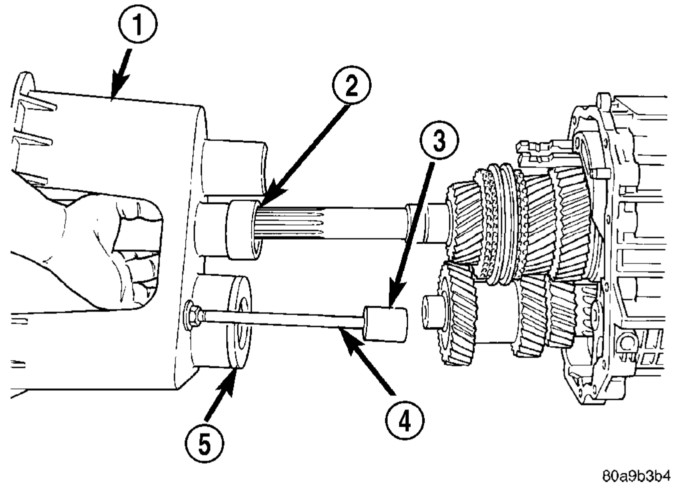


Fig. 25 FIXTURE ASSEMBLY

1 - FIXTURE
2 - ADAPTER 6747-1A
3 - CUP ADAPTER
4 - REVERSE IDLER PEDESTAL
5 - ADAPTER 6747-2A

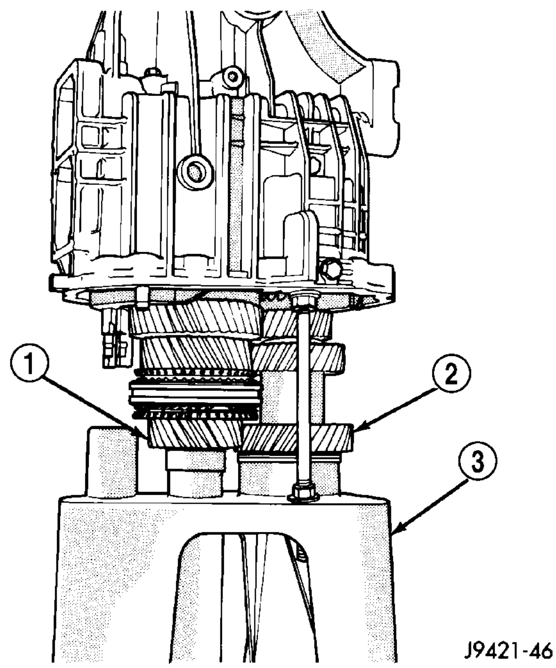


Fig. 26 GEARTRAIN/HOUSING FIXTURE

1 - INPUT SHAFT
2 - COUNTERSHAFT
3 - FIXTURE

(12) Remove rear bolt holding reverse idler shaft in housing.

MANUAL - NV3550 (Continued)

REAR ADAPTER HOUSING

(1) Locate rear seal dimples (Fig. 27). With slide hammer mounted screw, remove rear seal by inserting screw into one of the seal dimples (Fig. 28).

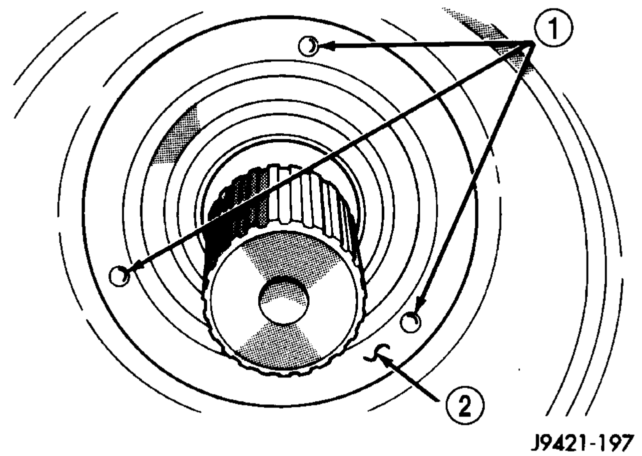


Fig. 27 SEAL DIMPLES

1 - LOCATION OF DIMPLES
2 - SEAL FACE

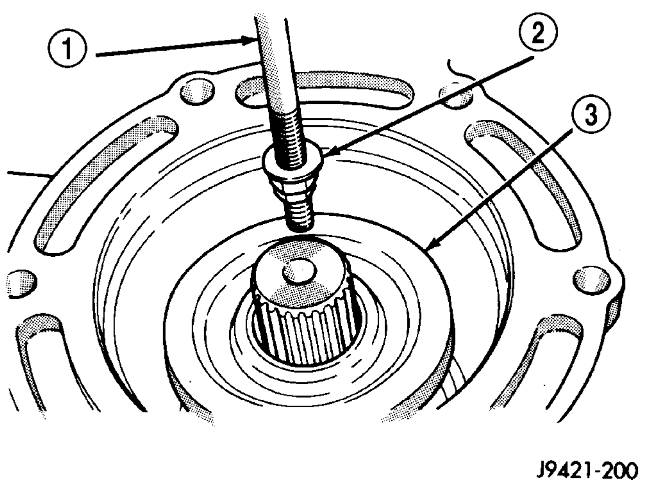


Fig. 28 REAR SEAL

1 - SLIDE HAMMER
2 - REMOVER
3 - REAR SEAL

(2) Remove rear bearing snap ring from output shaft with snap ring pliers (Fig. 29).

(3) Lift rear adapter housing upward and off geartrain (Fig. 30).

(4) Remove bearing retainer bolts and remove rear bearing retainer and rear bearing (Fig. 31). If needed push or tap bearing out of the housing with a hammer.

(5) Examine condition of bearing bore, countershaft rear bearing race and idler shaft notch in rear housing. Replace housing if race, bore or notch are worn or damaged.

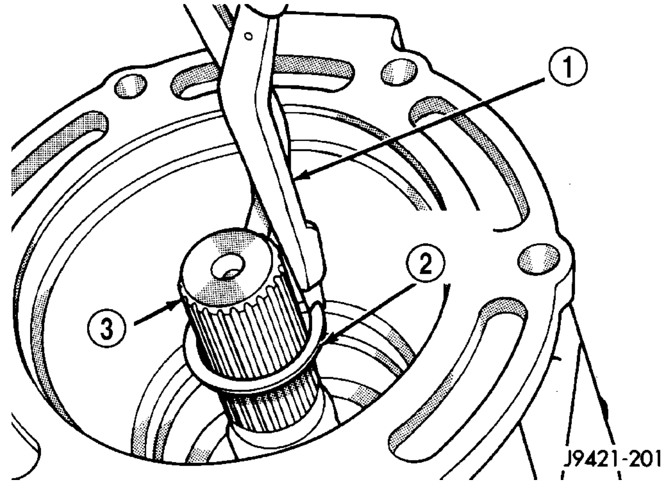


Fig. 29 REAR BEARING SNAP RING

1 - SNAP RING PLIERS
2 - REAR BEARING SNAP RING
3 - OUTPUT SHAFT

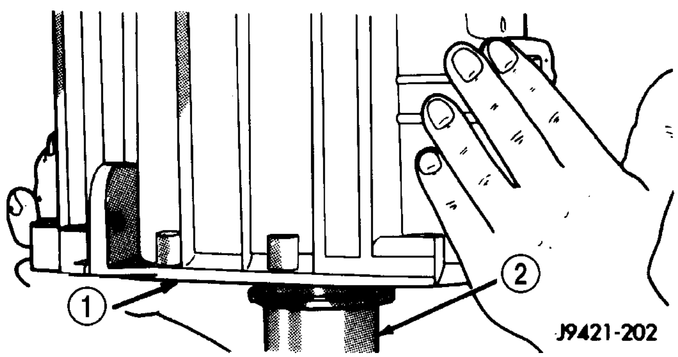


Fig. 30 REAR ADAPTER HOUSING

1 - REAR ADAPTER HOUSING
2 - OUTPUT SHAFT

GEARTRAIN FROM FIXTURE

(1) Remove reverse idler gear assembly from assembly fixture cup.

(2) Remove 1-2 and fifth-reverse forks from synchro sleeves.

(3) Slide countershaft out of fixture tool.

(4) Lift and remove output shaft and gears off input shaft.

(5) Lift and remove input shaft, pilot bearing and fourth gear synchro ring from assembly fixture tool.

OUTPUT SHAFT

NOTE: The synchronizer hubs and sleeves are different and must not be intermixed. Remove each synchronizer unit as an assembly to avoid intermixing parts. Reference mark or tag each synchro hub and sleeve for correct assembly.

(1) Remove snap ring that secures 3-4 synchro hub on output shaft.

MANUAL - NV3550 (Continued)

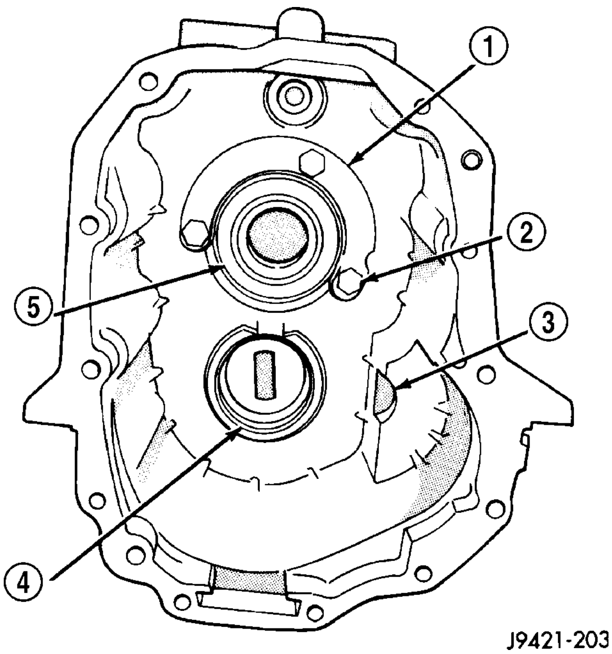


Fig. 31 REAR ADAPTER HOUSING COMPONENTS

1 - BEARING RETAINER
2 - RETAINER BOLTS (3)
3 - IDLER SHAFT NOTCH
4 - COUNTERSHAFT REAR BEARING RACE
5 - REAR BEARING

(2) Remove 3-4 synchro assembly, third gear synchro ring and third gear with shop press and Bearing Splitter 1130. Position splitter between second and third gears.

(3) Remove third gear needle bearing (Fig. 32).

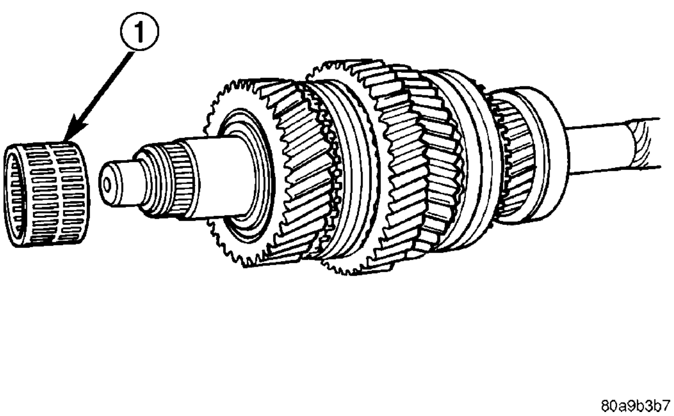


Fig. 32 THIRD GEAR NEEDLE BEARING

1 - THIRD GEAR NEEDLE BEARING

(4) Remove retaining ring that secures two-piece thrust washer on shaft (Fig. 33). Use a small pry tool to remove retaining ring.

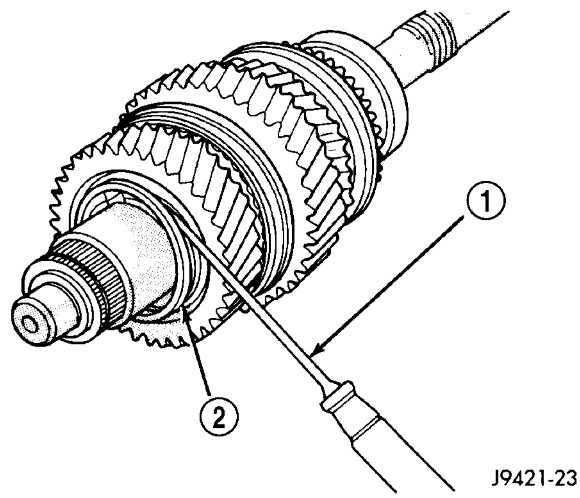


Fig. 33 THRUST WASHER

1 - PRY TOOL
2 - THRUST WASHER RETAINING RING

(5) Remove two-piece thrust washer (Fig. 34). Note position of washer locating lugs in shaft notches for installation reference.

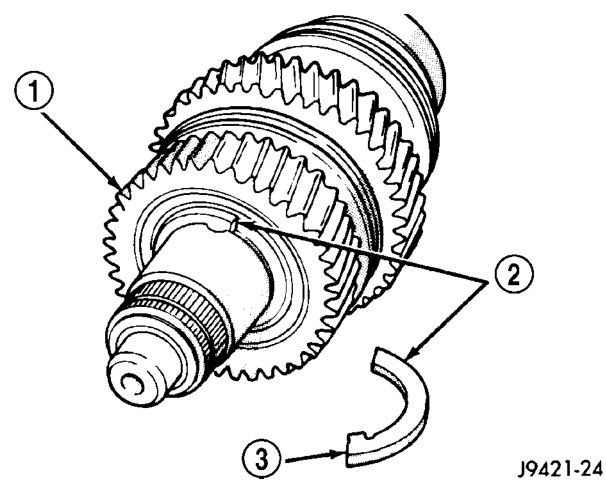


Fig. 34 TWO-PIECE THRUST WASHER

1 - SECOND GEAR
2 - THRUST WASHER (2-PIECE)
3 - WASHER LOCATING LUG

MANUAL - NV3550 (Continued)

(6) Remove second gear and needle bearing (Fig. 35).

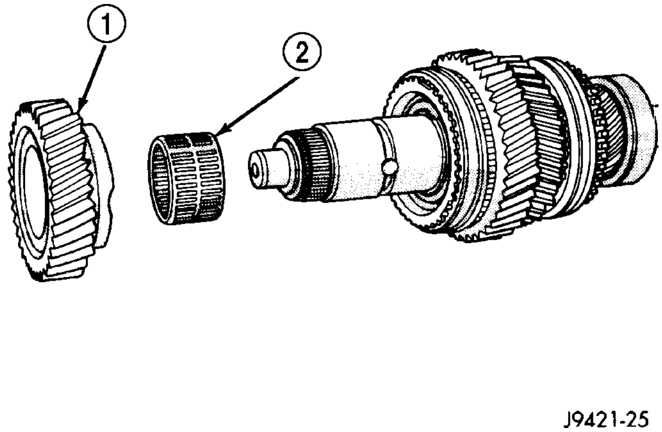


Fig. 35 SECOND GEAR AND NEEDLE BEARING

1 - SECOND GEAR
2 - SECOND GEAR NEEDLE BEARING

(7) Remove second gear synchro ring, synchro friction cone and synchro cone (Fig. 36).

(8) Remove interim ring.

(9) Remove 1-2 synchro hub snap ring.

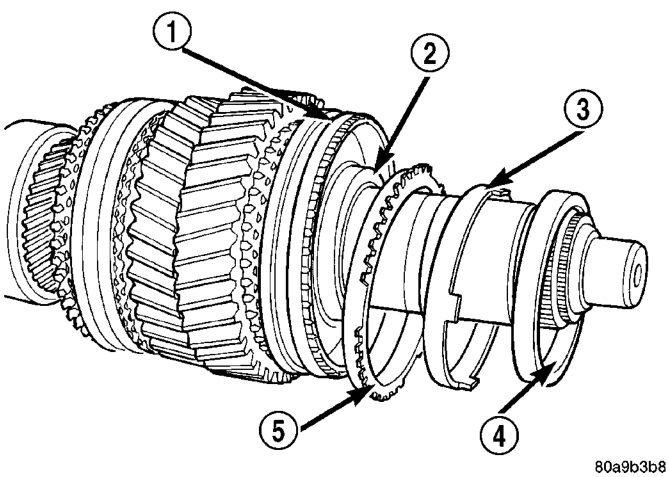


Fig. 36 SECOND GEAR SYNCHRO RING AND CONES

1 - 1-2 SYNCHRO HUB AND SLEEVE
2 - INTERM RING
3 - SYNCHRO FRICTION CONE
4 - SYNCHRO CONE
5 - SYNCHRO RING

(10) Remove 1-2 synchro hub and sleeve and first gear from output shaft with press and Bearing Splitter 1130 (Fig. 37). Position splitter between first and reverse gears.

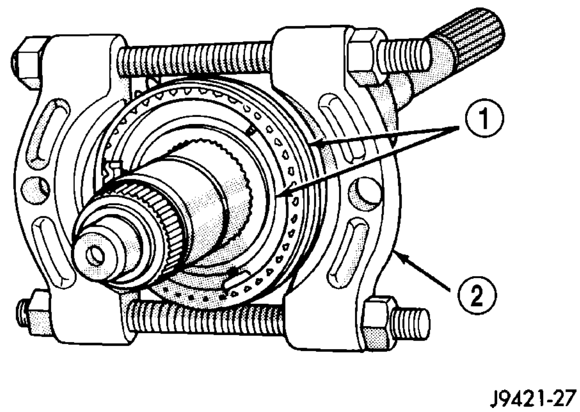


Fig. 37 HUB SLEEVE AND 1-2 SYNCHRO

1 - 1-2 SYNCHRO HUB AND SLEEVE
2 - SPLITTER

(11) Remove first gear needle bearing (Fig. 38).

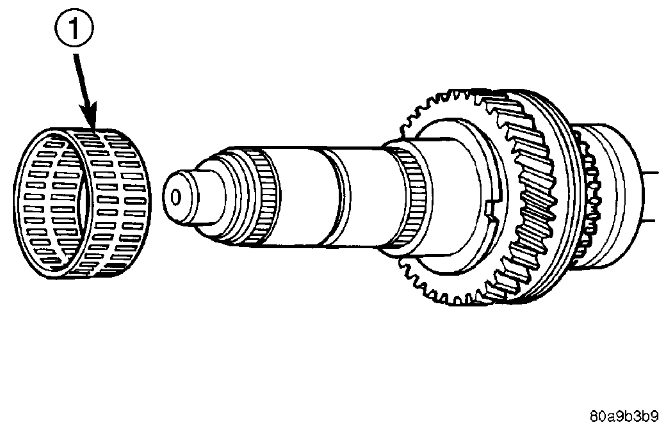


Fig. 38 FIRST GEAR NEEDLE BEARING

1 - FIRST GEAR NEEDLE BEARING

(12) Remove fifth gear (Fig. 39).

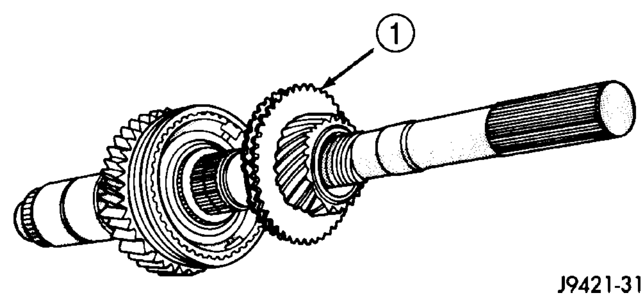


Fig. 39 FIFTH GEAR

1 - FIFTH GEAR AND SYNCHRO RING

MANUAL - NV3550 (Continued)

(13) Remove fifth gear needle bearing.

NOTE: Spread bearing apart just enough to clear shoulder on output shaft (Fig. 40).

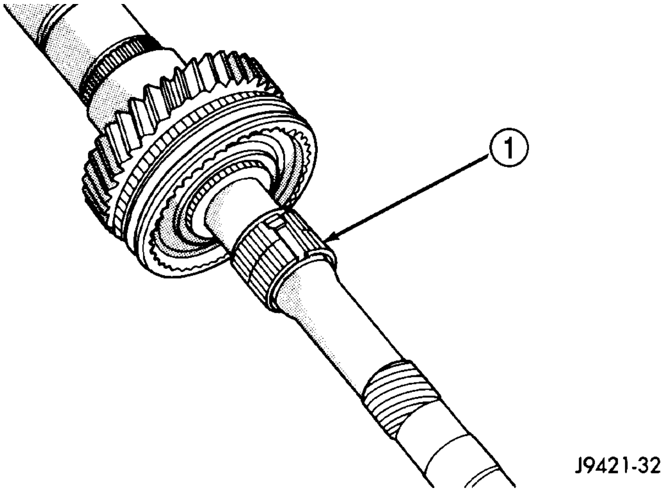


Fig. 40 FIFTH GEAR NEEDLE BEARING

1 - FIFTH GEAR NEEDLE BEARING

(14) Remove fifth-reverse synchro hub snap ring (Fig. 41).

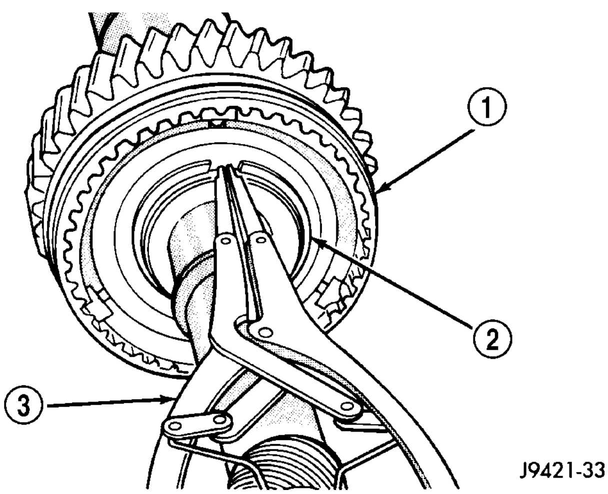


Fig. 41 FIFTH-REVERSE SYNCHRO HUB SNAP RING

1 - FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
2 - SYNCHRO HUB SNAP RING
3 - SNAP RING PLIERS

(15) Remove fifth-reverse synchro hub and sleeve with a press (Fig. 42).

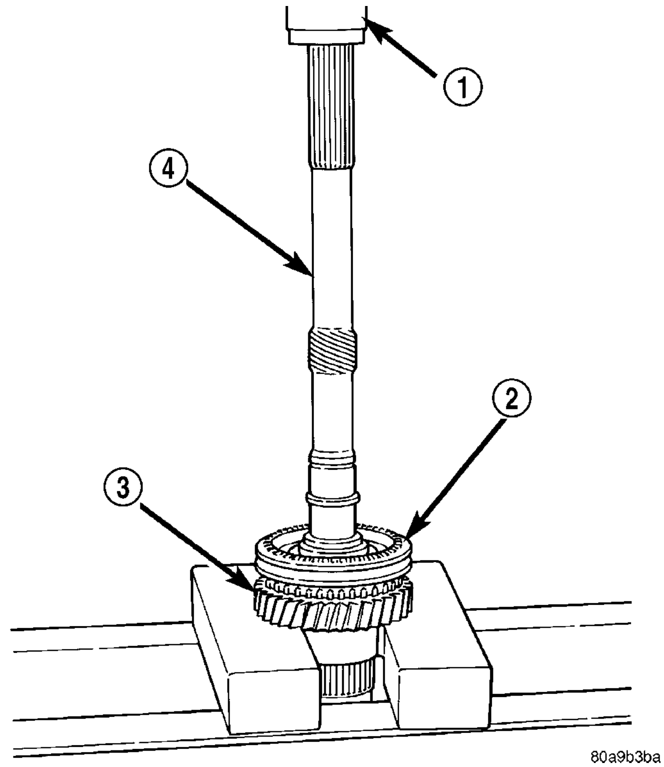


Fig. 42 FIFTH-REVERSE SYNCHRO HUB AND SLEEVE

1 - PRESS
2 - FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
3 - REVERSE GEAR
4 - OUTPUT SHAFT

(16) Remove reverse gear and needle bearing (Fig. 43).

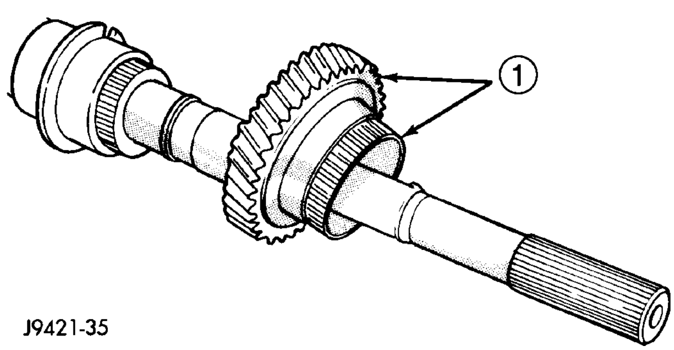


Fig. 43 REVERSE GEAR AND NEEDLE BEARING

1 - REVERSE GEAR AND NEEDLE BEARING

MANUAL - NV3550 (Continued)

REVERSE IDLER

(1) Remove idler gear snap rings (Fig. 44).

(2) Remove thrust washer, wave washer, thrust plate and idler gear from shaft.

(3) Remove idler gear needle bearing from shaft.

CLEANING

Clean the gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean the shaft bearings with a mild solvent such as Mopar® degreasing solvent, Gunk, or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry, or wipe them dry with clean shop towels.

INSPECTION

NOTE: Minor nicks on component surfaces can be smoothed with 320/420 grit emery soaked in oil and final polished with crocus cloth.

SHIFT LEVER ASSEMBLY

The shift lever assembly is not serviceable. Replace the lever and shift tower as an assembly if the tower, lever, lever ball, or internal components are worn, or damaged.

SHIFT SHAFT AND FORKS

Inspect the shift fork interlock arms and synchro sleeve contact surfaces (Fig. 45). Replace any fork exhibiting wear or damage in these areas. Do not attempt to salvage shift forks.

Check condition of the shift shaft detent plunger and spring. The plunger should be smooth and free of nicks, or scores. The plunger spring should be straight and not collapsed, or distorted. Replace the plunger and spring if in doubt about condition. Check condition of detent plunger bushings. Replace if damaged.

Inspect the shift shaft, shift shaft bushing and bearing, the shaft lever, and the lever bushing that fits over the lever. Replace the shaft if bent, cracked, or severely scored. Replace the shift shaft bushing or bearing if damaged.

Replace the shaft lever and bushing if either part is deformed, or worn. Do not attempt to salvage these parts as shift fork binding will occur. Replace the roll pin that secures the lever to the shaft.

FRONT/REAR HOUSINGS AND BEARING RETAINERS

Inspect the housings carefully. Look for cracks, stripped threads, scored mating surfaces, damaged bearing bores, or worn dowel pin holes. Minor nicks on mating surfaces can be dressed off with a fine file, or emery cloth.

NOTE: The front housing contains the countershaft front bearing race. The rear housing contains the countershaft rear bearing race. Be advised that these components are NOT serviceable items. The front housing will have to be replaced if the countershaft bearing race is loose, worn, or damaged. The rear housing will have to be replaced if the countershaft rear bearing race is loose, worn, or damaged.

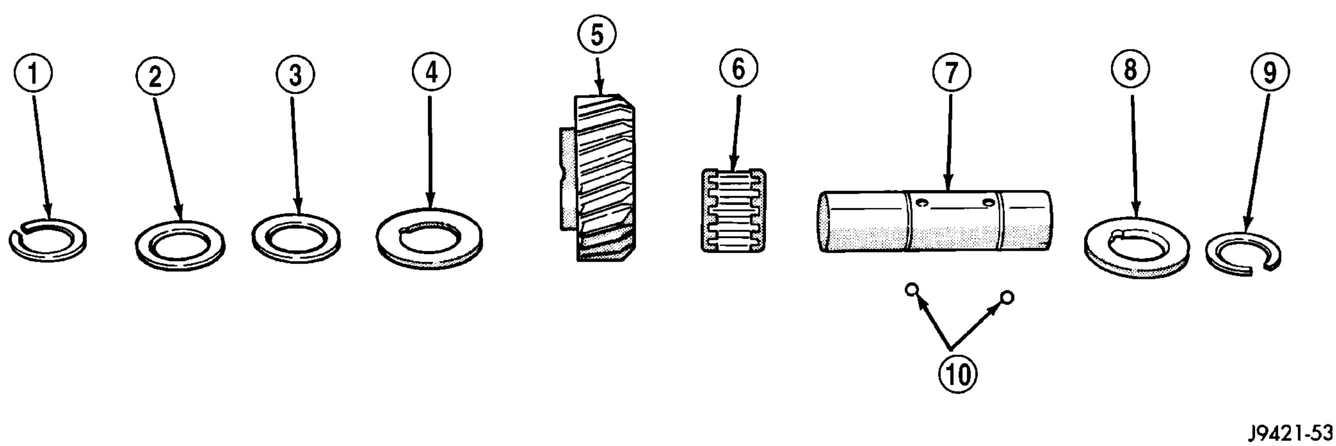


Fig. 44 REVERSE IDLER COMPONENTS

1 - SNAP RING
2 - FLAT WASHER
3 - WAVE WASHER
4 - THRUST WASHER
5 - REVERSE IDLER GEAR
6 - IDLER GEAR BEARING
7 - IDLER SHAFT
8 - THRUST WASHER
9 - SNAP RING
10 - THRUST WASHER LOCKBALLS

MANUAL - NV3550 (Continued)

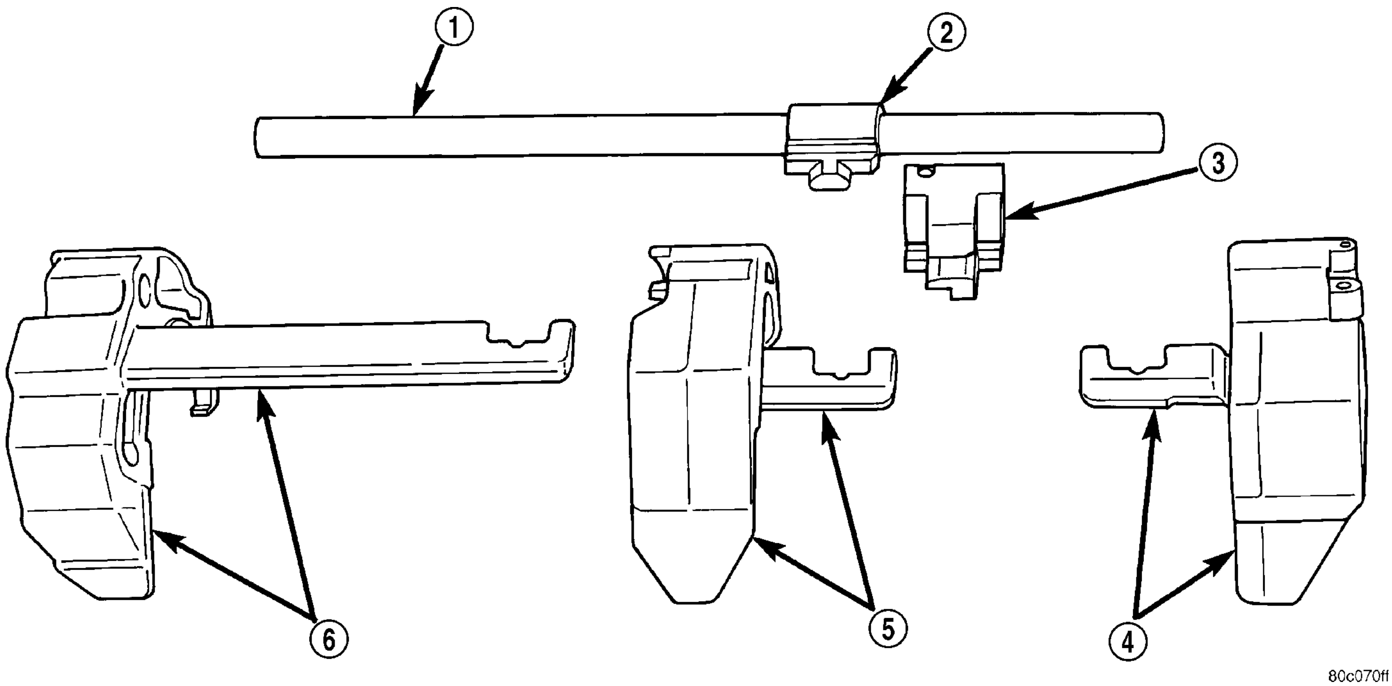


Fig. 45 SHIFT FORKS & SHAFT

1 - SHIFT SHAFT
2 - SHAFT LEVER
3 - SHAFT LEVER BUSHING
4 - 3-4 SHIFT FORK
5 - 1-2 SHIFT FORK
6 - FIFTH-REVERSE SHIFT FORK

Inspect the input shaft bearing retainer. Be sure the release bearing slide surface of the retainer is in good condition. Replace the retainer seal if necessary.

Inspect the output shaft bearing retainer. Be sure the U-shaped retainer is flat and free of distortion. Replace the retainer if the threads are damaged, or if the retainer is bent, or cracked.

COUNTERSHAFT BEARINGS AND RACES

The countershaft bearings and races are machine lapped during manufacture to form matched sets. The bearings and races should not be interchanged.

NOTE: The bearing races are a permanent press fit in the housings and are NOT serviceable. If a bearing race becomes damaged, it will be necessary to replace the front or rear housing as necessary. A new countershaft bearing will be supplied with each new housing for service use.

The countershaft bearings can be installed backwards if care is not exercised. The bearing roller cage is a different diameter on each side. Be sure the bearing is installed so the large diameter side of the cage is facing the countershaft gear (Fig. 46). The small diameter side goes in the bearing race.

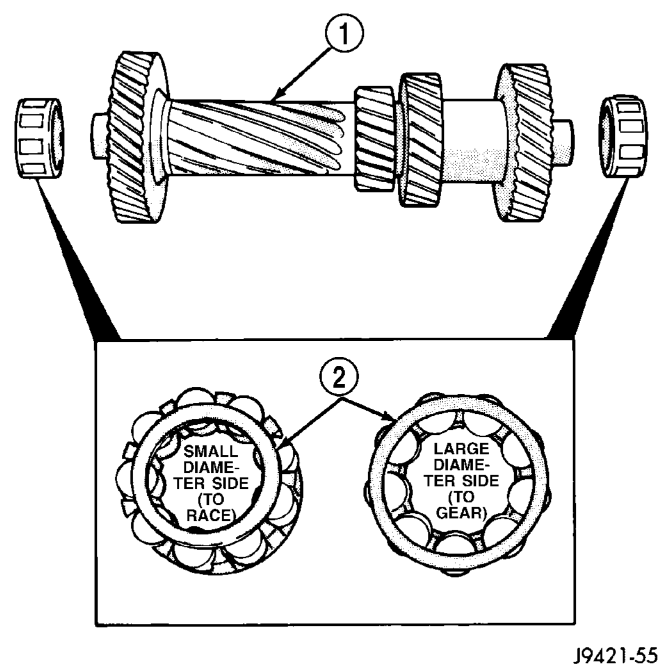


Fig. 46 COUNTERSHAFT & BEARINGS

1 - COUNTERSHAFT
2 - BEARING CAGE

MANUAL - NV3550 (Continued)

REVERSE IDLER COMPONENTS

Inspect the idler gear, bearing, shaft, thrust washer, wave washer and thrust plate. Replace the bearing if any of the needle bearing rollers are worn, chipped, cracked, flat-spotted, or brinnelled. Also replace the bearing if the plastic bearing cage is damaged or distorted.

Replace the thrust washer, wave washer, or thrust plate if cracked, chipped, or worn. Replace the idler gear if the teeth are chipped, cracked or worn thin. Replace the shaft if worn, scored, or the bolt threads are damaged beyond repair. Replace the support segment if cracked, or chipped and replace the idler attaching bolts if the threads are damaged.

Shift Socket

Inspect the shift socket for wear or damage. Replace the socket if the roll pin, or shift shaft bores are damaged. Replace the socket if the ball seat is worn, or cracked. Do not reuse the original shift socket roll pin. Install a new pin during reassembly. The socket roll pin is approximately 33 mm (1-1/4 in.) long.

Output Shaft And Geartrain

Inspect all of the gears for worn, cracked, chipped, or broken teeth. Also check condition of the bearing bore in each gear. The bores should be smooth and free of surface damage. Discoloration of the gear bores is a normal occurrence and is not a reason for replacement. Replace gears only when tooth damage has occurred, or if the bores are brinnelled or severely scored.

Inspect the shaft splines and bearings surfaces. Replace the shaft if the splines are damaged or bearing surfaces are deeply scored, worn, or brinnelled.

ASSEMBLY

Sealers are used at all case joints. Usea Mopar Gasket Maker for all case joints and Mopar silicone sealer or equivalent, for the input shaft bearing retainer. Apply these products as indicated in the assembly procedures.

CAUTION: The transmission shift components must be in the Neutral position during assembly. This prevents damage to the synchro and shift components when the housings are installed.

SYNCHRONIZER

WARNING: WEAR SAFETY GLASSES WHILE ASSEMBLING THE SYNCHRONIZER. A BALL COULD JUMP OUT AND CAUSE INJURY.

To assemble each synchro install the springs, struts and detent balls one at a time as follows:

(1) Lubricate synchronizer components with Mopar Manual Transmission lubricant or equivalent.

(2) Slide the sleeve part way onto the hub. Leave enough room to install the spring in the hub and the strut in the hub groove.

(3) Install the first spring in the hub. Then install a strut over the spring. Be sure the spring is seated in the spring bore in the strut.

(4) Slide the sleeve onto the hub just far enough to hold the first strut and spring in place.

(5) Place the detent ball in the top of the strut. Then carefully work the sleeve over the ball to hold it in place. Use a small flat blade screwdriver to press the ball into place while moving the sleeve over it.

(6) Repeat the procedure for the remaining springs, struts and balls. Tape or rubber band each strut and ball to temporarily secure as they are installed.

(7) Verify synchro springs, struts and detent balls are all in place (Fig. 47).

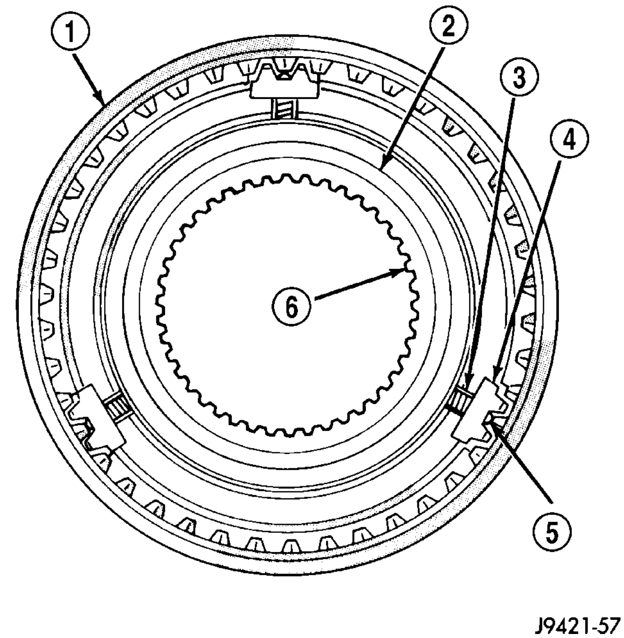


Fig. 47 SYNCHRONIZER COMPONENTS

1 - SLEEVE
2 - HUB SHOULDER
3 - SPRING (3)
4 - STRUT (3)
5 - DETENT BALL (3)
6 - HUB

OUTPUT SHAFT

NOTE: Lubricate all components with recommended lubricant during assembly. Petroleum jelly can be used to hold parts in place.

MANUAL - NV3550 (Continued)

(1) Lubricate and install reverse gear needle bearing on shaft (Fig. 48). Slide bearing up against shoulder on output shaft.

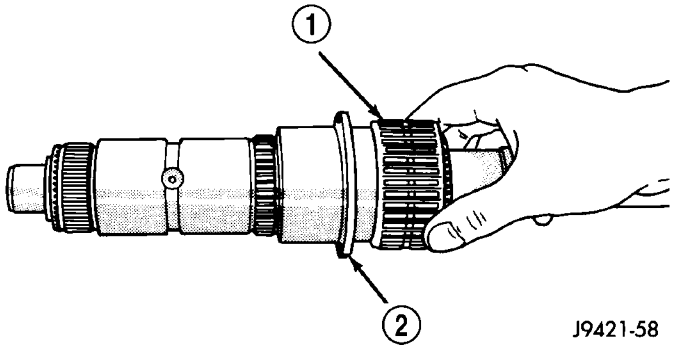


Fig. 48 REVERSE GEAR BEARING

1 - REVERSE GEAR BEARING
2 - SHOULDER

(2) Install reverse gear over needle bearing (Fig. 49).

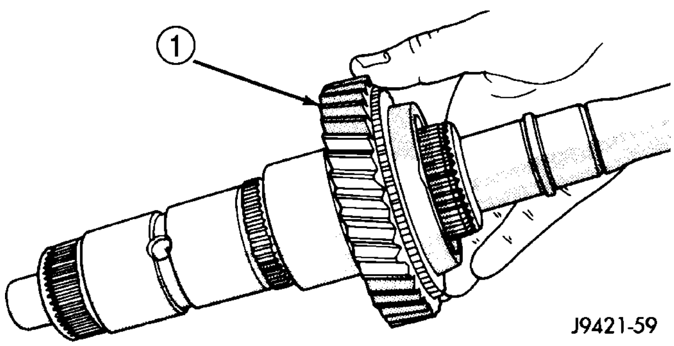


Fig. 49 REVERSE GEAR

1 - REVERSE GEAR

(3) Install brass synchro ring on reverse gear (Fig. 50).

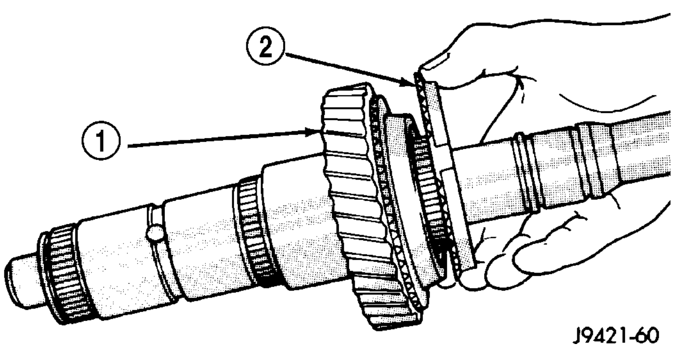


Fig. 50 REVERSE SYNCHRO

1 - REVERSE GEAR
2 - SYNCHRO RING

(4) Assemble fifth-reverse synchro hub, sleeve, struts, springs and detent balls, if not previously done.

CAUTION: One side of the hub has shoulders around the hub bore, this side of the hub faces the front of the shaft. One side of the sleeve is tapered. The tapered side faces the front of the shaft.

(5) Start fifth-reverse synchro assembly on output shaft splines by hand. Then seat synchro onto shaft with a press and Cup 6310-1 (Fig. 51).

NOTE: Lugs on the synchro ring must be aligned with the sleeve notches for installation.

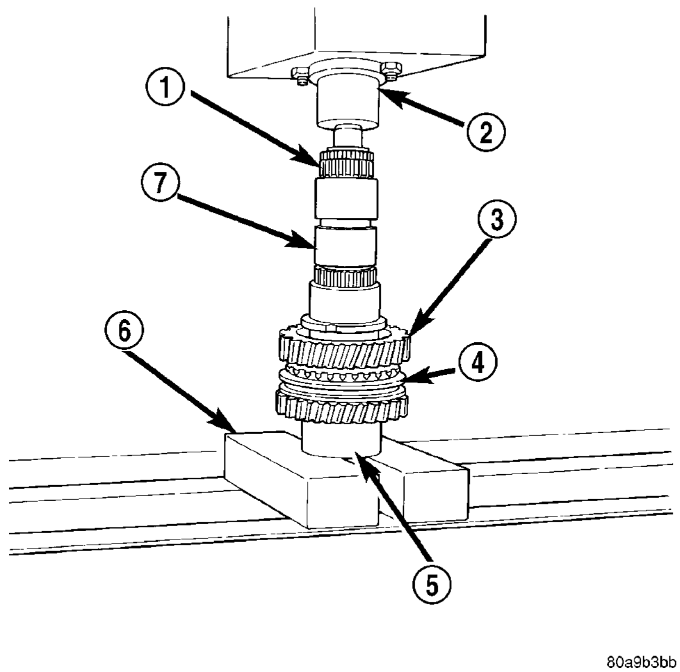


Fig. 51 FIFTH-REVERSE SYNCHRO ASSEMBLY

1 - SPACER
2 - PRESS RAM
3 - REVERSE GEAR
4 - FIFTH-REVERSE SYNCHRO ASSEMBLY
5 - CUP
6 - PRESS BLOCKS
7 - OUTPUT SHAFT

MANUAL - NV3550 (Continued)

(6) Install **new** fifth-reverse hub snap ring (Fig. 52) and verify the snap ring is seated.

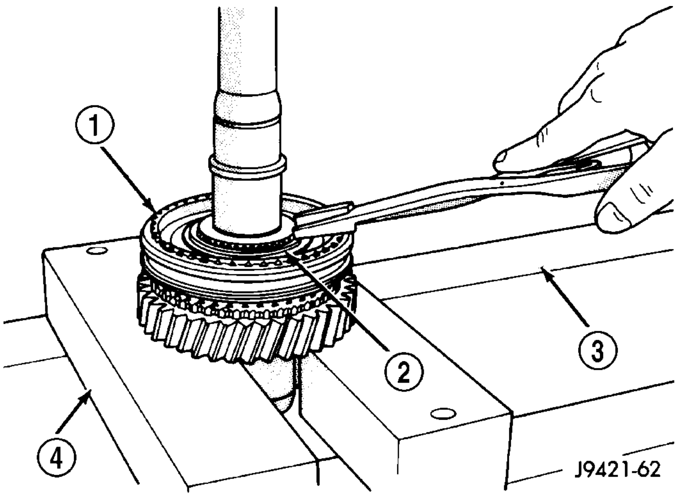


Fig. 52 FIFTH/REVERSE SYNCHRO HUB SNAP RING

1 - FIFTH-REVERSE SYNCHRO ASSEMBLY
2 - SNAP RING
3 - PRESS BED
4 - PRESS BLOCKS

(7) Install fifth gear synchro ring in synchro hub and sleeve (Fig. 53).

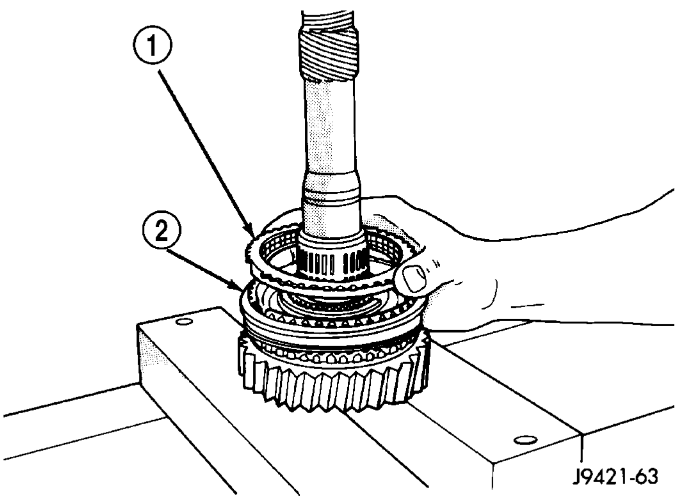


Fig. 53 FIFTH GEAR SYNCHRO RING

1 - FIFTH-SPEED SYNCHRO RING
2 - FIFTH-REVERSE SYNCHRO ASSEMBLY

(8) Install fifth gear bearing, spreading bearing only enough to clear shoulder on output shaft (Fig. 54). Verify bearing is properly seated.

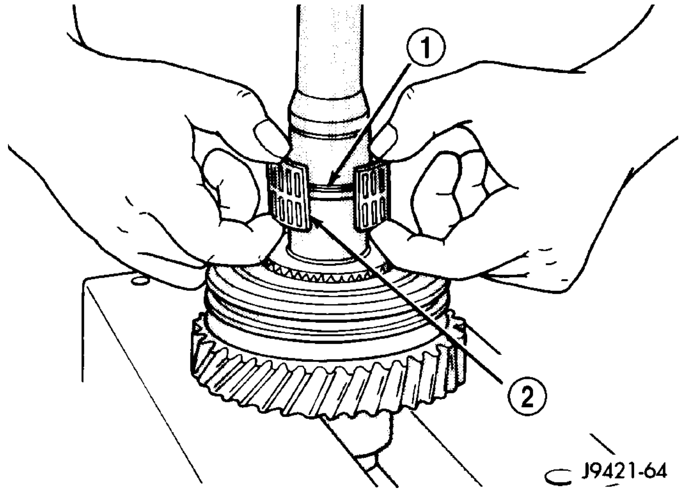


Fig. 54 FIFTH GEAR BEARING

1 - SHAFT SHOULDER
2 - FIFTH GEAR BEARING

(9) Install fifth gear on shaft and onto bearing (Fig. 55).

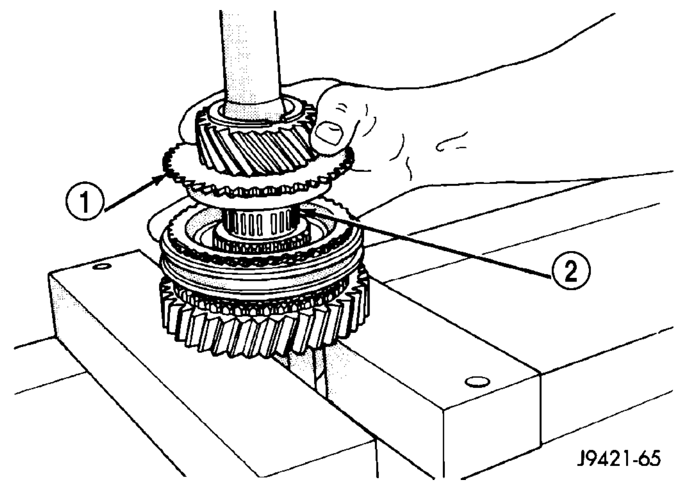


Fig. 55 FIFTH GEAR

1 - FIFTH GEAR
2 - BEARING

MANUAL - NV3550 (Continued)

(10) Invert output shaft and set the shaft in Cup 6310-1 so that fifth gear is seated on the tool (Fig. 56).

(11) Install first gear bearing on output shaft (Fig. 56). Verify bearing is seated on shaft shoulder and is properly joined.

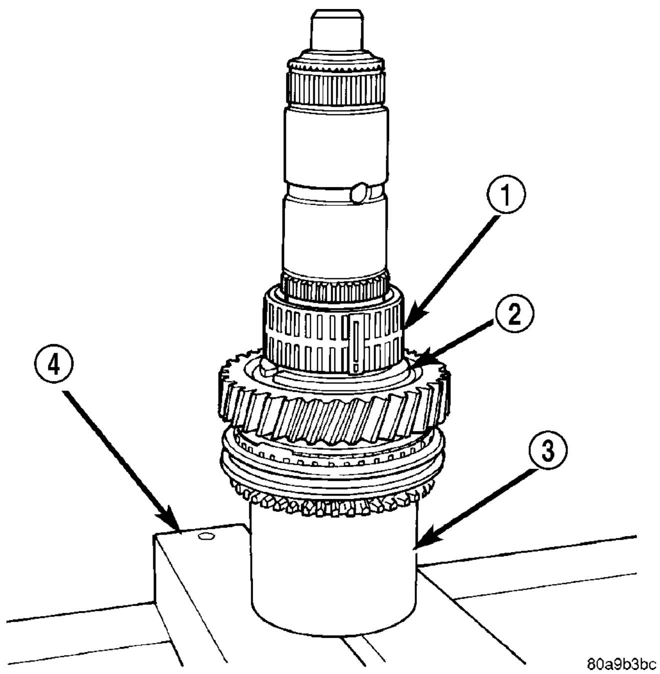


Fig. 56 FIRST GEAR BEARING

1 - FIRST GEAR BEARING
2 - SHAFT SHOULDER
3 - CUP
4 - PRESS BLOCKS

(12) Install first gear on shaft and over bearing with synchro cone facing up (Fig. 57).

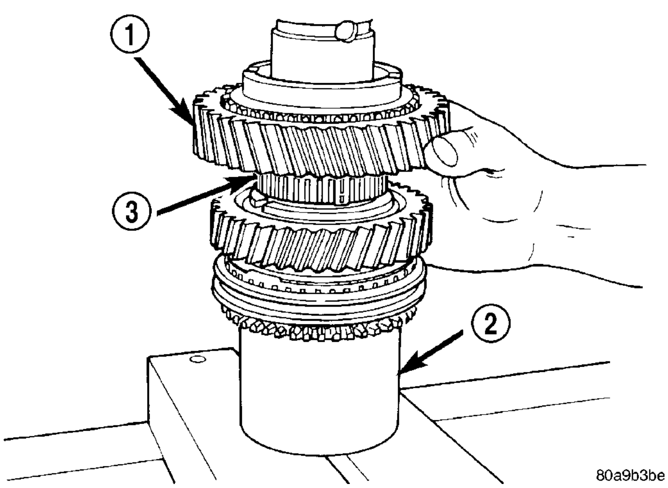


Fig. 57 FIRST GEAR

1 - FIRST GEAR
2 - CUP
3 - BEARING

(13) Install first gear synchro ring (Fig. 58).

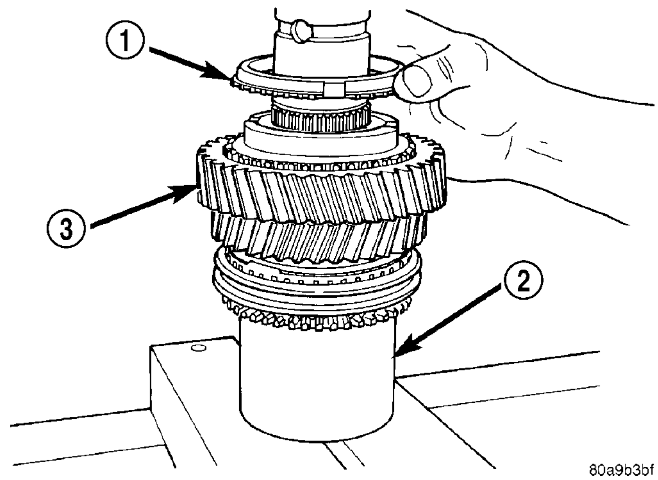


Fig. 58 FIRST GEAR SYNCHRO RING

1 - FIRST GEAR SYNCHRO RING
2 - CUP
3 - FIRST GEAR

(14) Assemble 1-2 synchro hub sleeve, springs, struts and detent balls.

CAUTION: The 1-2 synchro hub and sleeve can be installed backwards. One side of the synchro sleeve is marked First Gear Side. Verify this side of the sleeve is facing first gear.

(15) Start 1-2 synchro assembly on shaft by hand (Fig. 59). Verify synchro sleeve is properly positioned.

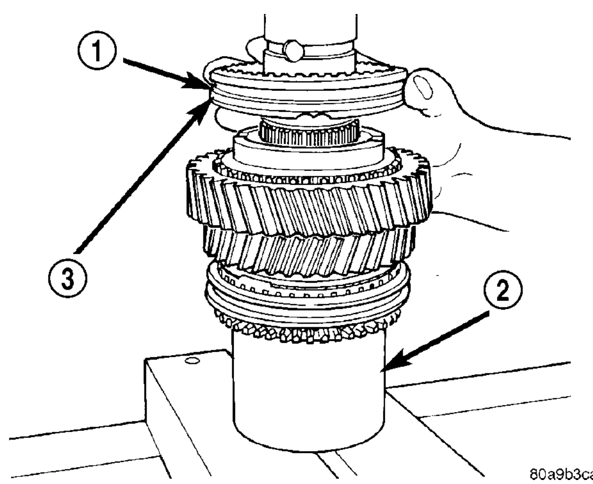


Fig. 59 STARTING 1-2 SYNCHRO

1 - 1–2 SYNCHRO ASSEMBLY
2 - CUP
3 - FIRST GEAR SIDE OF SYNCHRO SLEEVE

MANUAL - NV3550 (Continued)

(16) Press 1-2 synchro onto output shaft using suitable size pipe tool and shop press (Fig. 60).

CAUTION: Align the synchro ring and sleeve as hub the is being pressed onto the shaft. The synchro ring can crack if not aligned.

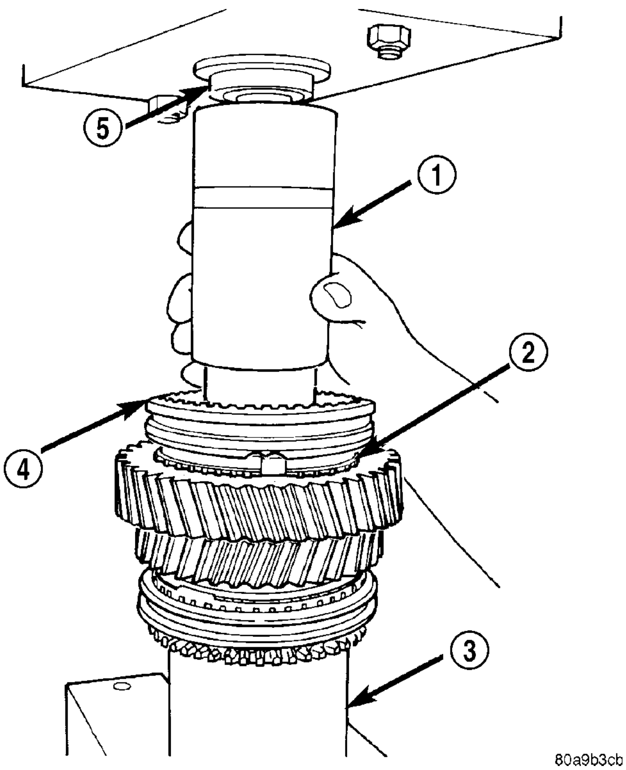


Fig. 60 PRESS 1-2 SYNCHRO

1 - SUITABLE SIZE PIPE TOOL
2 - SYNCHRO RING
3 - CUP
4 - 1-2 SYNCHRO ASSEMBLY
5 - PRESS RAM

(17) Install interm ring.

(18) Install **new** 1-2 synchro hub snap ring (Fig. 61) and verfiy the snap ring is seated.

(19) Install second gear synchro ring in 1-2 synchro hub and sleeve (Fig. 62). Verify synchro ring is properly seated.

(20) Install synchro friction cone and synchro cone in synchro ring.

(21) Install second gear needle bearing on shaft (Fig. 63).

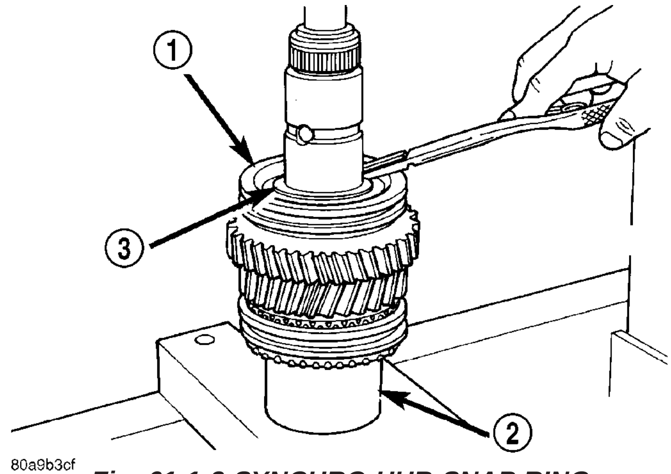


Fig. 61 1-2 SYNCHRO HUB SNAP RING

1 - 1-2 SYNCHRO
2 - CUP
3 - SYNCHRO SNAP RING

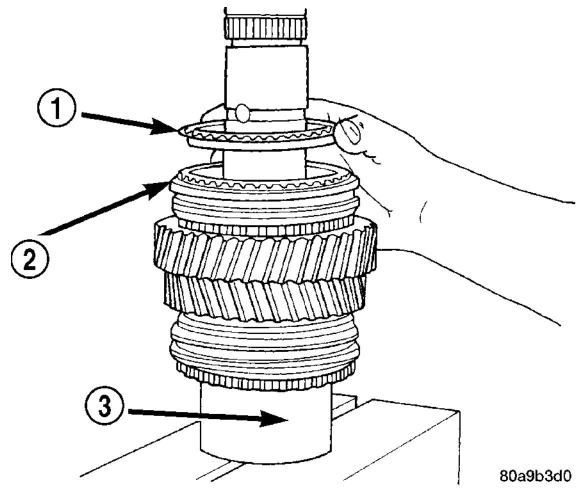


Fig. 62 SECOND GEAR SYNCHRO RING

1 - SECOND GEAR SYNCHRO RING
2 - 1-2 SYNCHRO
3 - CUP

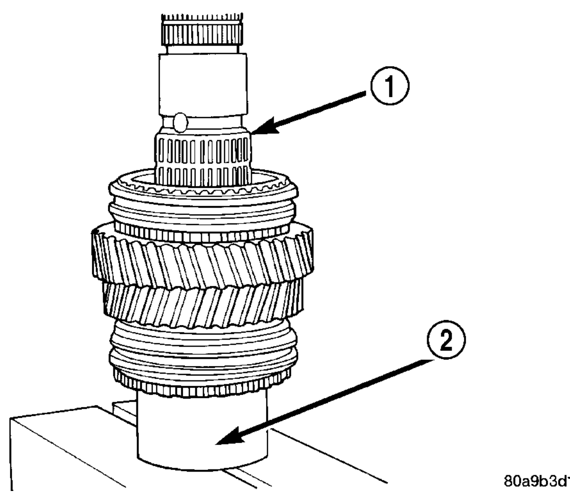


Fig. 63 SECOND GEAR BEARING

1 - SECOND GEAR BEARING
2 - CUP

MANUAL - NV3550 (Continued)

(22) Install second gear onto shaft and bearing (Fig. 64). Verify second gear is fully seated on synchro components.

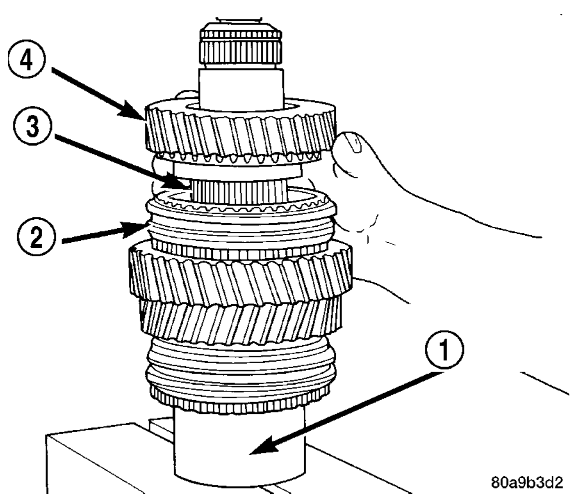


Fig. 64 SECOND GEAR

1 - CUP
2 - 1-2 SYNCHRO ASSEMBLY
3 - BEARING
4 - SECOND GEAR

(23) Install two-piece thrust washer (Fig. 65). Ensure washer halves are seated in shaft groove and that washer lugs are seated in shaft lug bores.

NOTE: Dot or markings on the two-piece thrust washer go toward 3rd gear.

(24) Start retaining ring around two-piece thrust washer (Fig. 66). Ensure locating dimple is between the thrust washer halves.

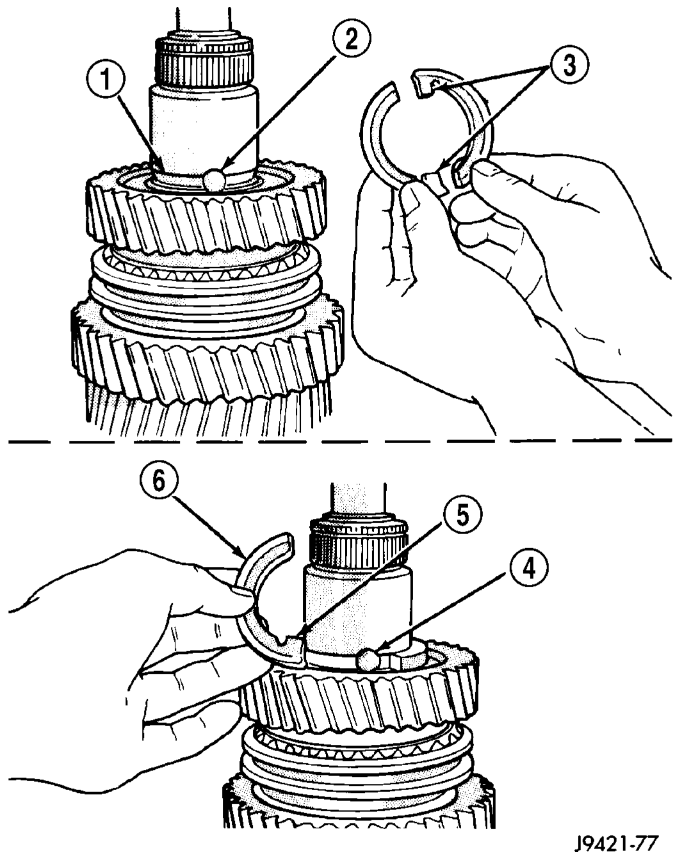


Fig. 65 TWO-PIECE THRUST WASH

1 - WASHER GROOVE IN SHAFT
2 - LUG BORE
3 - THRUST WASHER LUGS
4 - LUG BORE
5 - LUG
6 - WASHER HALF

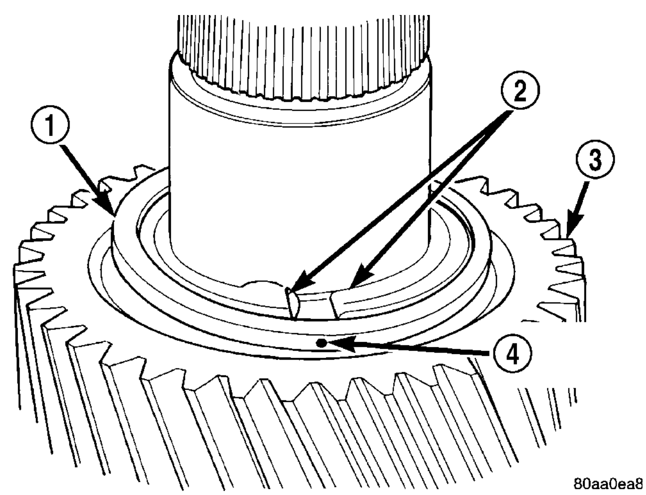


Fig. 66 RETAINING RING

1 - THRUST WASHER RETAINING RING
2 - THRUST WASHER HALVES
3 - SECOND GEAR
4 - LOCATING DIMPLE

MANUAL - NV3550 (Continued)

(25) Seat thrust washer retaining ring with plastic mallet (Fig. 67).

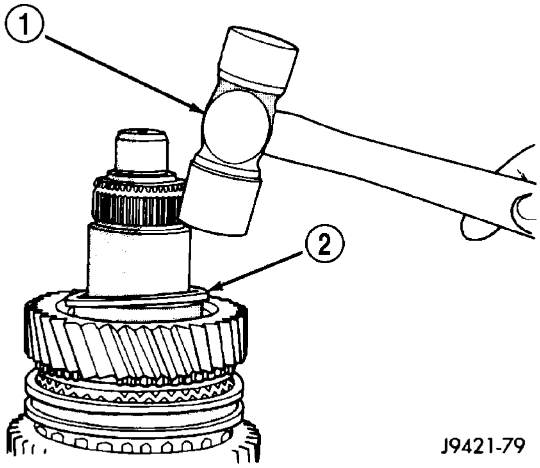


Fig. 67 THRUST RETAINER

1 - PLASTIC MALLET
2 - THRUST WASHER RETAINING RING

(26) Install third gear needle bearing on shaft (Fig. 68).

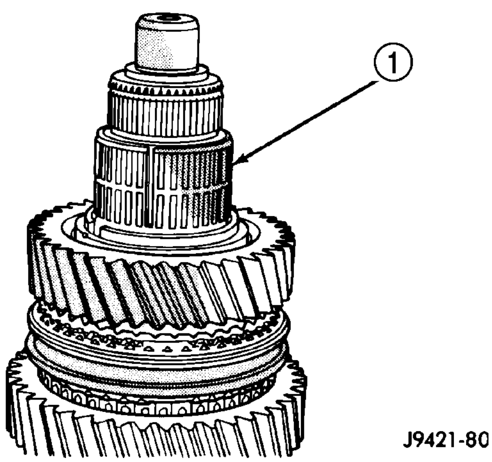


Fig. 68 THIRD GEAR BEARING

1 - THIRD GEAR BEARING

(27) Install third gear on shaft and bearing (Fig. 69).

(28) Install third speed synchro ring on third gear (Fig. 70).

(29) Assemble 3-4 synchro hub, sleeve, springs, struts and detent balls.

(30) Start 3-4 synchro hub on output shaft splines by hand (Fig. 71).

CAUTION: The 3-4 synchro hub and sleeve can be installed backwards. One side of the sleeve has grooves in it. This side of sleeve faces the front of the shaft.

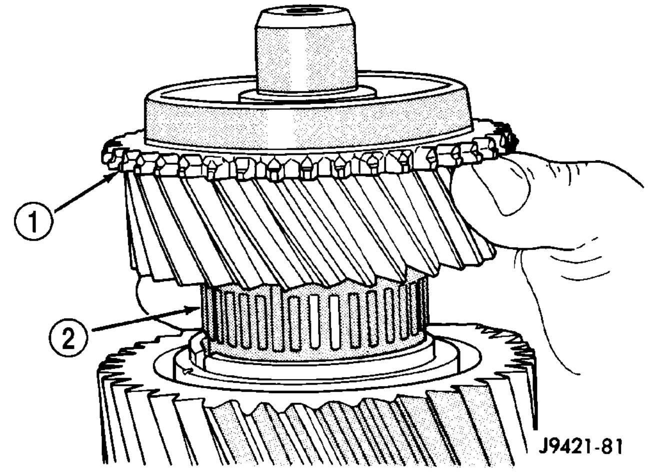


Fig. 69 THIRD GEAR

1 - THIRD GEAR
2 - BEARING

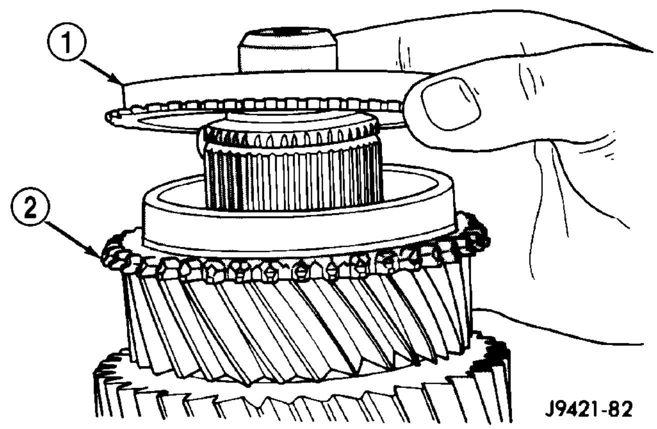


Fig. 70 THIRD SPEED SYNCHRO RING

1 - THIRD SPEED SYNCHRO RING
2 - THIRD GEAR

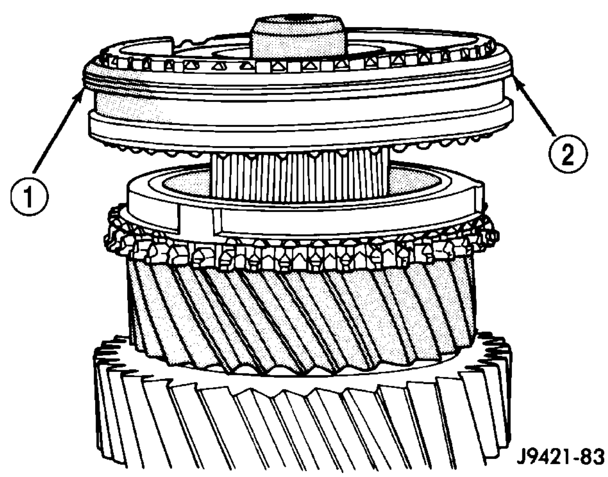


Fig. 71 3-4 SYNCHRO HUB ON OUTPUT SHAFT

1 - GROOVED SIDE OF SLEEVE (TO FRONT)
2 - 3-4 SYNCHRO ASSEMBLY

MANUAL - NV3550 (Continued)

(31) With the lug on the ring aligned with the slot on the synchro, press 3-4 synchro assembly onto output shaft with shop press and suitable size pipe tool (Fig. 72).

NOTE: Place the pipe on hub as close to output shaft as possible without contacting the shaft splines.

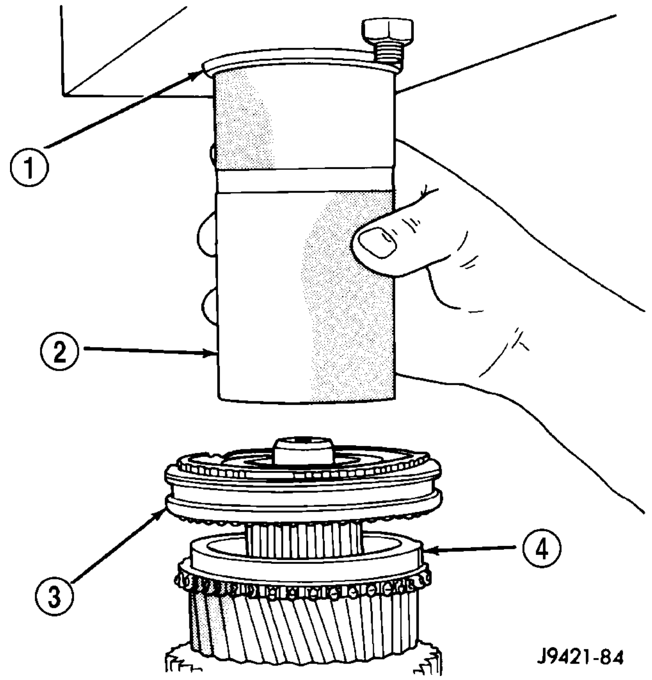


Fig. 72 3-4 SYNCHRO ON OUTPUT SHAFT

1 - PRESS RAM
2 - PIPE TOOL
3 - 3-4 SYNCHRO
4 - THIRD SPEED SYNCHRO RING

(32) Install **new** 3-4 synchro hub snap ring (Fig. 73) and verify snap ring is seated.

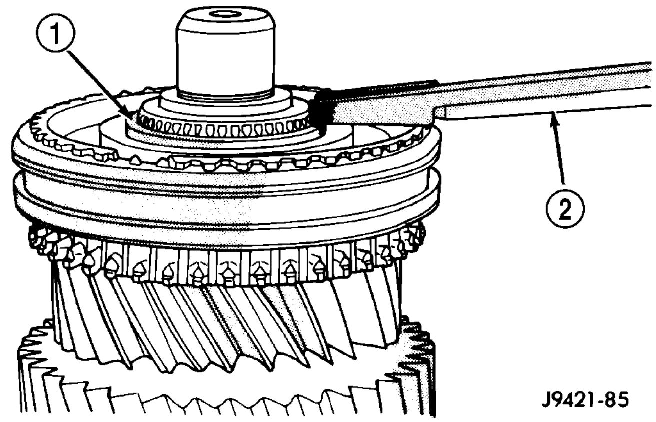


Fig. 73 3-4 SYNCHRO HUB SNAP RING

1 - 3-4 SYNCHRO HUB SNAP RING
2 - HEAVY DUTY SNAP RING PLIERS

(33) Verify position of synchro sleeves before proceeding with assembly operations (Fig. 74). Grooved side of 3-4 sleeve should be facing forward. First gear side of 1-2 sleeve should be facing first gear. Tapered side of fifth-reverse sleeve should be facing forward.

REVERSE IDLER ASSEMBLY

(1) Lubricate idler components with Mopar Manual Transmission lubricant or equivalent.

(2) Slide idler gear bearing on shaft (Fig. 75). Bearing fits either way on shaft.

(3) Slide gear onto shaft. Side of gear with recess goes to rear (Fig. 75).

(4) Place first lock ball in dimple at rear end of idler shaft (Fig. 75). Hold ball in place with petroleum jelly.

(5) Slide rear thrust washer onto shaft and over lock ball (Fig. 76).

(6) Install snap ring in groove at rear of shaft (Fig. 76).

MANUAL - NV3550 (Continued)

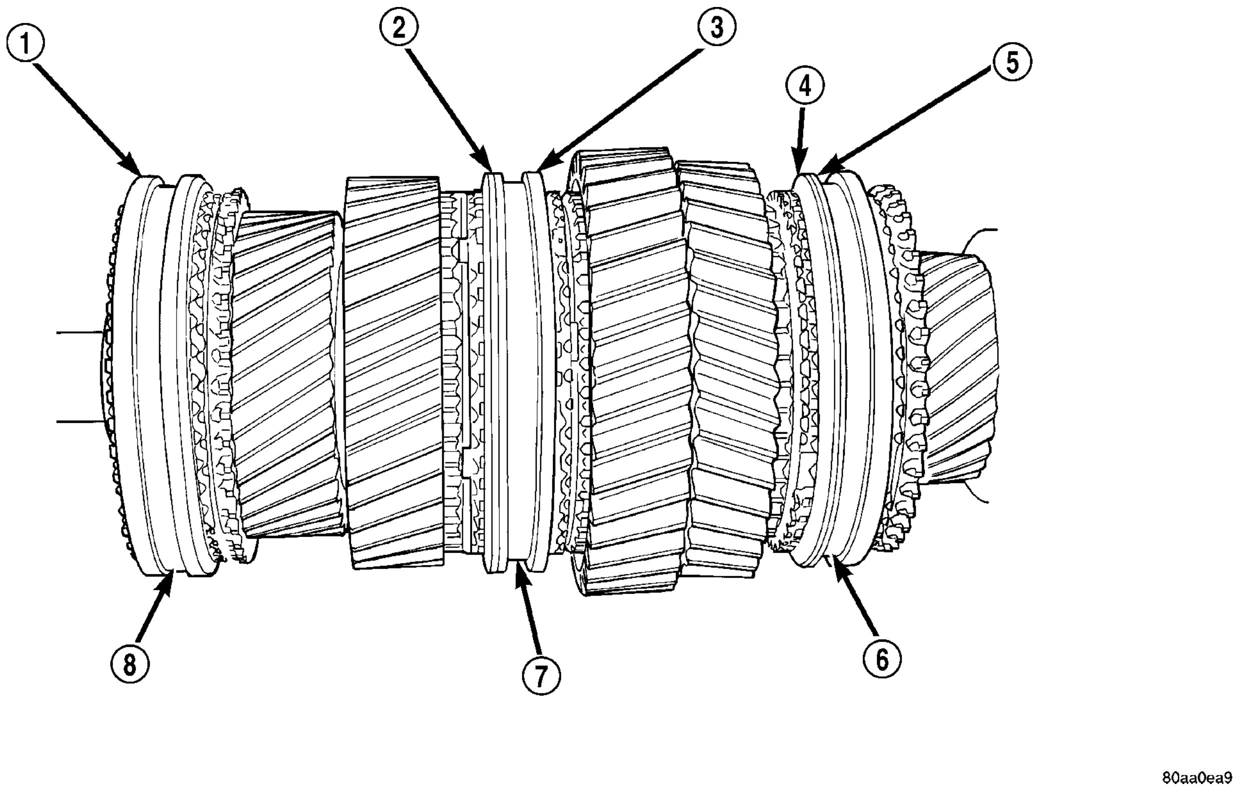


Fig. 74 SYNCHRO SLEEVE LOCATIONS

1 - DOUBLE GROOVE FORWARD
2 - GROOVE FORWARD
3 - FIRST GEAR SIDE MARKING TOWARD FIRST GEAR
4 - TAPER FORWARD
5 - GROOVE FORWARD
6 - 5TH-REV SYNCHRO SLEEVE
7 - 1-2 SYNCHRO SLEEVE
8 - 3-4 SYNCHRO SLEEVE

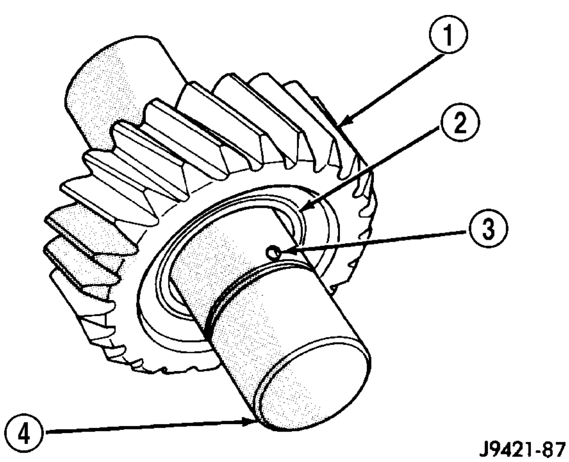


Fig. 75 IDLER GEAR AND BEARING

1 - IDLER GEAR
2 - BEARING
3 - LOCK BALL
4 - REAR OF SHAFT

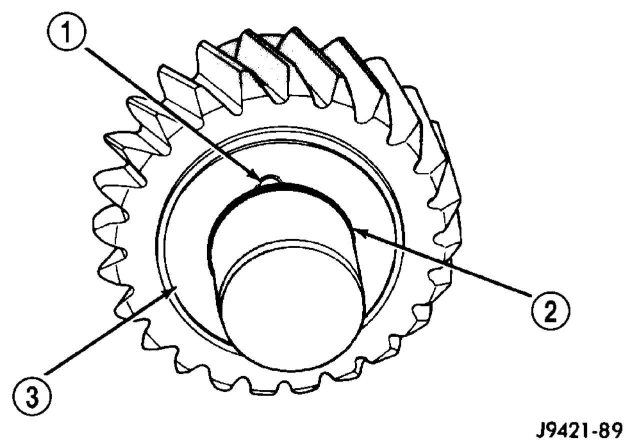


Fig. 76 IDLER GEAR REAR THRUST WASHER

1 - LOCK BALL
2 - SNAP RING GROOVE
3 - THRUST WASHER

MANUAL - NV3550 (Continued)

(7) Install lock ball in dimple at front of shaft. Hold ball in place with petroleum jelly.

(8) Install front thrust washer on shaft and slide washer up against gear and over lock ball (Fig. 77).

(9) Install wave washer, flat washer and remaining snap ring on idler shaft (Fig. 77). Verify snap ring is seated.

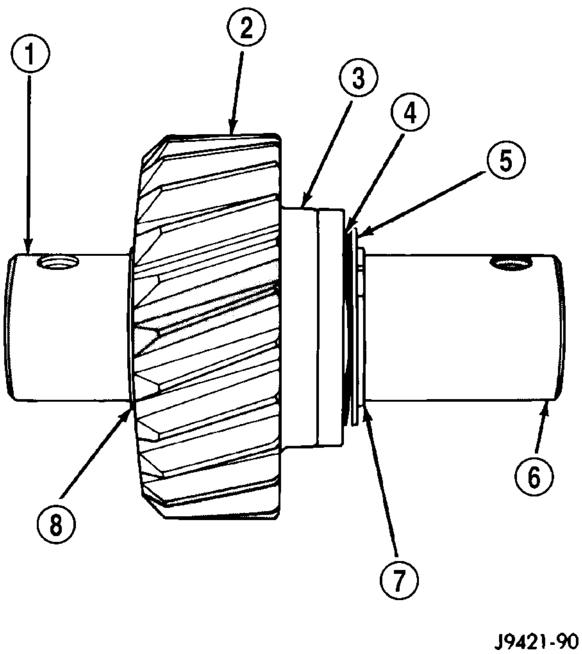


Fig. 77 IDLER GEAR AND SHAFT ASSEMBLY

1 - REAR OF SHAFT
2 - GEAR
3 - THRUST WASHER AND BALL
4 - WAVE WASHER
5 - FLAT WASHER
6 - FRONT OF SHAFT
7 - SNAP RING
8 - SNAP RING

SHIFT SHAFT AND BUSHINGS/BEARINGS

Inspect shift shaft bushing and bearing for damage and replace if necessary.

(1) Locate a bolt that will thread into the bushing without great effort.

(2) Thread the bolt into the bushing, allowing the bolt to make its own threads in the bushing.

(3) Attach a slide hammer or suitable puller to the bolt and remove bushing.

(4) Use the short end of Installer 8119 to install the new bushing.

(5) The bushing is correctly installed if the bushing is flush with the transmission case.

(6) To replace the bearing locate a bolt that will thread into the bearing without great effort.

(7) Thread the bolt into the bearing as much as possible.

(8) Attach a slide hammer or suitable puller to the bolt and remove the bearing.

(9) Use the short end of Installer 8119 to install the new bearing.

(10) The bearing is correctly installed if the bearing is flush with the transmission case.

DETENT PLUNGER BUSHING

Inspect detent plunger bushings for damage and replace if necessary.

NOTE: The detent plunger bushings are installed to a specific depth. The space between the two bushings when correctly installed contain an oil feed hole. Do not attempt to install the bushings with anything other than the specified tool or this oil hole may become restricted.

(1) Using the long end of Installer 8119, drive the detent bushings through the outer case and into the shift shaft bore.

(2) Remove the bushings from the shift shaft bore.

(3) Install a new detent plunger bushing on the long end of Installer 8118.

(4) Start the bushing in the detent plunger bore in the case.

(5) Drive the bushing into the bore until the tool contacts the transmission case.

(6) Install a new detent plunger bushing on the short end of Installer 8118.

(7) Start the bushing in the detent plunger bore in the case.

(8) Drive the bushing into the bore until the tool contacts the transmission case.

MANUAL - NV3550 (Continued)

GEARTRAIN ASSEMBLY

(1) Install Adapter 6747-1A on input shaft hub of Fixture 6747 (Fig. 78).

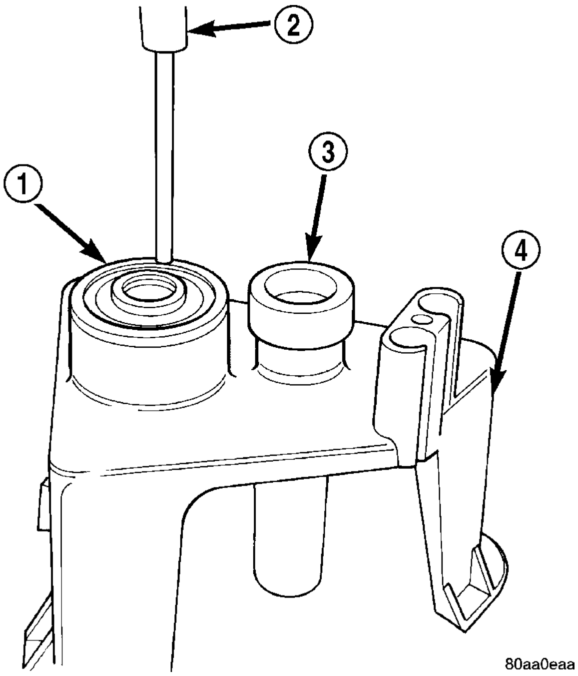


Fig. 78 ASSEMBLY FIXTURE

1 - ADAPTER 6747-2A (INSTALL ON COUNTERSHAFT FRONT HUB)
2 - CUP ADAPTER 8115
3 - ADAPTER 6747-A
4 - FIXTURE 6747

(2) Install input shaft in fixture tool. Make sure Adapter 6747-1A is positioned under shaft as shown (Fig. 79).

(3) Install pilot bearing in input shaft (Fig. 79).

NOTE: The side of the pilot bearing with the small diameter goes toward the input shaft.

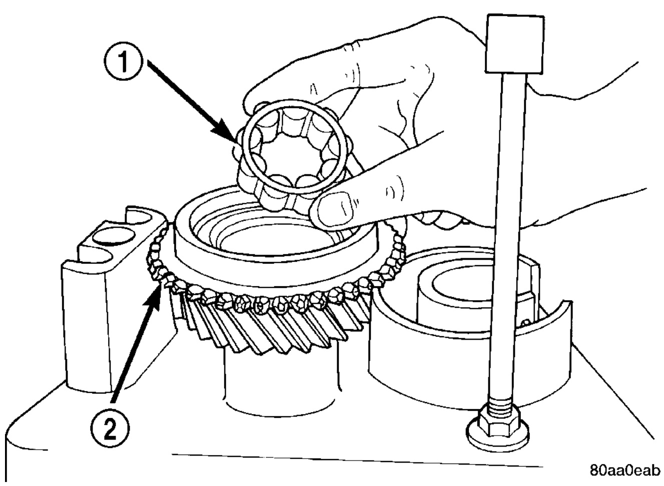


Fig. 79 PILOT BEARING AND INPUT SHAFT

1 - PILOT BEARING
2 - INPUT SHAFT

(4) Install fourth gear synchro ring on input shaft (Fig. 80).

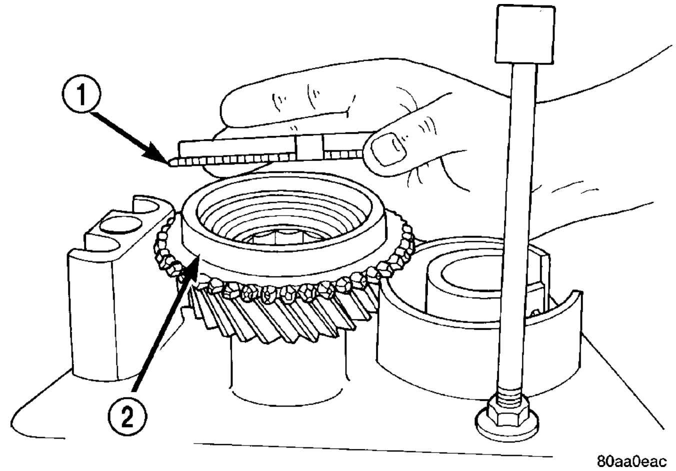


Fig. 80 FOURTH GEAR SYNCHRO

1 - FOURTH GEAR SYNCHRO RING
2 - INPUT SHAFT

(5) Adjust height of idler gear pedestal on assembly fixture (Fig. 81). Start with a basic height of 18.4 cm (7-1/4 in.). Final adjustment can be made after gear is positioned on pedestal.

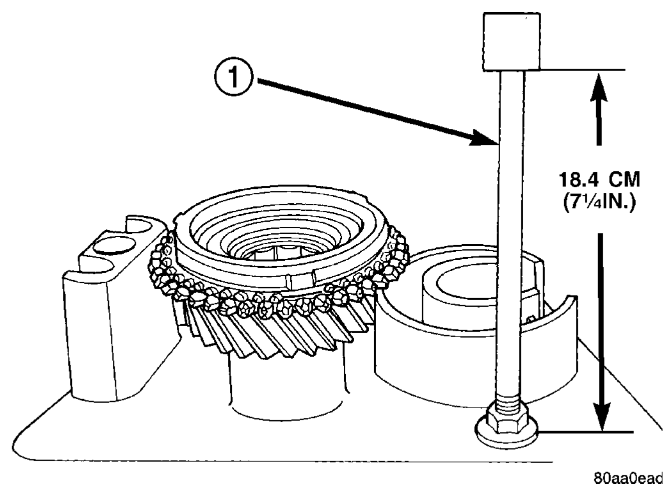


Fig. 81 IDLER PEDESTAL BASIC HEIGHT

1 - REVERSE IDLER PEDESTAL

MANUAL - NV3550 (Continued)

(6) Install assembled output shaft and geartrain in input shaft (Fig. 82). Carefully rotate output shaft until the 3-4 synchro ring seats in synchro hub and sleeve.

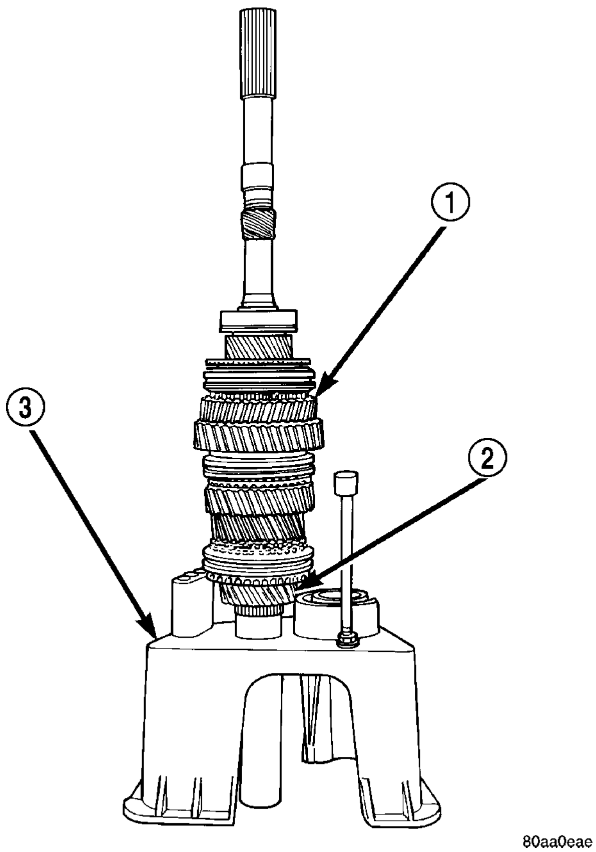


Fig. 82 OUTPUT SHAFT AND GEARTRAIN

1 - OUTPUT SHAFT AND GEARTRAIN
2 - INPUT SHAFT
3 - FIXTURE 6747

(7) Install Adapter 6747-2A on front bearing hub of countershaft. The adapter has a shoulder on one side that goes towards the countershaft.

(8) Slide countershaft (and adapter) into fixture slot. Verify countershaft and output shaft gears are fully meshed with the mainshaft gears (Fig. 83).

(9) Check alignment of countershaft and output shaft gear teeth. Note that gears may not align perfectly. A difference in height of 1.57 to 3.18 mm (1/16 to 1/8 in.) will probably exist. This difference will not interfere with assembly.

(10) Position reverse idler in support cup of assembly fixture (Fig. 84). Ensure idler gear is properly meshed and aligned with shaft gear teeth and that bolt holes are facing out and not toward geartrain. Adjust pedestal up or down if necessary. Also be sure that short end of idler shaft is facing up as shown.

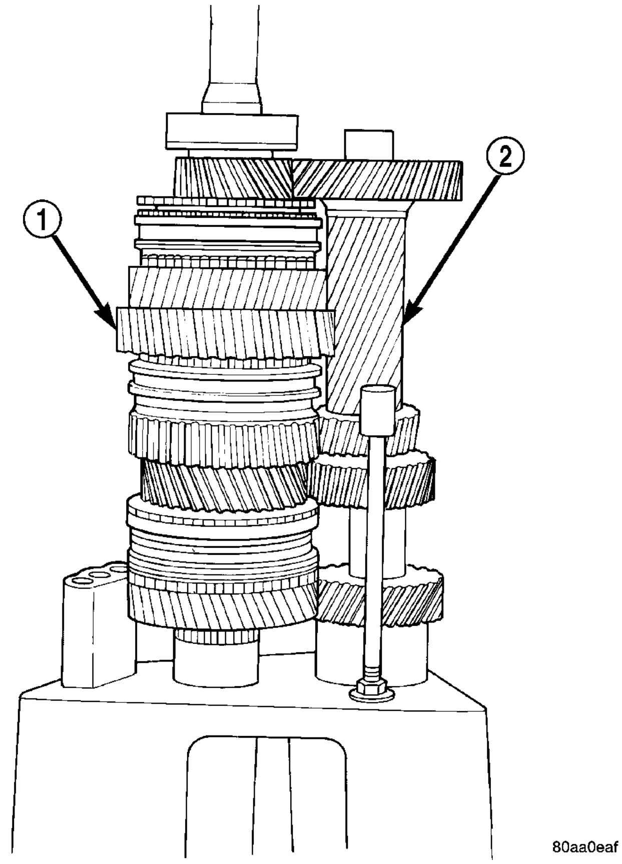


Fig. 83 COUNTERSHAFT ON FIXTURE

1 - OUTPUT SHAFT AND GEARTRAIN
2 - COUNTERSHAFT (SLIDE INTO PLACE ON FIXTURE TOOL)

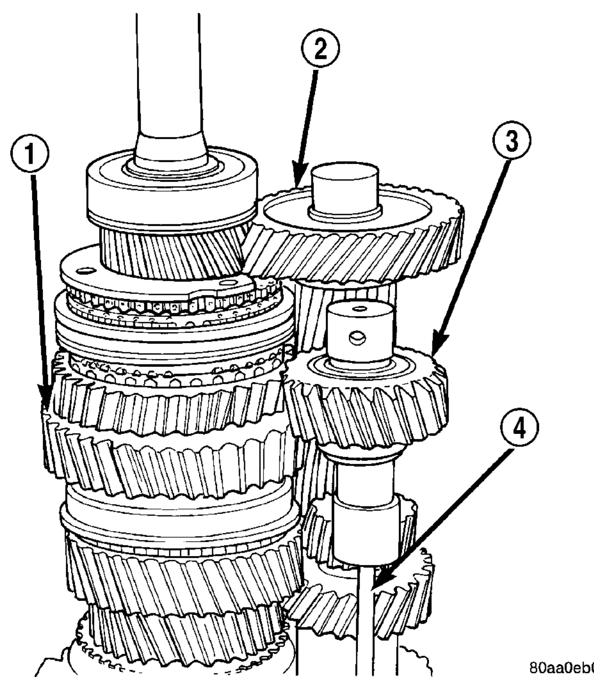


Fig. 84 REVERSE IDLER ASSEMBLY POSITION

1 - OUTPUT SHAFT AND GEARTRAIN
2 - COUNTERSHAFT
3 - REVERSE IDLER ASSEMBLY
4 - TOOL PEDESTAL

MANUAL - NV3550 (Continued)

(11) Assemble 1-2 and fifth reverse-shift forks (Fig. 85). Arm of fifth-reverse fork goes through slot in 1-2 fork.

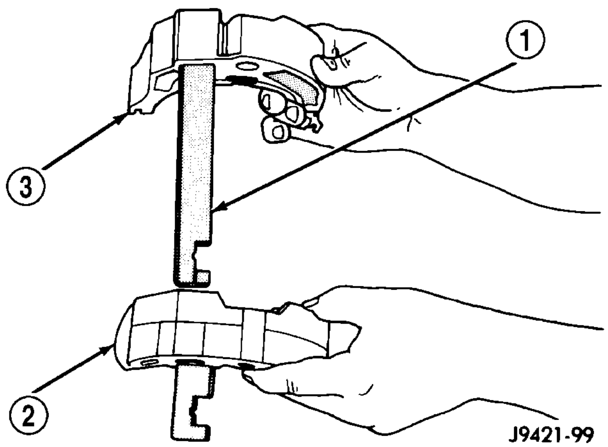


Fig. 85 1-2 AND FIFTH-REVERSE

1 - FIFTH-REVERSE FORK ARM
2 - 1-2 FORK
3 - FIFTH-REVERSE FORK

(12) Install assembled shift forks in synchro sleeves (Fig. 86). Verify forks are properly seated in sleeves.

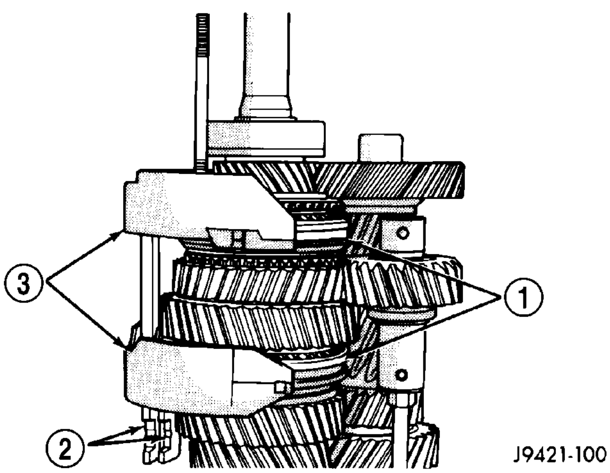


Fig. 86 SHIFT FORKS IN SYNCHRO

1 - SYNCHRO SLEEVES
2 - FORK ARMS
3 - SHIFT FORKS

ADAPTER HOUSING

(1) Install rear bearing in adapter housing. Use wood hammer handle or wood dowel to tap bearing into place.

(2) Position rear bearing retainer in adapter housing (Fig. 87).

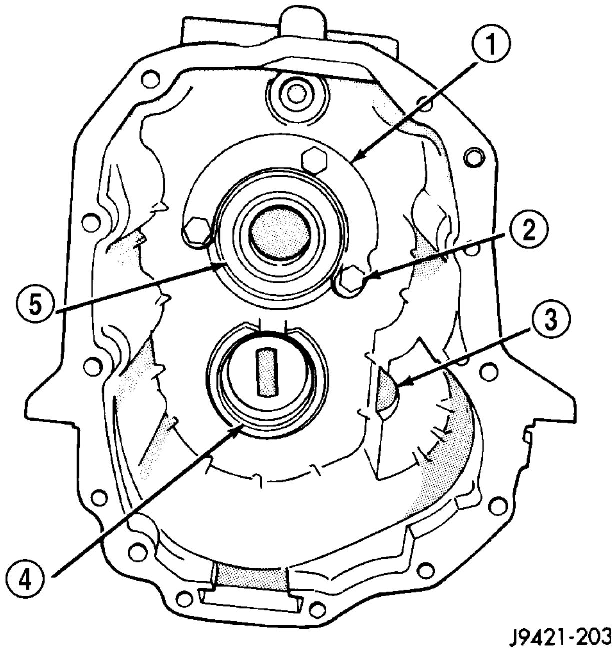


Fig. 87 ADAPTER HOUSING

1 - BEARING RETAINER
2 - RETAINER BOLT
3 - IDLER SHAFT NOTCH
4 - COUNTERSHAFT BEARING RACE
5 - REAR BEARING

(3) Apply Mopar Gasket Maker or equivalent, to threads, bolt shanks and under hex heads of bearing retainer bolts.

(4) Apply liberal quantity of petroleum jelly to countershaft rear bearing and bearing race.

(5) Install countershaft rear bearing in bearing race (Fig. 87).

CAUTION: Be sure the large diameter side of the roller retainer faces the countershaft and the small diameter side faces the race and housing.

(6) Apply extra petroleum jelly to hold countershaft rear bearing in place when housing is installed.

(7) Apply light coat of petroleum jelly to shift shaft bushing/bearing in adapter housing.

(8) Install adapter housing on geartrain.

MANUAL - NV3550 (Continued)

(9) Install rear bearing snap ring on output shaft (Fig. 88).

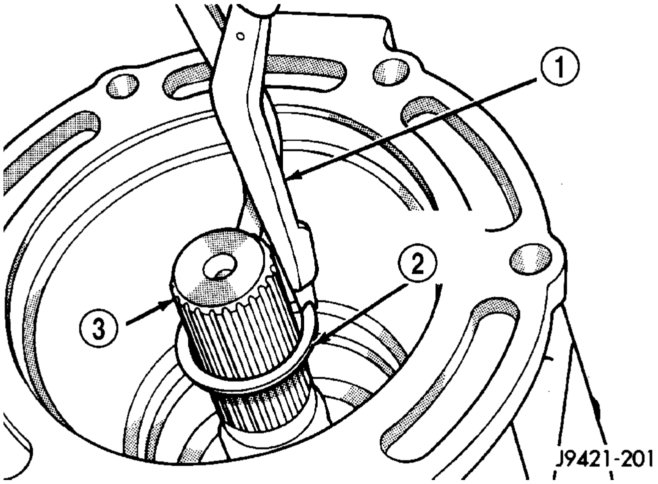


Fig. 88 REAR BEARING SNAP RING

1 - SNAP RING PLIERS
2 - SNAP RING
3 - OUTPUT SHAFT

(10) Lubricate lip of new rear seal (Fig. 89) with Mopar Door Ease or transmission fluid.

(11) Install new rear seal in adapter housing bore with Installer C-3860-A. Verify seal is seated in housing bore (Fig. 89).

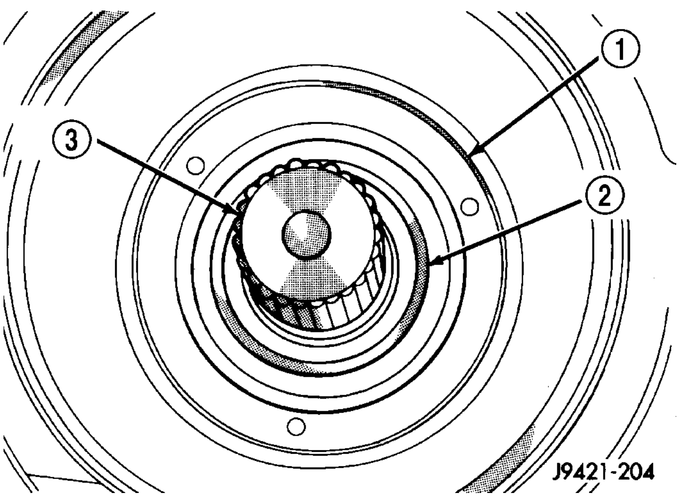


Fig. 89 REAR SEAL

1 - REAR SEAL
2 - SEAL LIP
3 - OUTPUT SHAFT

(12) Slide reverse idler shaft support straight into the housing.

(13) Install reverse idler shaft support bolt and idler shaft bolt (Fig. 90). Tighten bolts to 19-25 N·m (14-18 ft. lbs.).

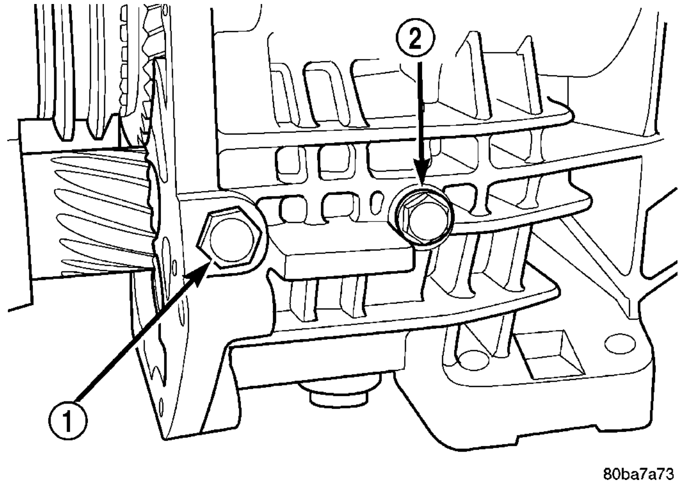


Fig. 90 REVERSE IDLER SHAFT/SUPPORT BOLT

1 - SUPPORT BOLT
2 - SHAFT BOLT

SHIFT SHAFT, SHAFT LEVER AND BUSHING AND SHIFT SOCKET

(1) Verify that all synchro sleeves are in Neutral position (centered on hub).

CAUTION: The transmission synchros must all be in Neutral position for assembly. Otherwise the housings, shift forks and gears can be damaged during installation of the two housings.

(2) Install 3-4 shift fork in synchro sleeve (Fig. 91). Verify that groove in fork arm is aligned with grooves in 1-2 and fifth-reverse fork arms as shown.

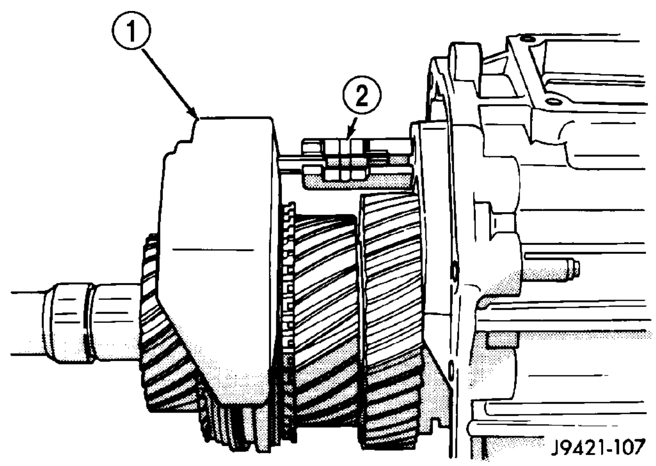


Fig. 91 3-4 SHIFT FORK

1 - 3-4 FORK
2 - ALIGN GROOVES IN FORK ARMS

MANUAL - NV3550 (Continued)

(3) Slide the end of shift shaft with shaft detent notches through 3-4 shift fork.

(4) Assemble shift shaft shift lever and bushing (Fig. 92). Be sure slot in bushing is facing up and roll pin hole for lever is aligned with hole in shaft.

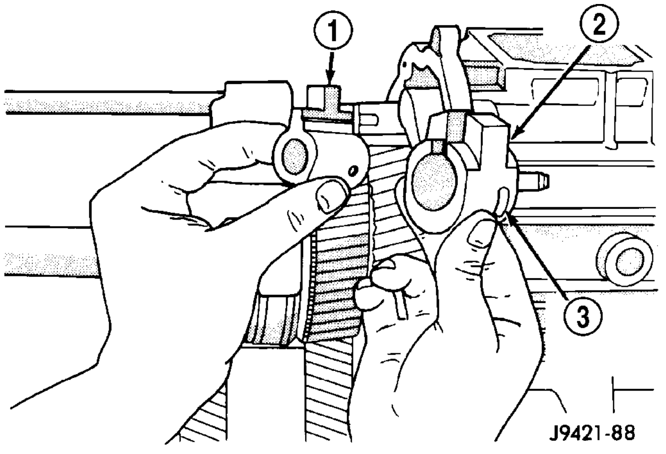


Fig. 92 LEVER AND BUSHING

1 - SHAFT LEVER
2 - LEVER BUSHING
3 - BUSHING LOCK PIN SLOT

(5) Install assembled lever and bushing on shift shaft (Fig. 93).

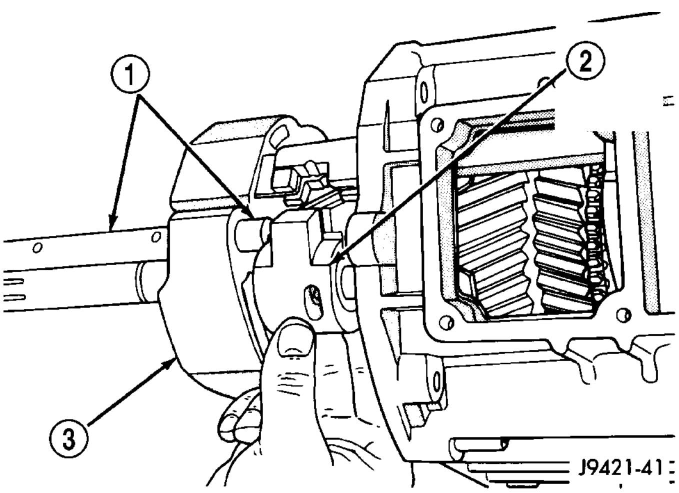


Fig. 93 LEVER AND BUSHING ASSENBLY

1 - SHIFT SHAFT
2 - SHAFT LEVER AND BUSHING
3 - 3-4 FORK

(6) Slide shift shaft through shift forks (Fig. 94) and into shift lever opening in rear housing (Fig. 95).

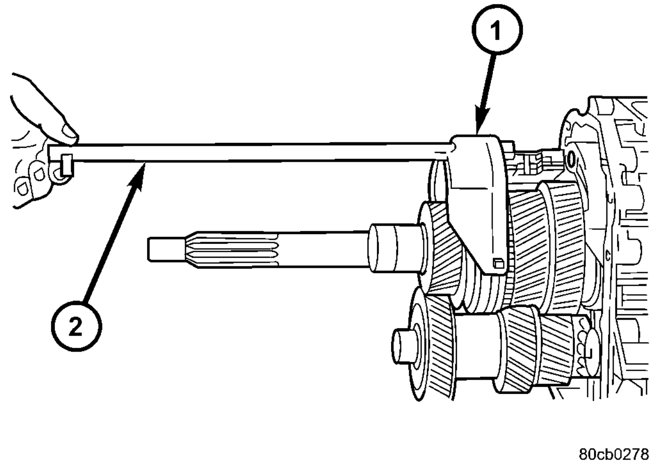


Fig. 94 SHIFT SHAFT

1 - SHIFT SHAFT
2 - 3-4 SHIFT FORK

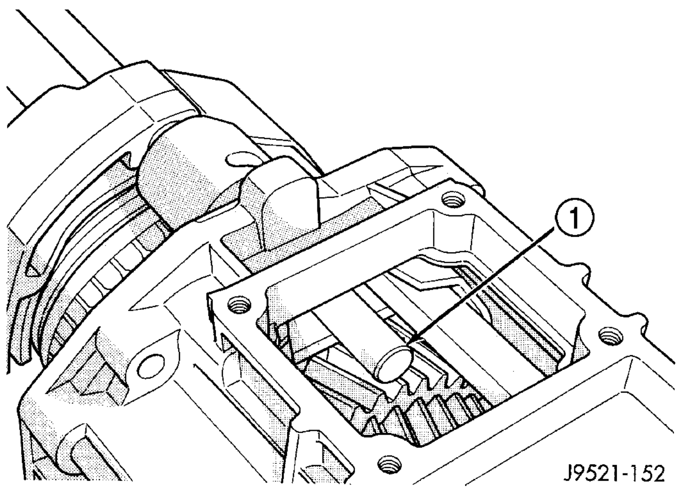


Fig. 95 SHAFT IN LEVER OPENING

1 - SHIFT SHAFT

MANUAL - NV3550 (Continued)

(7) Align shift socket with shaft and slide shaft through socket and into shift shaft bearing in rear housing (Fig. 96).

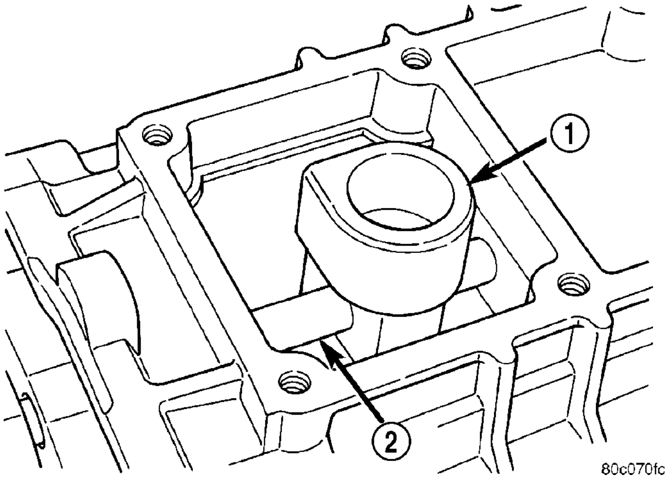


Fig. 96 SHIFT SOCKET

1 - SHIFT SOCKET
2 - SHIFT SHAFT

(8) Rotate shift shaft so detent notches in shaft are facing the TOP of the transmission housing.

CAUTION: Positioning of the shift shaft detent notch is important. Both of the shaft roll pins can be installed even when the shaft is 180° off. If this occurs, the transmission will have to be disassembled again to correct shaft alignment.

(9) Select correct new roll pin for shift shaft lever (Fig. 97). Shaft lever roll pin is approximately 22 mm (7/8 in.) long. Shift socket roll pin is approximately 33 mm (1-1/4 in.) long.

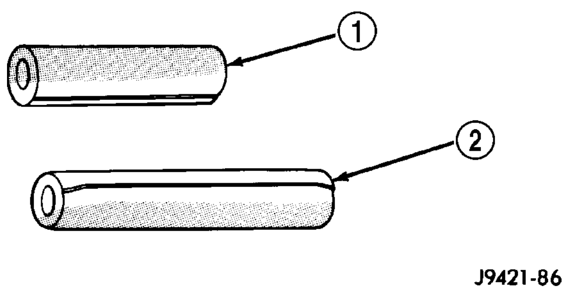


Fig. 97 ROLL PIN IDENTIFICATION

1 - SHAFT LEVER ROLL PIN
2 - SHIFT SOCKET ROLL PIN

(10) Align roll pin holes in shift shaft, lever and bushing. Then start roll pin into shaft lever by hand (Fig. 98).

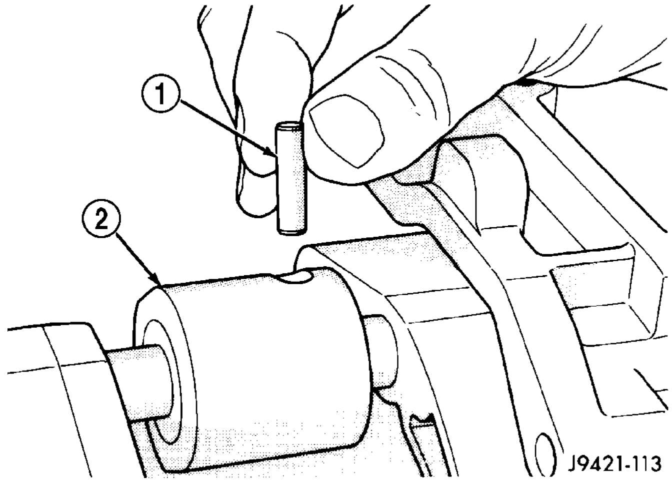


Fig. 98 ROLL PIN IN SHIFT SHAFT

1 - SHAFT LEVER ROLL PIN 22 mm (7/8 in.)
2 - LEVER AND BUSHING

(11) Seat shaft lever roll pin with pin punch (Fig. 99).

CAUTION: The shaft lever roll pin must be flush with the surface of the lever. The lever bushing will bind on the roll pin if the pin is not seated flush.

(12) Verify that lock pin slot in lever bushing is positioned as shown (Fig. 99).

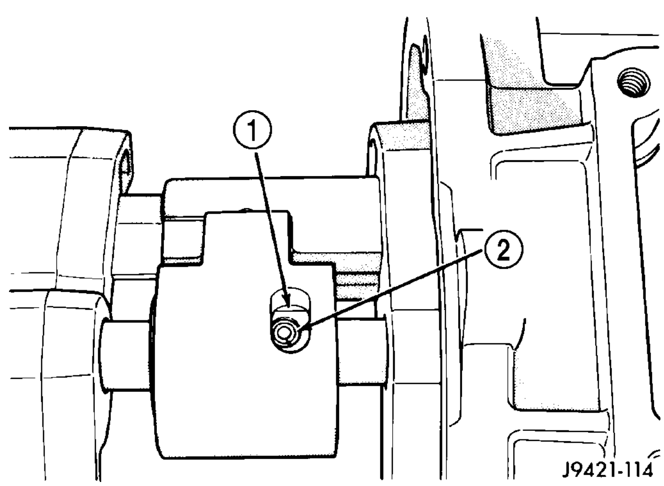


Fig. 99 SHIFT SHAFT LEVER ROLL

1 - BUSHING LOCK PIN SLOT
2 - ROLL PIN FLUSH WITH LEVER

MANUAL - NV3550 (Continued)

(13) Align roll pin holes in shift socket and shift shaft. Then start roll pin into shift shaft by hand (Fig. 100).

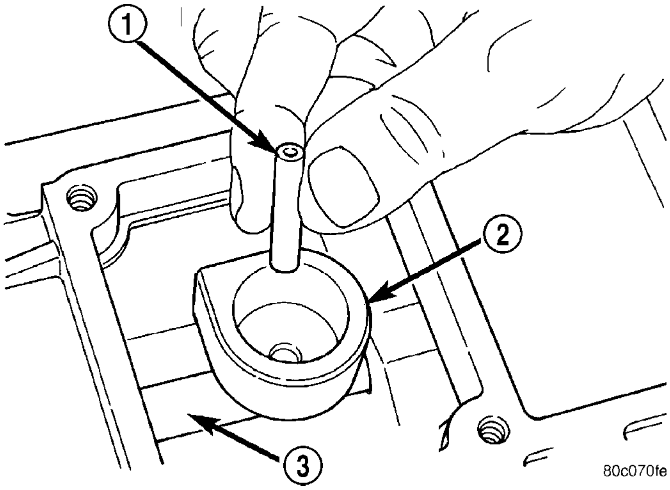


Fig. 100 ROLL PIN IN SHIFT SOCKET

1 - ROLL PIN 33 mm (1 1/4 in.)
2 - SHIFT SOCKET
3 - SHIFT SHAFT

(14) Seat roll pin in shift socket with pin punch. Roll pin must be flush with socket (Fig. 101).

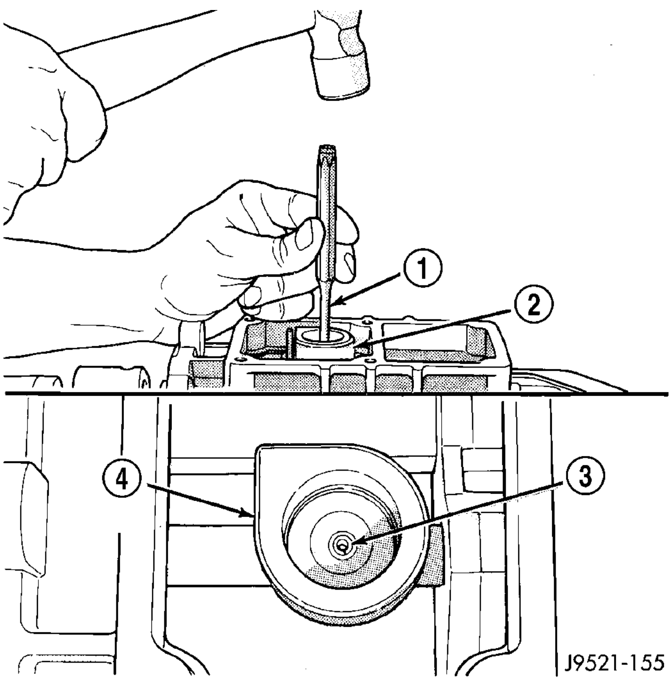


Fig. 101 SEATING SHIFT SOCKET ROLL PIN

1 - PIN PUNCH
2 - SHIFT SOCKET
3 - SEAT ROLL PIN FLUSH
4 - SHIFT SOCKET

(15) Verify that notches in shift fork arms are aligned (Fig. 102). Realign arms if necessary.

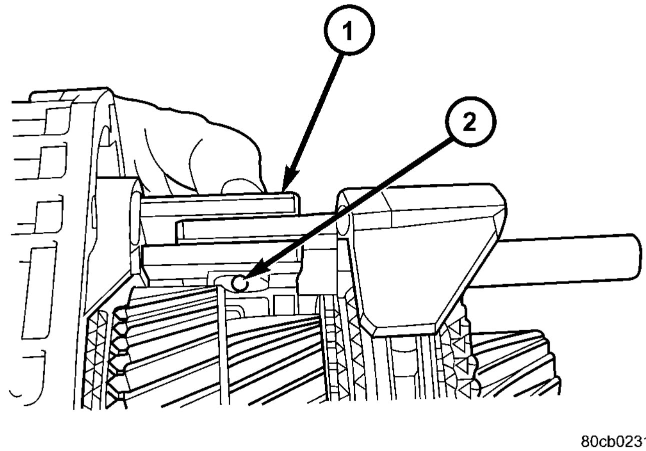


Fig. 102 SHIFT LEVER POSITION

1 - SHIFT FORK ARMS
2 - DETENT BORE

(16) Rotate shift lever and bushing downward to expose detent bore in the lever.

(17) Install detent spring then the ball into the detent bore (Fig. 103) and hold the ball in the lever. Then rotate the lever upward into the fork arm notches.

NOTE: Verify detent ball is seated in the fork arms before proceeding.

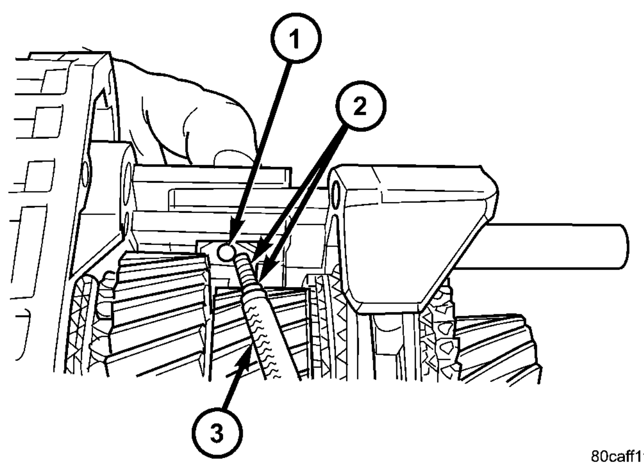


Fig. 103 DETENT SPRING AND BALL

1 - SHAFT LEVER
2 - SPRING AND BALL
3 - MAGNET

MANUAL - NV3550 (Continued)

FRONT HOUSING AND INPUT SHAFT BEARING RETAINER

(1) Install reverse blocker, retainter and retainer bolt in front housing.

(2) If previously removed, input shaft bearing in front housing (Fig. 104). Install snap ring and use plastic mallet to seat bearing. Bearing goes in from front side of housing only.

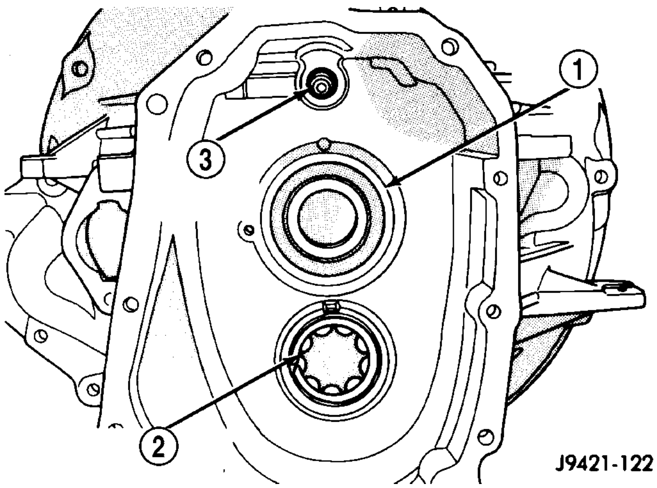


Fig. 104 INPUT SHAFT AND COUNTERSHAFT FRONT BEARING

1 - INPUT SHAFT BEARING
2 - COUNTERSHAFT FRONT BEARING
3 - SHIFT SHAFT BUSHING

(3) Apply liberal quantity of petroleum jelly to countershaft front bearing. Then insert bearing in front housing race (Fig. 104). Large diameter side of bearing cage goes toward countershaft (Fig. 105). Small diameter side goes toward bearing race in housing.

(4) Reach into countershaft front bearing with finger, and push each bearing roller outward against race. Then apply extra petroleum jelly to hold rollers in place. This avoids having rollers becoming displaced during housing installation.

(5) Apply small amount of petroleum jelly to shift shaft bushing in front housing.

(6) Apply 1/8 in. wide bead of Mopar Gasket Maker or equivalent, to mating surfaces of front and rear housings (Fig. 106).

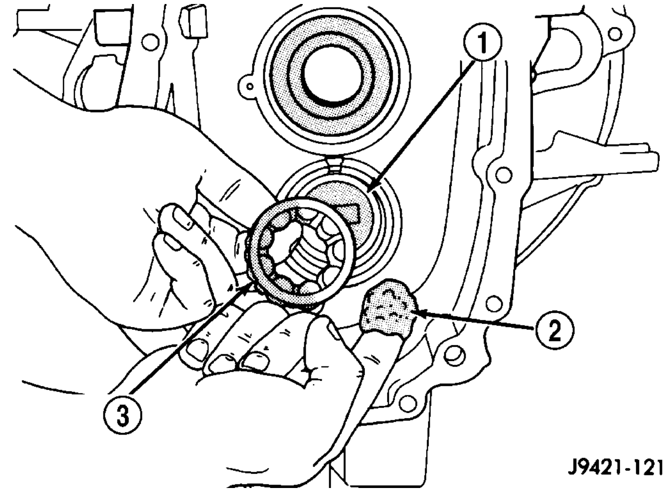


Fig. 105 COUNTERSHAFT FRONT BEARING

1 - BEARING RACE
2 - PETROLEUM JELLY
3 - COUNTERSHAFT FRONT BEARING

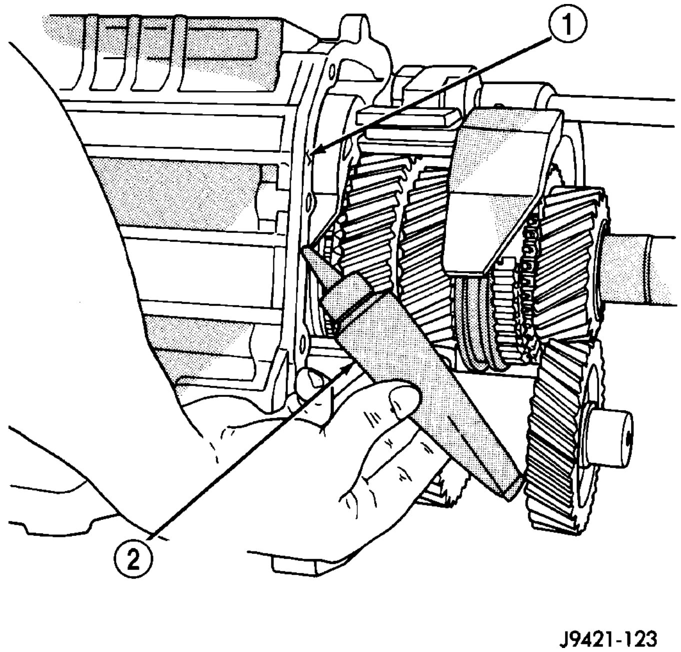


Fig. 106 SEAL FRONT/REAR HOUSINGS

1 - HOUSING FLANGE SURFACE
2 - GASKET MAKER

MANUAL - NV3550 (Continued)

(7) Have helper hold rear housing and geartrain in upright position. Then install front housing on rear housing and geartrain.

(8) Work front housing downward onto geartrain until seated on rear housing.

CAUTION: If the front housing will not seat on the rear housing, either the shift components are not in Neutral, or one or more components are misaligned. Do not force the front housing into place. This will only result in damaged components.

(9) Tap rear housing alignment dowels back into place with hammer and pin punch. Both dowels should be flush fit in each housing. Have helper hold transmission upright while dowels are tapped back into place.

(10) Place transmission in horizontal position.

(11) Apply Mopar Gasket Maker or equivalent to housing attaching bolts. Apply sealer material sealer to underside of bolt heads and to bolt shanks and threads (Fig. 107).

(12) Install and start housing attaching bolts by hand (Fig. 107). Then tighten bolts to 34 N·m (25 ft. lbs.).

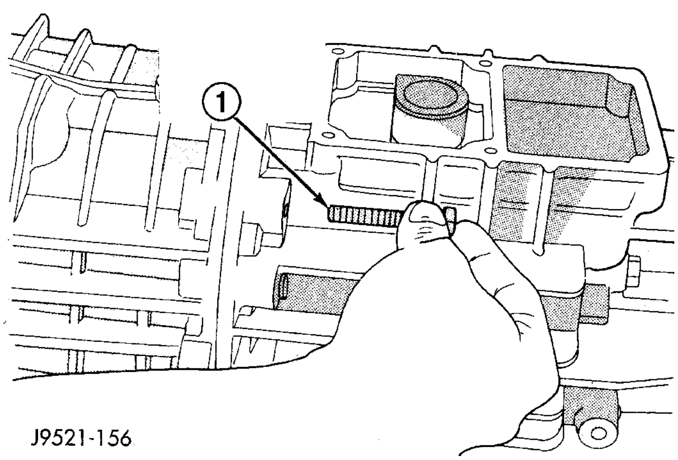


Fig. 107 HOUSING BOLTS

1 - HOUSING BOLTS

(13) Install shift shaft bushing lock bolt (Fig. 108). Apply Mopar Gasket Maker or equivalent, to bolt threads, shank and underside of bolt head before installation.

NOTE: This is a special bolt and can not be substituted with any other bolt.

CAUTION: If the lock bolt cannot be fully installed, do not try to force it into place. Either the shift shaft is not in Neutral or the shaft bushing (or lever) is misaligned.

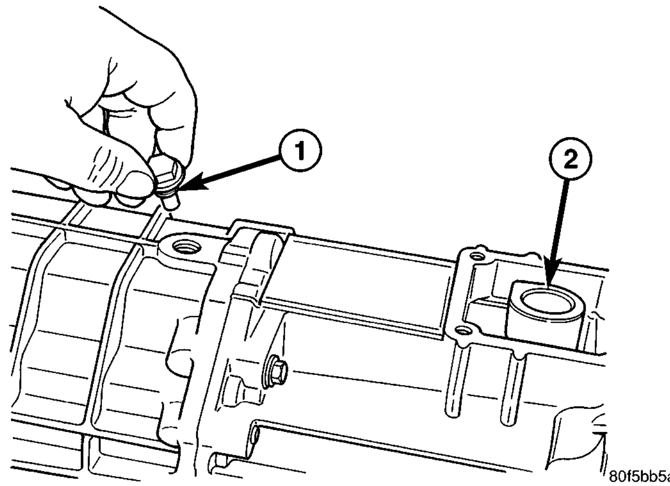


Fig. 108 SHAFT LOCK BOLT

1 - SHIFT SHAFT LOCK BOLT
2 - SHAFT SOCKET

(14) Lubricate then install shift shaft detent plunger in housing bore. Lubricate plunger with Valvoline Dura Blend® semi-synthetic/synthetic grease or equivalent. **Verify plunger is fully seated in detent notch in shift shaft.**

(15) Install detent spring inside plunger.

(16) Install plug on detent spring and compress spring. Then drive detent plug with Installer 8123 into transmission case until plug seats.

(17) Install backup light switch (Fig. 109).

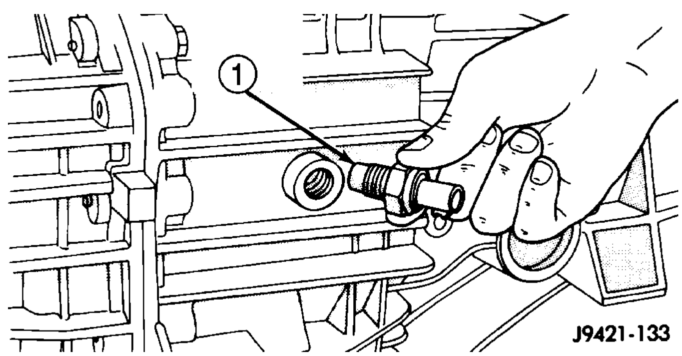


Fig. 109 BACKUP LIGHT SWITCH

1 - BACKUP LIGHT SWITCH

MANUAL - NV3550 (Continued)

(18) Install input shaft snap ring (Fig. 110).

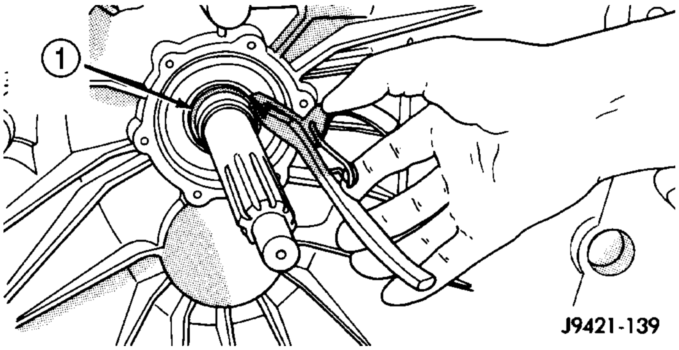


Fig. 110 SHAFT SNAP RING - TYPICAL

1 - INPUT SHAFT SNAP RING

(19) Install new oil seal in front bearing retainer with Installer 6448 (Fig. 111).

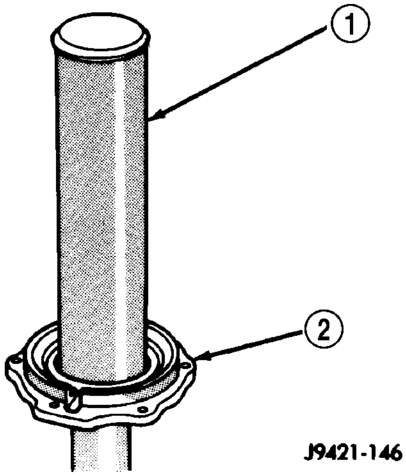


Fig. 111 OIL SEAL IN FRONT BEARING RETAINER

1 - INSTALLER
2 - FRONT BEARING RETAINER

(20) Apply bead of Mopar silicone sealer or equivalent to flange surface of front bearing retainer (Fig. 112).

(21) Align and install front bearing retainer over input shaft and onto housing mounting surface (Fig. 113). Although retainer is one-way fit on housing, be sure bolt holes are aligned before seating retainer.

NOTE: Ensure no sealer gets in the transmission case oil feed hole and slot in bearing retainer is aligned with oil feed hole.

(22) Install and tighten bearing retainer bolts to 9-14 N·m (7-10 ft. lbs.) (Fig. 114).

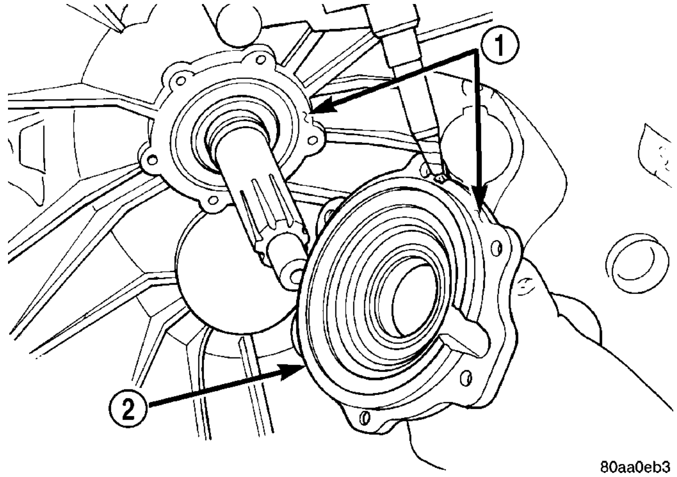


Fig. 112 SEAL BEARING RETAINER AND HOUSING

1 - APPLY SEALER BEAD
2 - INPUT SHAFT BEARING RETAINER

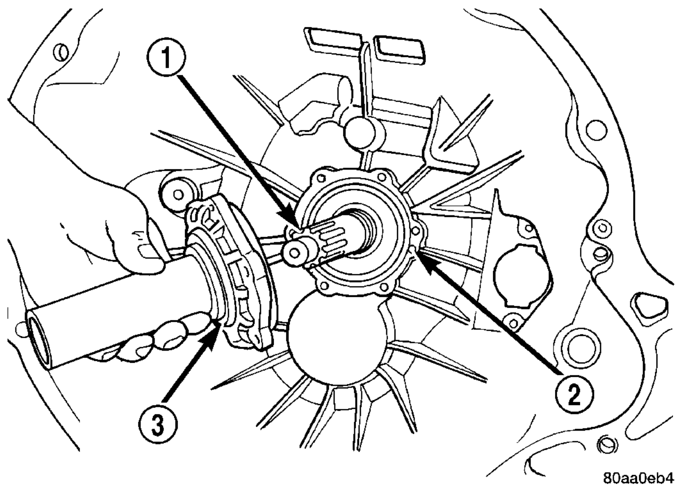


Fig. 113 INPUT SHAFT BEARING RETAINER

1 - INPUT SHAFT
2 - OIL FEED
3 - BEARING RETAINER

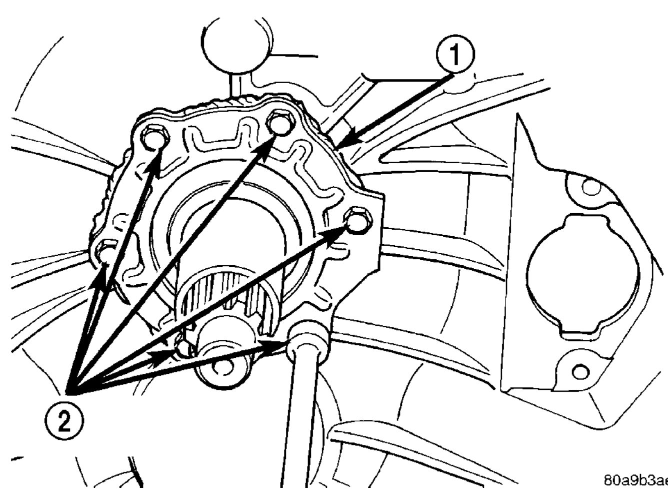


Fig. 114 BEARING RETAINER BOLTS

1 - RETAINER
2 - BOLTS

MANUAL - NV3550 (Continued)

SHIFT TOWER AND LEVER

(1) Apply petroleum jelly to ball end of shift lever and interior of shift socket.

(2) Shift the transmission into third gear.

(3) Align and install shift tower and lever assembly (Fig. 115). Be sure shift ball is seated in socket and the offset in the tower is toward the passenger side of the vehicle before installing tower bolts.

(4) Install shift tower bolts (Fig. 116). Tighten bolts to 8.5 N·m (75.2 in. lbs.).

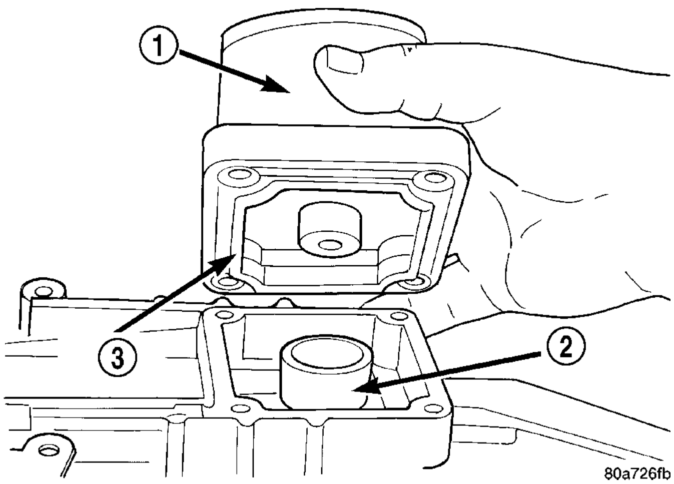


Fig. 115 SHIFT TOWER

1 - SHIFT TOWER
2 - SHIFT SOCKET
3 - SEALING SURFACE

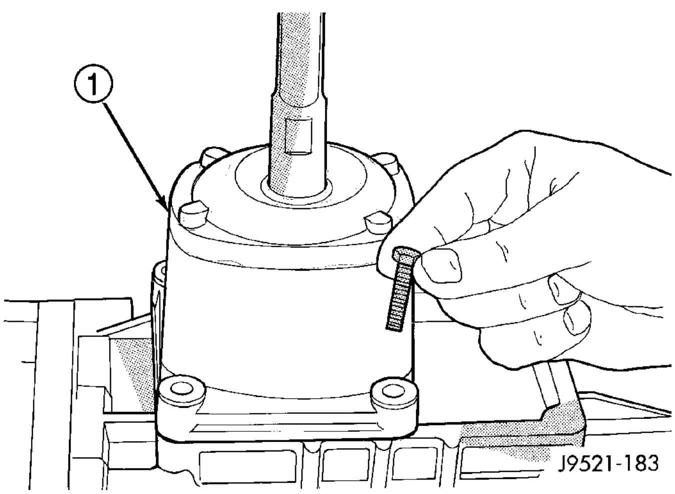


Fig. 116 SHIFT TOWER BOLTS

1 - SHIFT TOWER AND LEVER ASSEMBLY

(5) Fill transmission to bottom edge of fill plug hole with Mopar Transmission Lubricant.

(6) Install and tighten fill plug to 34 N·m (25 ft. lbs.).

(7) Check transmission vent. Be sure vent is open and not restricted.

INSTALLATION

(1) Install clutch housing on transmission and tighten housing bolts to 46 N·m (34 ft. lbs.).

(2) Lubricate contact surfaces of release fork pivot ball stud and release fork with high temp grease.

(3) Install release bearing, fork and retainer clip.

(4) Position and secure transmission on transmission jack.

(5) Lightly lubricate pilot bearing and transmission input shaft splines with Mopar high temp grease.

(6) Raise transmission and align transmission input shaft and clutch disc splines. Then slide transmission into place.

(7) Install and tighten clutch housing-to-engine bolts (Fig. 117) to:**Be sure the housing is properly seated on engine block before tightening bolts.**

- Tighten 3/8” diameter bolts to 37 N·m (27 ft.lbs.)
- Tighten 7/16” diameter bolts to 58 N·m (43 ft.lbs.)
- Tighten M12 bolts to 75 N·m (55 ft.lbs.)

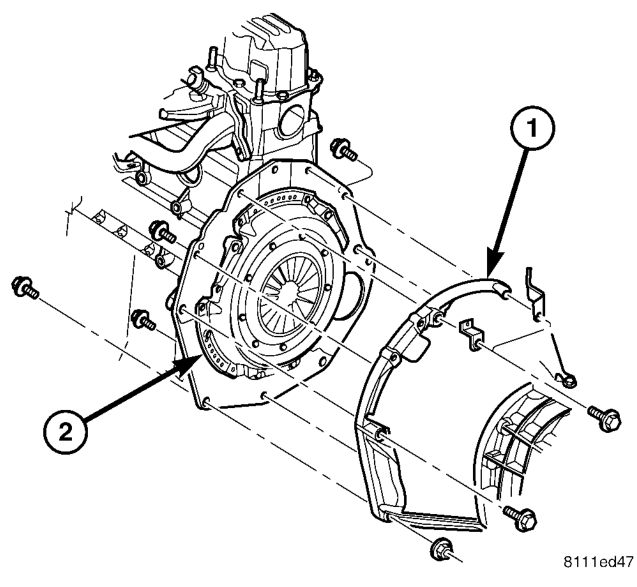


Fig. 117 NV3550 TRANSMISSION

1 - TRANSMISSION
2 - CLUTCH ASSEMBLY

(8) Be sure transmission is in first or third gear.

(9) Install crossmember and tighten crossmember-to-frame bolts to 41 N·m (31 ft. lbs.).

(10) Install fasteners to hold rear cushion and bracket to transmission. Then tighten transmission-to-rear support bolts/nuts to 54 N·m (40 ft. lbs.).

(11) Remove support stands from engine and transmission.

(12) Install and connect crankshaft position sensor.

(13) Install transfer case.

(14) Install propeller shafts.

(15) Install slave cylinder in clutch housing.

MANUAL - NV3550 (Continued)

(16) Install skid plate, if equipped and tighten bolts to 42 N·m (31 ft. lbs.). Tighten stud nuts to 17 N·m (150 in. lbs.).

(17) Fill transmission and transfer case if equipped, with recommended lubricants. Refer to the Lubricant Recommendation sections of the appropriate component for correct fluid.

(18) Install nuts on two M6X1.0 bolts and thread the bolts into the threaded holes at the base of the shift lever.

(19) Tighten the nuts equally until the shift lever will slide over the shift tower stub shaft.

(20) Install the floor console and shift boot.

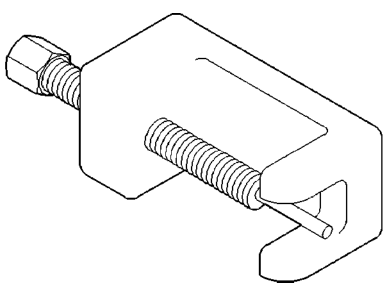
SPECIFICATIONS

MANUAL

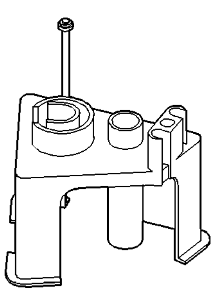
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Clutch Housing Bolts	54-61	40-45	-
Crossmember To Frame Bolts	61-75	44-55	-
Crossmember To Insulator Nuts	54-61	40-45	-
Drain/Fill Plug	9-27	14-20	-
Front To Rear Housing Bolts	30-35	22-26	-
Front Bearing Retainer Bolts	9-14	7-8	80-124
Idler Shaft Bolts	19-25	14-18	-
Rear Bearing Retainer Bolts	30-35	22-26	-
Shift Tower Bolts	7-10	5-7	62-88
Slave Cylinder Nuts	23	17	-
Transfer Case Nuts	47	35	-
U-Joint Clamp Bolts	19	14	-

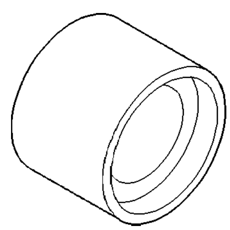
SPECIAL TOOLS



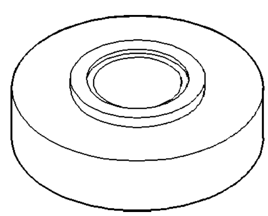
REMOVER/INSTALLER 6858



FIXTURE 6747

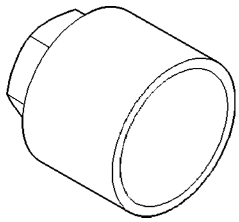


ADAPTER 6747-1A

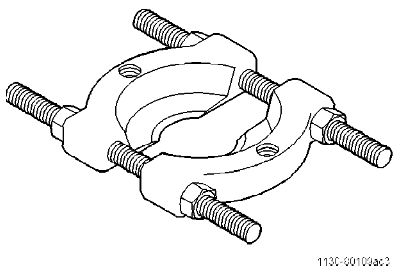


ADAPTER 6747-2A

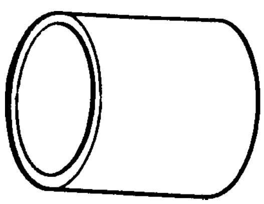
MANUAL - NV3550 (Continued)



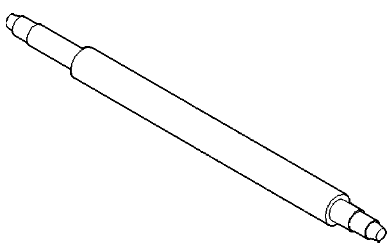
CUP 8115



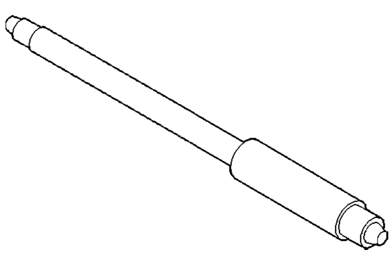
SPLITTER 1130



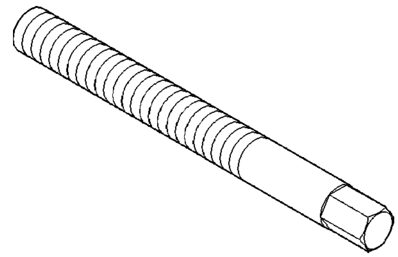
TUBE 6310-1



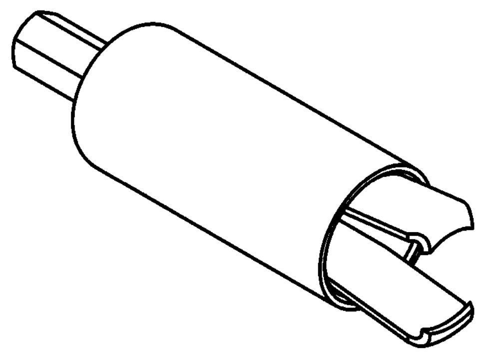
INSTALLER 8118



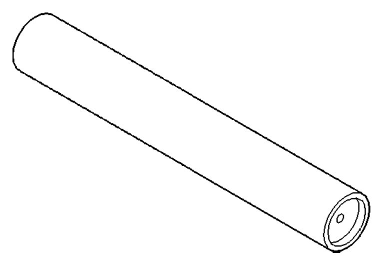
REMOVER/INSTALLER 8119



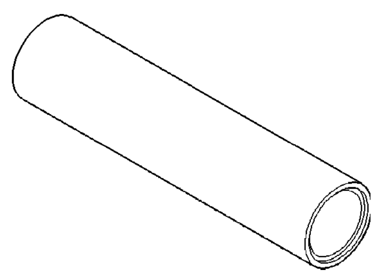
PIN ALIGNMENT 8120



REMOVER 8117A



INSTALLER 8123



INSTALLER 6448

VEHICLE SPEED SENSOR

DESCRIPTION

The 3-wire Vehicle Speed Sensor (VSS) is located on the speedometer pinion gear adapter. If equipped with 4WD, this adapter is located on the extension housing of the transfer case (drivers side). If equipped with 2WD, this adapter is located on the left side of the transmission extension housing.

OPERATION

The VSS is a 3-circuit (3–wire), magnetic, hall-effect sensor.

The 3 circuits are:

- A 5-volt power supply from the Powertrain Control Module (PCM).
- A ground is provided for the sensor though a low-noise sensor return circuit in the PCM.
- An input to the PCM is used to determine vehicle speed and distance traveled.

The speed sensor generates 8 pulses per sensor revolution. These signals, in conjunction with a closed throttle signal from the throttle position sensor, indicate a closed throttle deceleration to the PCM. When the vehicle is stopped at idle, a closed throttle signal is received by the PCM (but a speed sensor signal is not received).

Under deceleration conditions, the PCM adjusts the Idle Air Control (IAC) motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

REMOVAL

The Vehicle Speed Sensor (VSS) is located on the speedometer pinion gear adapter. If equipped with 4WD, this adapter is located on the transfer case extension (left side) (Fig. 118). If equipped with 2WD, this adapter is located on the extension housing of the transmission (left side).

(1) Raise and support vehicle.

(2) Disconnect electrical connector from sensor by pushing slide tab (Fig. 118). After slide tab has been positioned, push in on secondary release lock (Fig. 118) on side of connector and pull connector from sensor.

(3) Remove sensor mounting bolt (Fig. 119).

(4) Remove sensor (pull straight out) from speedometer pinion gear adapter (Fig. 119). Do not remove gear adapter from transmission.

INSTALLATION

(1) Clean inside of speedometer pinion gear adapter before installing speed sensor.

(2) Install sensor into speedometer gear adapter and install mounting bolt. Before tightening bolt, verify speed sensor is fully seated (mounted flush) to speedometer pinion gear adapter.

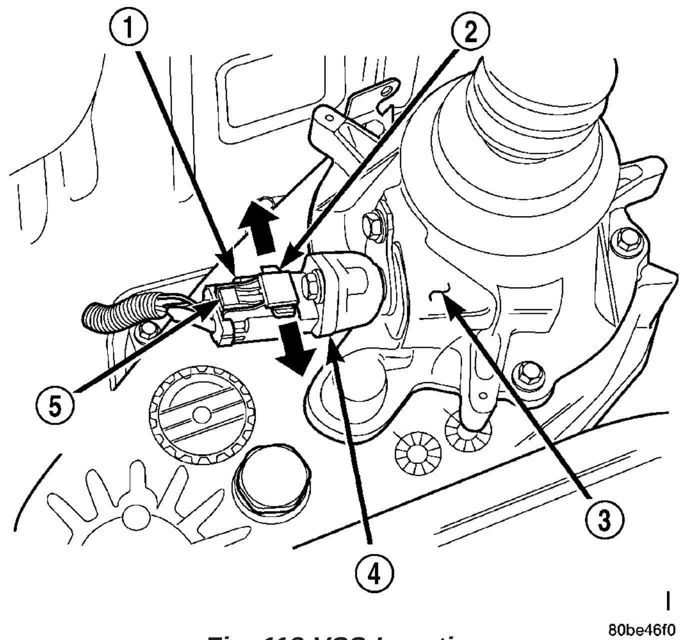


Fig. 118 VSS Location

1 - SENSOR ELECTRICAL CONNECTOR
2 - SLIDE TAB
3 - 4WD TRANSFER CASE EXTENSION
4 - VEHICLE SPEED SENSOR
5 - RELEASE LOCK

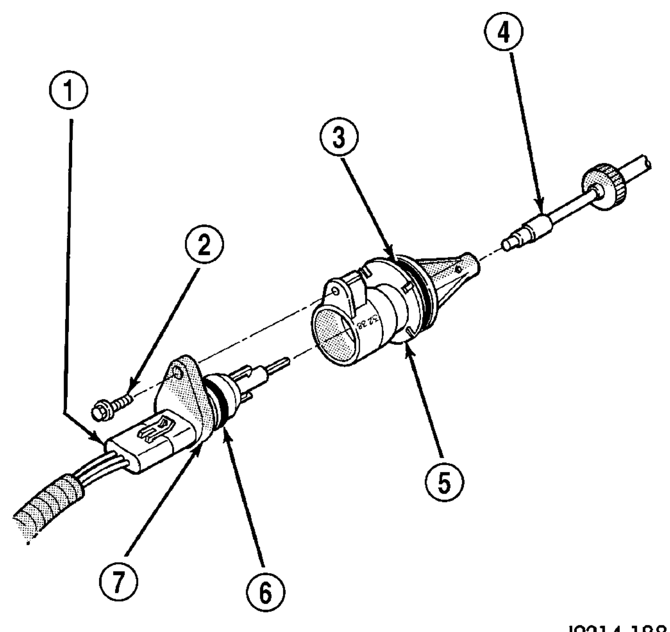


Fig. 119 VSS Removal/Installation

1 - ELECTRICAL CONNECTOR
2 - SENSOR MOUNTING BOLT
3 - O-RING
4 - SPEEDOMETER PINION GEAR
5 - SPEEDOMETER PINION GEAR ADAPTER
6 - O-RING
7 - VEHICLE SPEED SENSOR

(3) Tighten sensor mounting bolt to 2.2 N·m (20 in. lbs.) torque.

(4) Connect electrical connector to sensor.

AUTOMATIC TRANSMISSION - 42RLE

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AUTOMATIC TRANSMISSION - 42RLE

DESCRIPTION

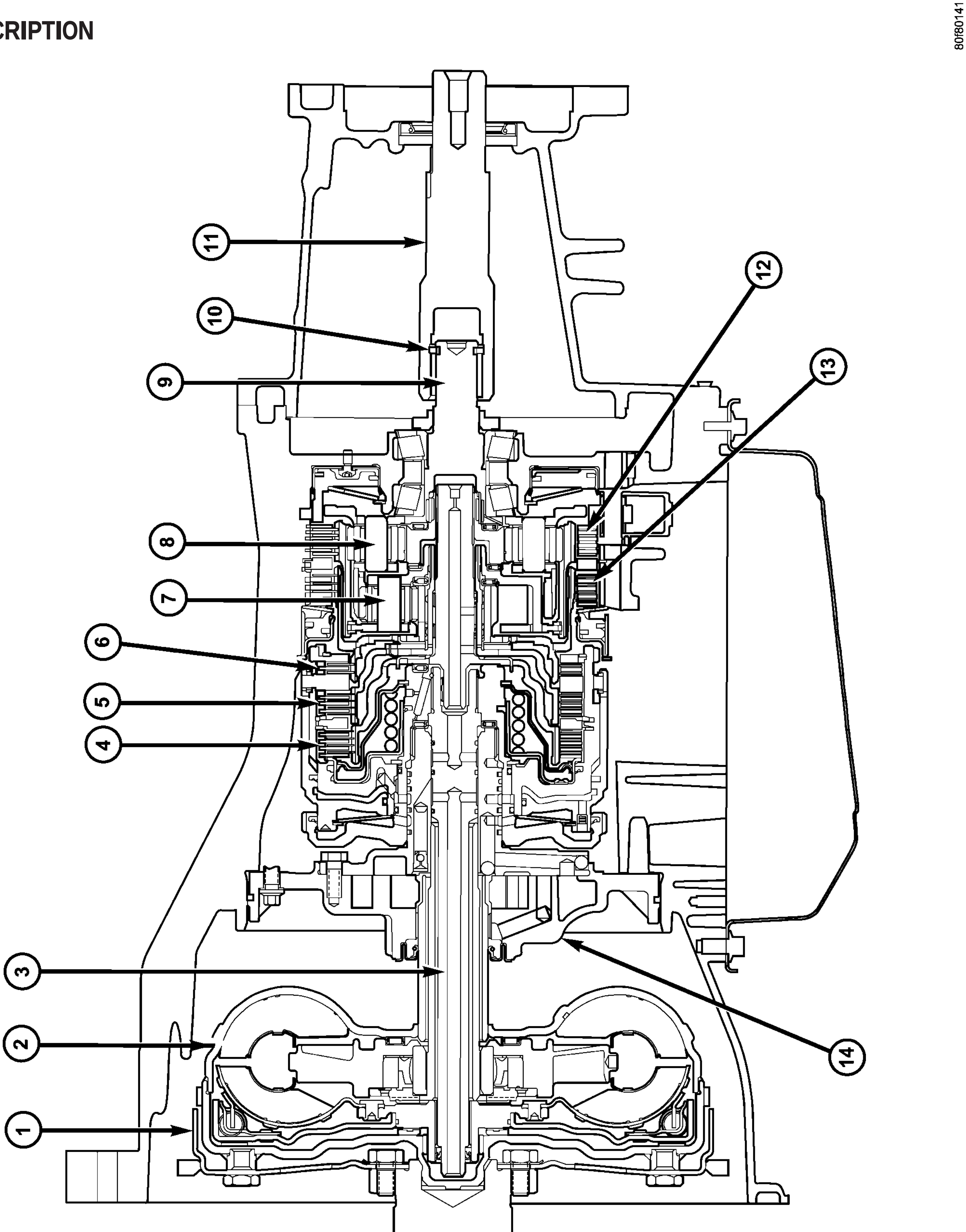


Fig. 1 42RLE Automatic Transmission

AUTOMATIC TRANSMISSION - 42RLE (Continued)

1 - DRIVEPLATE
2 - TORQUE CONVERTER
3 - INPUT SHAFT
4 - UNDERDRIVE CLUTCH
5 - OVERDRIVE CLUTCH
6 - REVERSE CLUTCH
7 - FRONT PLANET CARRIER
8 - REAR PLANET CARRIER
9 - OUTPUT SHAFT
10 - SNAP RING
11 - STUB SHAFT
12 - LOW/REVERSE CLUTCH
13 - 2/4 CLUTCH
14 - OIL PUMP

The 42RLE (Fig. 1) is a four-speed transmission that is a conventional hydraulic/mechanical assembly controlled with adaptive electronic controls and monitors. The hydraulic system of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid/Pressure switch assembly

Control of the transmission is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor feedback information provided to the Transmission Control Module (TCM) portion of the Powertrain Control Module (PCM).

The TCM is the heart of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB® scan tool.

TRANSMISSION IDENTIFICATION

The 42RLE transmission can be identified by a barcode label that is affixed to the upper left area of the bellhousing.

The label contains a series of digits that can be translated into useful information such as transmission part number, date of manufacture, manufacturing origin, assembly line identifier, build sequence number, etc. Refer to (Fig. 2) for identification label breakdown.

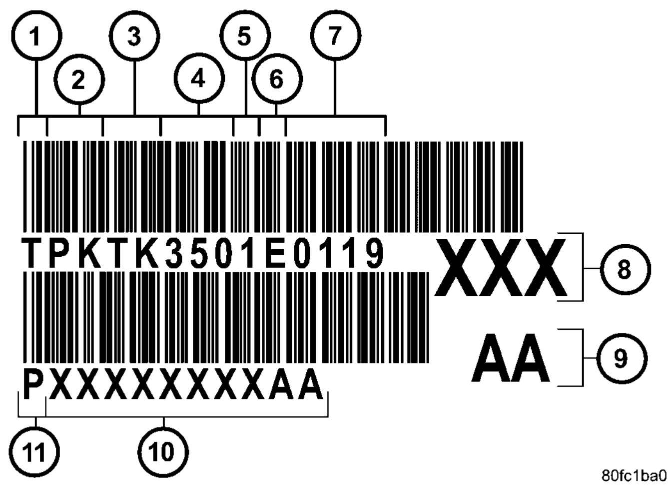


Fig. 2 Identification Label Breakdown

1 - T=TRACEABILITY
2 - SUPPLIER CODE (PK=KOKOMO)
3 - COMPONENT CODE (TK=KOKOMO TRANSMISSION)
4 - BUILD DAY (350=DEC. 15)
5 - BUILD YEAR (1=2001)
6 - ASSEMBLY LINE CODE
7 - BUILD SEQUENCE NUMBER
8 - LAST THREE OF P/N
9 - CHANGE LEVEL
10 - TRANSMISSION PART NUMBER
11 - P=PART NUMBER

If the tag is not legible or is missing, the "PK" number, which is stamped into the left rear flange of the transmission case, can be referred to for identification. The entire part number, build code, and sequence number are stamped into the flange.

OPERATION

The 42RLE transmission ratios are:

First	2.84 : 1
Second	1.57 : 1
Third	1.00 : 1
Overdrive	0.69 : 1
Reverse	2.21 : 1

AUTOMATIC TRANSMISSION - 42RLE (Continued)

FIRST GEAR POWERFLOW

In first gear range, torque input is through the underdrive clutch to the underdrive hub assembly (Fig. 3). The underdrive hub is splined to the rear sun gear. When the underdrive clutch is applied, it rotates the underdrive hub and rear sun gear. The L/R clutch is applied to hold the front carrier/rear annulus assembly. The rear sun gear drives the rear planetary pinion gears. The rear planetary pinion gears are forced to walk around the inside of the stationary rear annulus gear. The pinions are pinned to the rear carrier and cause the rear carrier assembly to rotate as they walk around the annulus gear. This provides the torque output for first gear. The other planetary gearset components are freewheeling. The first gear ratio is 2.84:1.

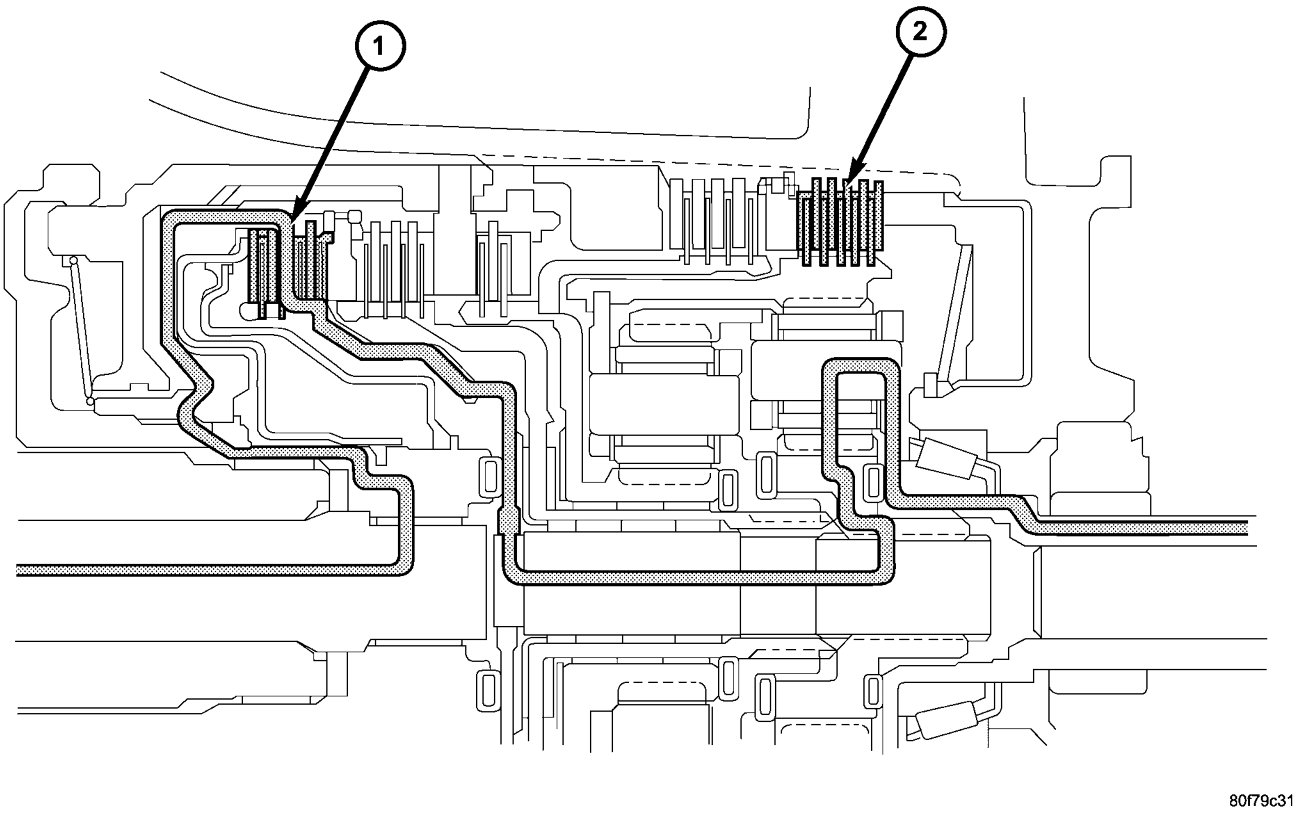


Fig. 3 First Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun) 2 - LOW-REVERSE CLUTCH APPLIED (Holds Rear Annulus/Front Carrier)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

SECOND GEAR POWERFLOW

Second gear is achieved by having both planetary gear sets contribute to torque multiplication (Fig. 4). As in first gear, torque input is through the underdrive clutch to the rear sun gear. The 2/4 clutch is applied to hold the front sun gear stationary. The rotating rear sun gear turns the rear planetary pinions. The rear pinions rotate the rear annulus/front carrier assembly. The pinions of the front carrier walk around the stationary front sun gear. This transmits torque to the front annulus/rear carrier assembly, which provides output torque and a gear ratio of 1.57:1.

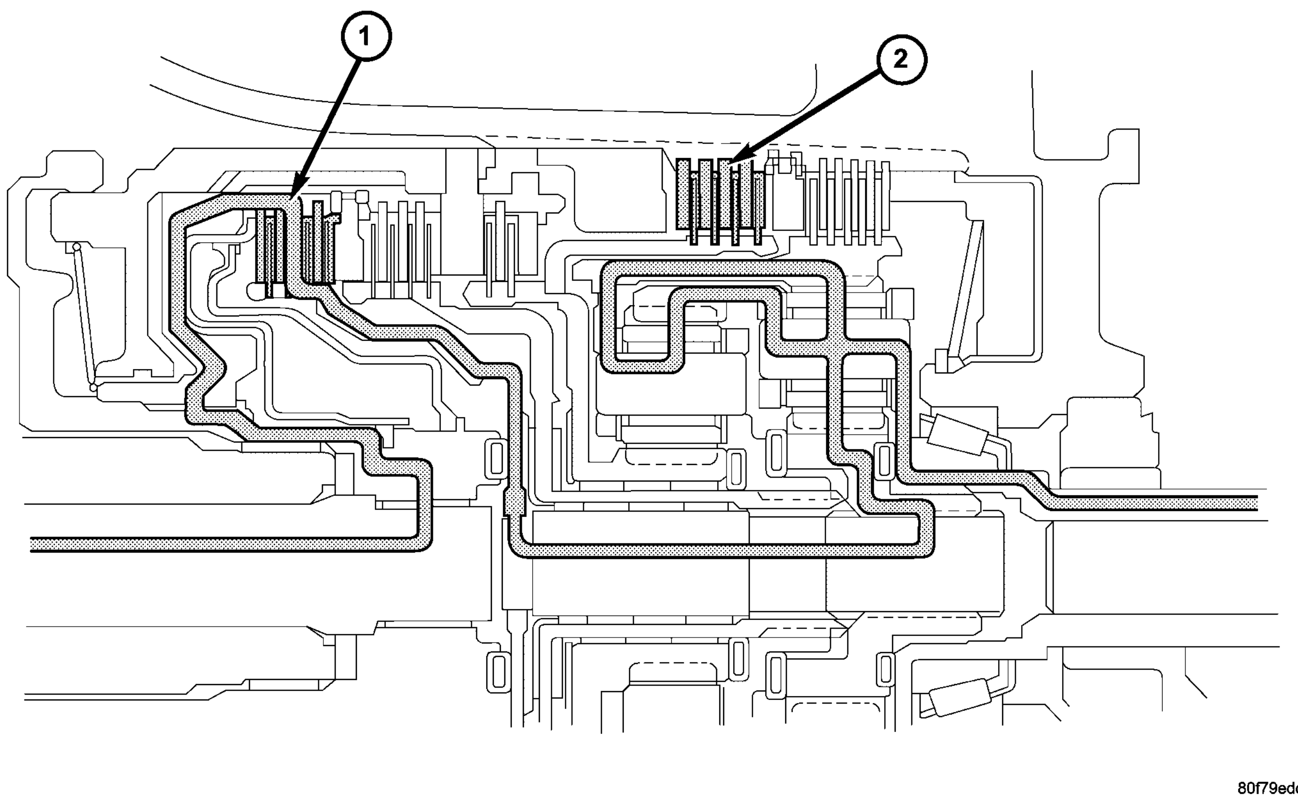


Fig. 4 Second Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - 2-4 CLUTCH APPLIED (Holds Front Sun)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

THIRD GEAR POWERFLOW

In third gear, two input clutches are applied to provide torque input: the underdrive clutch and overdrive clutch (Fig. 5). The underdrive clutch rotates the rear sun gear, while the overdrive clutch rotates the front carrier/rear annulus assembly. The result is two components (rear sun gear and rear annulus gear) rotating at the same speed and in the same direction. This effectively locks the entire planetary gearset together and is rotated as one unit. The gear ratio in third is 1:1.

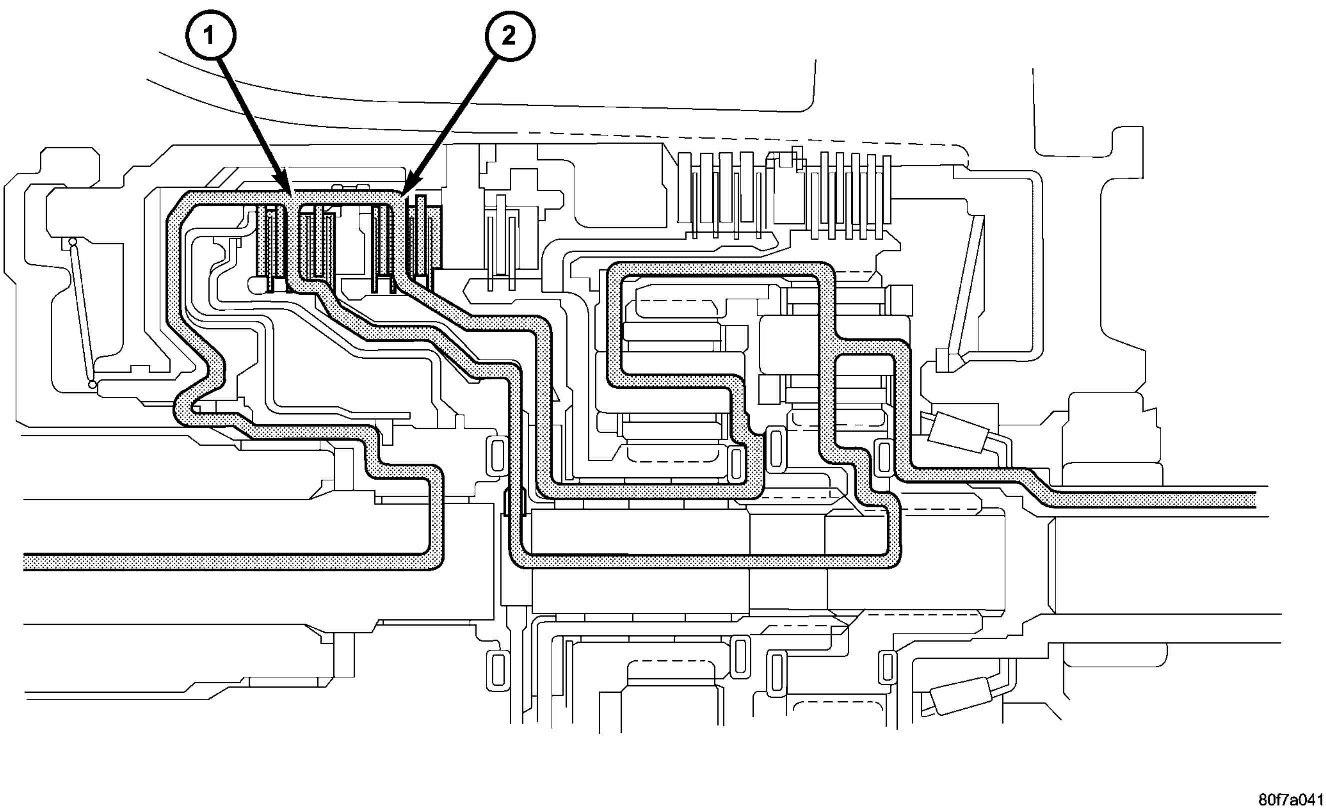


Fig. 5 Third Gear Powerflow

1 - UNDERDRIVE CLUTCH APPLIED (Turns Rear Sun) 2 - OVERDRIVE CLUTCH APPLIED (Turns Front Carrier/Rear Annulus)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

FOURTH GEAR POWERFLOW

In fourth gear input torque is through the overdrive clutch which drives the front carrier (Fig. 6). The 2/4 clutch is applied to hold the front sun gear. As the overdrive clutch rotates the front carrier, it causes the pinions of the front carrier to walk around the stationary front sun gear. This causes the front carrier pinions to turn the front annulus/rear carrier assembly which provides output torque. In fourth gear, transmission output speed is more than engine input speed. This situation is called overdrive and the gear ratio is 0.69:1.

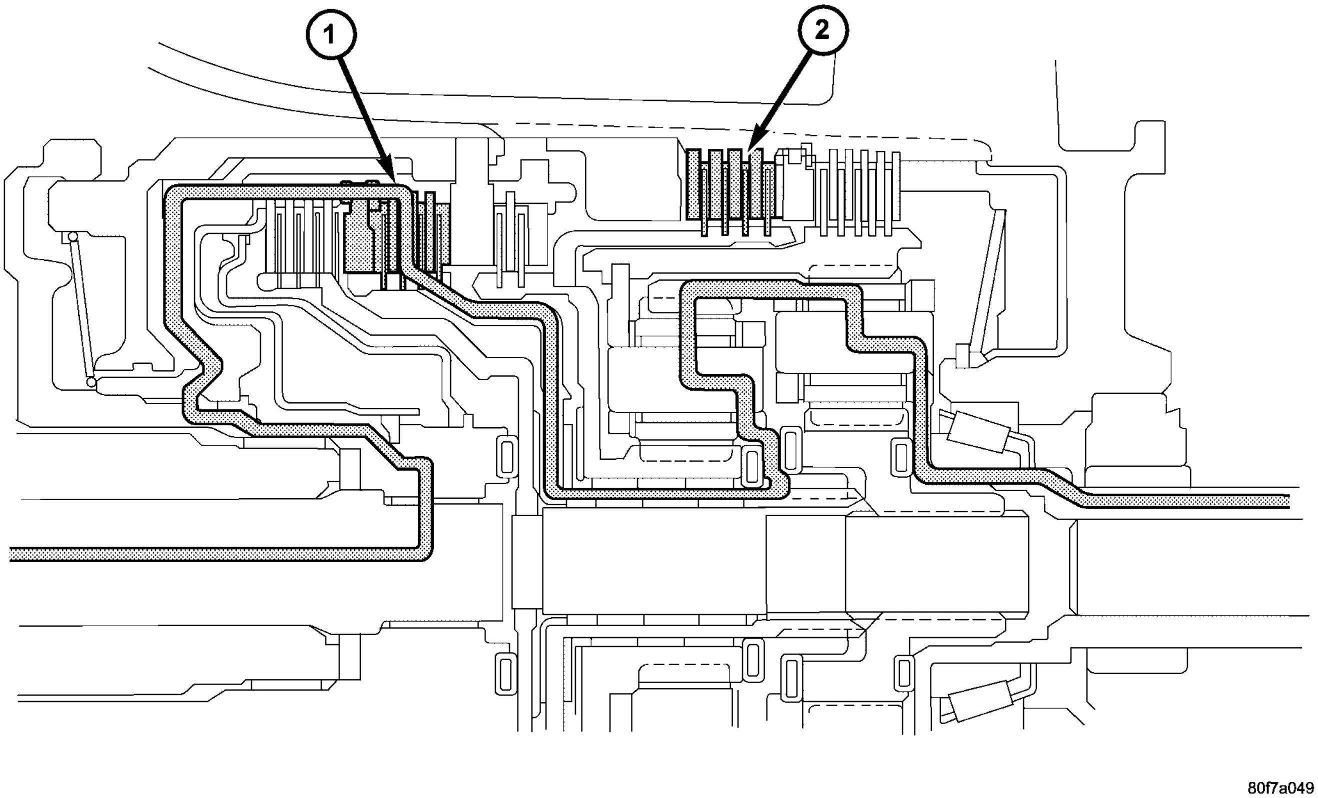


Fig. 6 Fourth Gear Powerflow

1 - OVERDRIVE CLUTCH APPLIED (Turns Rear Sun)
2 - 2-4 CLUTCH APPLIED (Holds Front Sun)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

REVERSE GEAR POWERFLOW

In reverse, input power is through the reverse clutch (Fig. 7). When applied, the reverse clutch drives the front sun gear through the overdrive hub and shaft. The L/R clutch is applied to hold the front carrier/rear annulus assembly stationary. The front carrier is being held by the L/R clutch so the pinions are forced to rotate the front annulus/rear carrier assembly in the reverse direction. Output torque is provided, in reverse, with a gear ratio of 2.21:1.

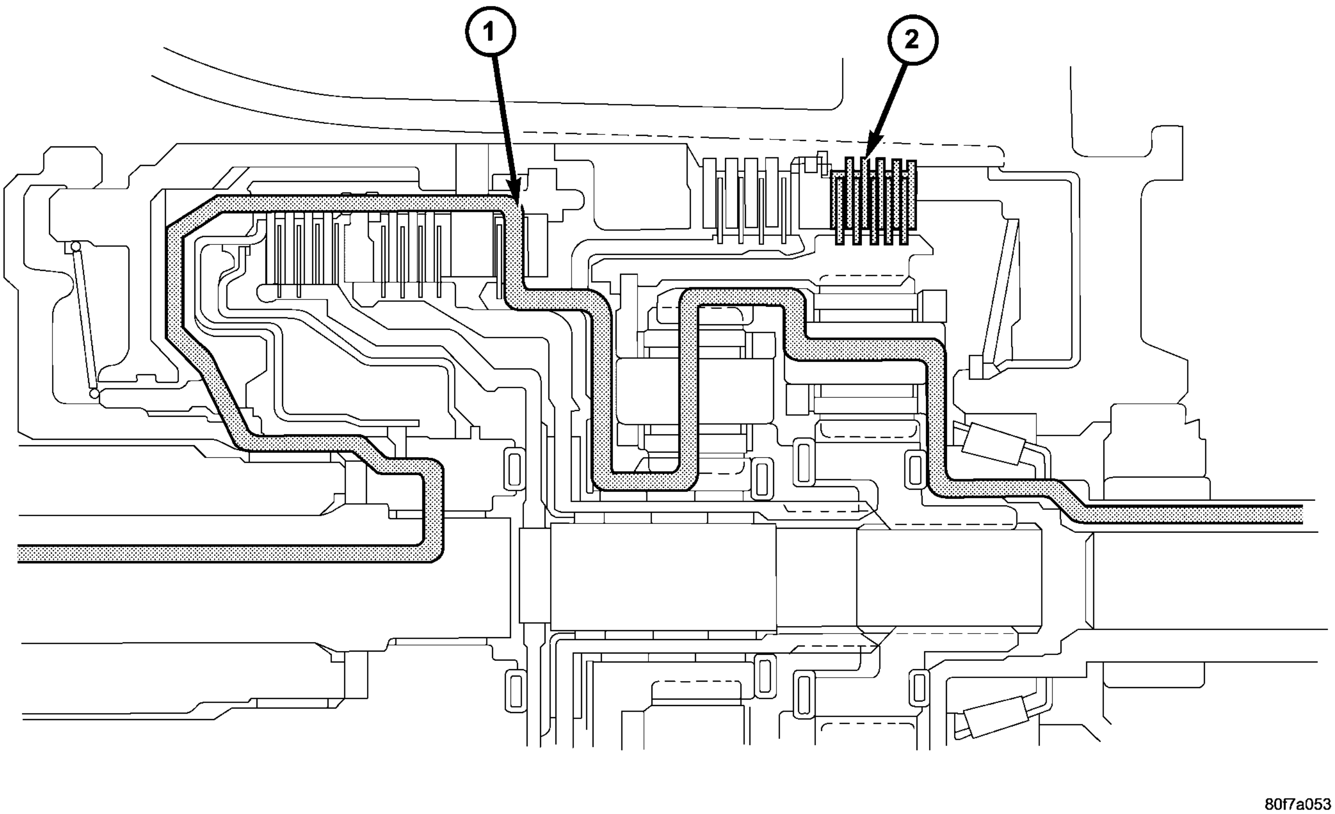


Fig. 7 Reverse Gear Powerflow

1 - LOW-REVERSE CLUTCH APPLIED (Holds Rear Annulus Front Carrier)
2 - REVERSE CLUTCH APPLIED (Turns Front Sun)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on the 42RLE Four Speed Automatic Transmission, always check for proper shift linkage adjustment. Also check for diagnostic trouble codes with the DRB® scan tool and the 42RLE Transmission Diagnostic Procedure Manual.

42RLE automatic transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

When diagnosing a problem always begin with recording the complaint. The complaint should be defined as specific as possible. Include the following checks:

- Temperature at occurrence (cold, hot, both)
- Dynamic conditions (acceleration, deceleration, upshift, cornering)
- Elements in use when condition occurs (what gear is transmission in during condition)
- Road and weather conditions
- Any other useful diagnostic information.

After noting all conditions, check the easily accessible variables:

- Fluid level and condition
- Shift linkage adjustment
- Diagnostic trouble code inspection

Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

DIAGNOSIS AND TESTING - ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transmission should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transmission cleaning.

Slipping clutches can be isolated by comparing the “Elements in Use” chart with clutch operation encountered on a road test. This chart identifies which clutches are applied at each position of the selector lever.

A slipping clutch may also set a DTC and can be determined by operating the transmission in all selector positions.

AUTOMATIC TRANSMISSION - 42RLE (Continued)

ELEMENTS IN USE AT EACH POSITION OF SELECTOR LEVER

Shift Lever Position	INPUT CLUTCHES			HOLDING CLUTCHES	
	Underdrive	Overdrive	Reverse	2/4	Low/Reverse
P - PARK					X
R - REVERSE			X		X
N - NEUTRAL					X
OD - OVERDRIVE					
First	X				X
Second	X			X	
Direct	X	X			
Overdrive		X		X	
D - DRIVE*					
First	X				X
Second	X			X	
Direct	X	X			
L - LOW*					
First	X				X
Second	X			X	
Direct	X	X			
* Vehicle upshift and downshift speeds are increased when in these selector positions.					

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

DIAGNOSIS AND TESTING - HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows the wheels to turn, and position tachometer so it can be read.

Using special adapters L-4559, attach 300 psi gauge(s) C-3293SP to the port(s) required for test being conducted.

Test port locations are shown in (Fig. 8).

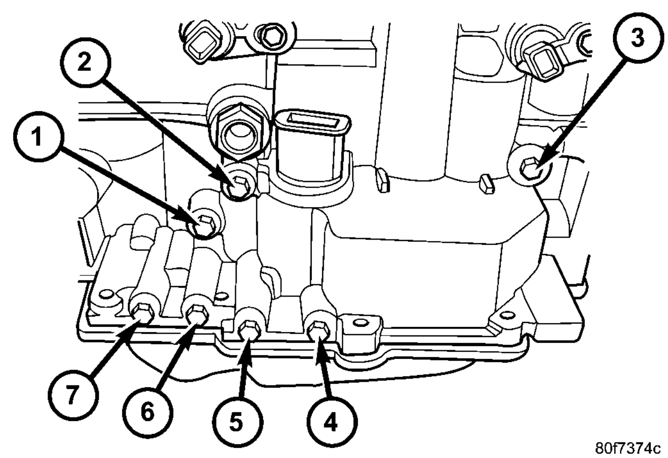


Fig. 8 Pressure Taps

1 - TORQUE CONVERTER CLUTCH OFF
2 - REVERSE
3 - LOW/REVERSE
4 - 2/4
5 - UNDERDRIVE
6 - TORQUE CONVERTER CLUTCH ON
7 - OVERDRIVE

AUTOMATIC TRANSMISSION - 42RLE (Continued)

TEST ONE-SELECTOR IN L (1st Gear)

NOTE: This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

(1) Attach pressure gauge to the low/reverse clutch tap.
(2) Move selector lever to the L position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.
(4) Low/reverse clutch pressure should read 115 to 145 psi.

TEST TWO-SELECTOR IN DRIVE (Second Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the underdrive clutch tap.
(2) Move selector lever to the 3 position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
(4) In second gear the underdrive clutch pressure should read 110 to 145 psi.

TEST TWO A–SELECTOR IN OD (Fourth Gear)

NOTE: This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the underdrive clutch tap.
(2) Move selector lever to the OD position.
(3) Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
(4) Underdrive clutch pressure should read below 5 psi. If not, than either the solenoid assembly or controller is at fault.

TEST THREE-SELECTOR IN OVERDRIVE (Third and Second Gear)

NOTE: This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

(1) Attach gauge to the overdrive clutch tap.
(2) Move selector lever to the OD position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph.
(4) Overdrive clutch pressure should read 74 to 95 psi.
(5) Move selector lever to the 3 position and increase indicated vehicle speed to 30 mph.
(6) The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.

TEST FOUR-SELECTOR IN OD (Fourth Gear)

NOTE: This test checks the 2/4 clutch hydraulic circuit.

(1) Attach gauge to the 2/4 clutch tap.
(2) Move selector lever to the OD position.
(3) Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph. Vehicle should be in fourth gear.
(4) The 2/4 clutch pressure should read 75 to 95 psi.

TEST FIVE-SELECTOR IN OVERDRIVE (Fourth Gear, CC on)

NOTE: These tests check the torque converter clutch hydraulic circuit.

(1) Attach gauge to the torque converter clutch off pressure tap.
(2) Move selector lever to the overdrive position.
(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph. Vehicle should be in 4th gear, CC on.

CAUTION: Both wheels must turn at the same speed.

(4) Torque converter clutch off pressure should be less than 5 psi.
(5) Now attach the gauge to the torque converter clutch on pressure tap.
(6) Move selector to the overdrive position.
(7) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph.
(8) Verify the torque converter clutch is applied mode using the RPM display of the DRB scan tool.
(9) Torque converter clutch on pressure should be 60-90 psi.

TEST SIX-SELECTOR IN REVERSE

NOTE: This test checks the reverse clutch hydraulic circuit.

(1) Attach gauge to the reverse and low/reverse clutch tap.
(2) Move selector lever to the reverse position.
(3) Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.
(4) Reverse and low/reverse clutch pressure should read 165 to 235 psi.

AUTOMATIC TRANSMISSION - 42RLE (Continued)

TEST RESULT INDICATIONS

(1) If proper line pressure is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

(3) Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.

(4) If the overdrive clutch pressure is greater than 5 psi in Step 6 of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.

(5) If the underdrive clutch pressure is greater than 5 psi in Step 4 of Test Two-A, a defective solenoid/pressure switch assembly or controller is the cause.

ALL PRESSURE SPECIFICATIONS ARE PSI (ON HOIST, WITH WHEELS FREE TO TURN)

Gear Selector Position	Actual Gear	PRESSURE TAPS						
		Underdrive Clutch	Overdrive Clutch	Reverse Clutch	Torque Converter Clutch Off	Torque Converter Clutch On	2/4 Clutch	Low/ Reverse Clutch
PARK - 0 mph *	PARK	0-2	0-5	0-2	60-110	45-100	0-2	115-145
REVERSE - 0 mph *	REVERSE	0-2	0-7	165-235	50-100	35-85	0-2	165-235
NEUTRAL - 0 mph *	NEUTRAL	0-2	0-5	0-2	60-110	45-100	0-2	115-145
Low - 20 mph #	FIRST	110-145	0-5	0-2	60-110	45-100	0-2	115-145
Third - 30 mph #	SECOND	110-145	0-5	0-2	60-110	45-100	115-145	0-2
Third - 45 mph #	DIRECT	75-95	75-95	0-2	60-90	45-80	0-2	0-2
OD - 30 mph #	OVERDRIVE	0-2	75-95	0-2	60-90	45-80	75-95	0-2
OD - 50 mph #	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	60-95	75-95	0-2
*** Engine Speed at 1500 rpm**								
# CAUTION: Both wheels must be turning at same speed.								

DIAGNOSIS AND TESTING - CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located by substituting air pressure for fluid pressure. The clutches may be tested by applying air pressure to their respective passages after the valve body has been removed. Use Special Tool 6599-1 and 6599-2 to perform test (Fig. 9).

To make air pressure tests, proceed as follows:

NOTE: The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

Remove oil pan and valve body. See Valve body recondition.

Apply air pressure to the holes in the special tool, one at a time.

Listen for the clutch to apply. It will give a slight thud sound. If a large amount of air is heard escaping, the transmission must be removed from vehicle, disassembled and all seals inspected.

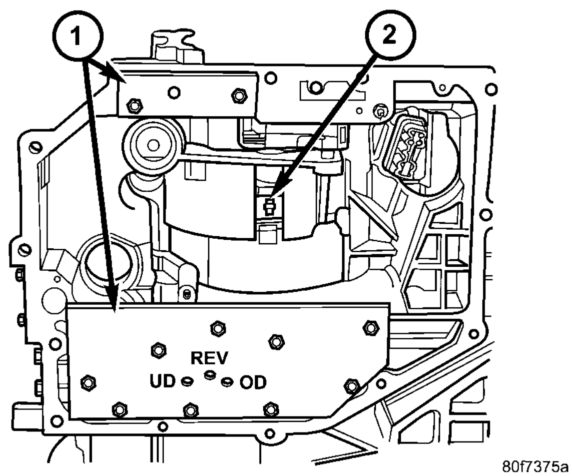


Fig. 9 Air Pressure Test Plate

1 - AIR PRESSURE TEST PLATES
2 - 2/4 CLUTCH RETAINER HOLE

AUTOMATIC TRANSMISSION - 42RLE (Continued)

OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Air pressure is applied to the low/reverse or the 2/4 clutches. This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch (Fig. 10). The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.

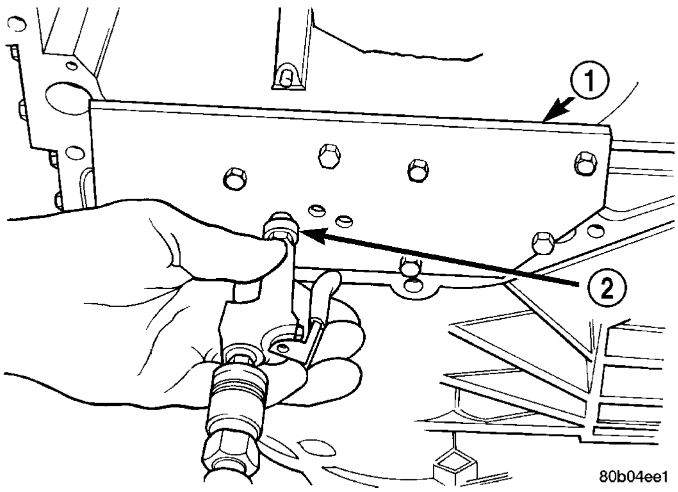


Fig. 10 Testing Underdrive Clutch

1 - AIR PRESSURE TEST PLATE 6599–1
2 - AIR NOZZLE

REVERSE CLUTCH

Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer. Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole passage. Look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

DIAGNOSIS AND TESTING - FLUID LEAKAGE

FLUID LEAKAGE - TORQUE CONVERTER HOUSING AREA

When diagnosing converter housing fluid leaks, three actions must be taken before repair:

(1) Verify proper transmission fluid level.

(2) Verify that the leak originates from the converter housing area and is transmission fluid.

(3) Determine the true source of the leak.

Fluid leakage at or around the torque converter area may originate from an engine oil leak (Fig. 11). The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

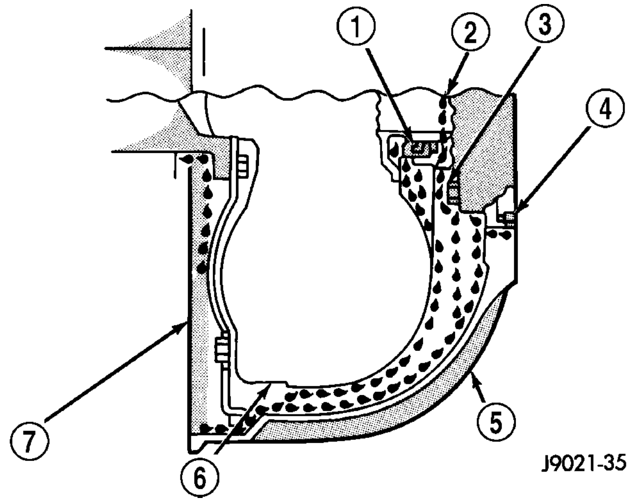


Fig. 11 Converter Housing Leak Paths

1 - PUMP SEAL
2 - PUMP VENT
3 - PUMP BOLT
4 - PUMP GASKET
5 - CONVERTER HOUSING
6 - CONVERTER
7 - REAR MAIN SEAL LEAK

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill, or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal leaks tend to move along the drive hub and onto the rear of the converter (Fig. 11). Pump o-ring or pump body leaks follow the same path as a seal leak. Pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself. Pump seal or gasket leaks usually travel down the inside of the converter housing (Fig. 11).

AUTOMATIC TRANSMISSION - 42RLE (Continued)

TORQUE CONVERTER LEAKAGE

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter weld (Fig. 12).
- Torque converter hub weld (Fig. 12).

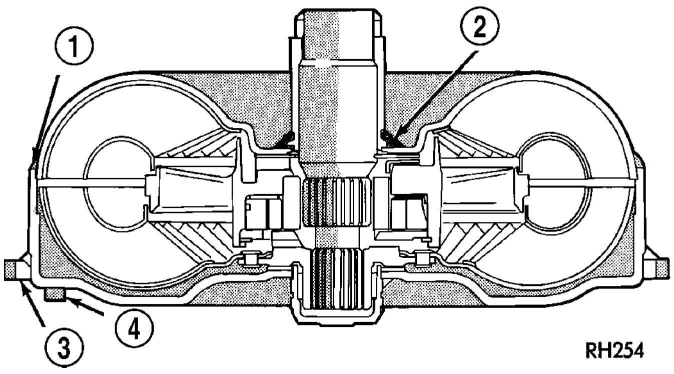


Fig. 12 Converter Leak Points - Typical

1 - OUTSIDE DIAMETER WELD
2 - TORQUE CONVERTER HUB WELD
3 - STARTER RING GEAR
4 - LUG

STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL

(1) Disconnect battery negative cable.

(2) Raise and support vehicle.

(3) Disconnect and lower or remove necessary exhaust components.

(4) Remove engine-to-transmission bending braces or engine collar.

(5) Remove starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)

(6) On 4.0L engine equipped vehicles, disconnect and remove crankshaft position sensor (Fig. 13). Retain sensor attaching bolt.

CAUTION: The crankshaft position sensor can be damaged during transmission removal (or installation) if the sensor is left in place. To avoid damage, remove the sensor before removing the transmission.

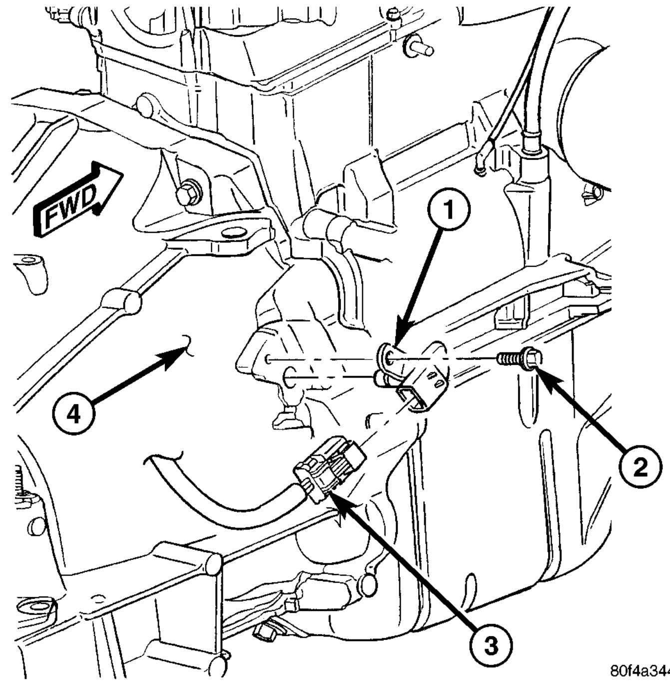


Fig. 13 Crankshaft Position Sensor

1 - CRANKSHAFT POSITION SENSOR
2 - MOUNTING BOLT
3 - ELECTRICAL CONNECTOR
4 - TRANSMISSION BELLHOUSING

(7) If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/FLUID - STANDARD PROCEDURE)

(8) Remove torque converter access cover.

(9) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(10) Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(11) Disconnect wires from the input and output speed sensors (Fig. 14).

(12) Disconnect wires from the transmission range sensor (Fig. 14) and the solenoid/pressure switch assembly (Fig. 15).

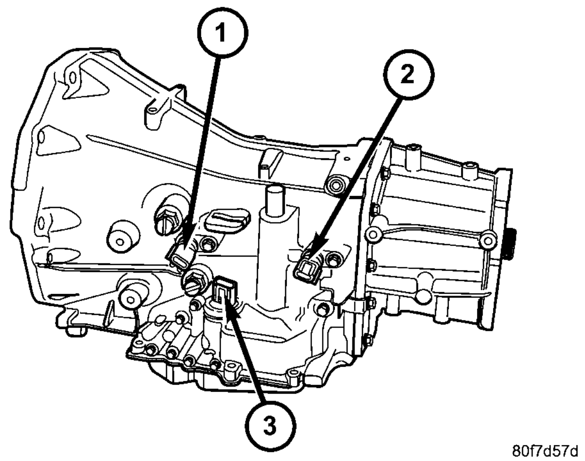


Fig. 14 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

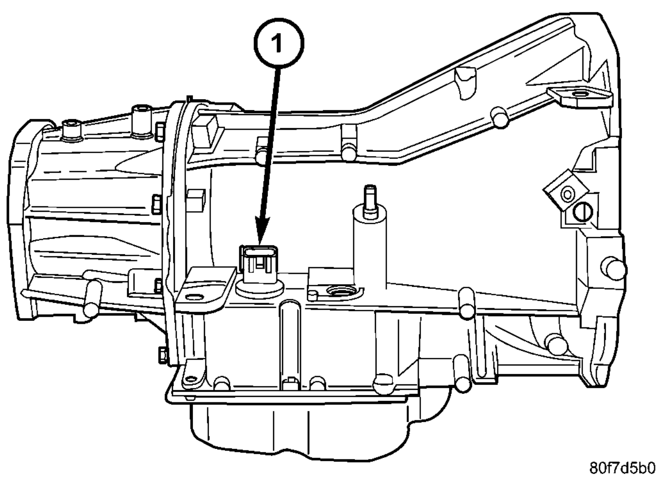


Fig. 15 Solenoid/Pressure Switch Assembly

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY CONNECTOR

(13) Disconnect gearshift cable from transmission manual valve lever.

(14) Disconnect shift rod from transfer case shift lever or remove shift lever from transfer case.

(15) Support rear of engine with safety stand or jack.

(16) Raise transmission slightly with service jack to relieve load on skid plate and transmission support.

(17) Remove bolts securing rear support (Fig. 16) and cushion to transmission and skid plate. Raise transmission slightly, slide exhaust hanger arm from bracket and remove rear support.

(18) Remove bolts attaching skid plate (Fig. 16) to frame and remove skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)

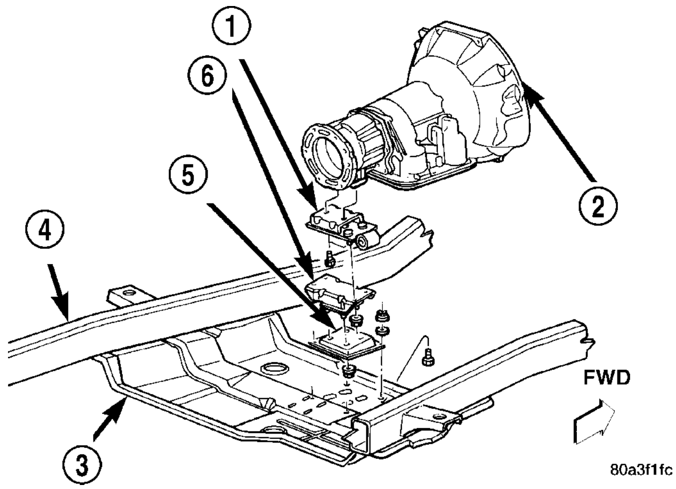


Fig. 16 Transmission Mount - Automatic Transmission

1 - TRANSMISSION SUPPORT BRACKET
2 - AUTOMATIC TRANSMISSION
3 - SKID PLATE
4 - FRAME
5 - TRANSMISSION MOUNT SUPPORT BRACKET
6 - CUSHION

(19) Disconnect transfer case vent hose.

(20) Remove transfer case. (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL)

(21) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. Remove the bolt attaching transfer case vent tube to converter housing.

(22) Disconnect fluid cooler lines at transmission.

(23) Remove all converter housing bolts.

(24) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(25) Hold torque converter in place during transmission removal.

(26) Lower transmission and remove assembly from under the vehicle.

(27) To remove torque converter, carefully slide torque converter out of the transmission.

AUTOMATIC TRANSMISSION - 42RLE (Continued)

DISASSEMBLY

NOTE: If the transmission is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool (Refer to 8 - ELECTRICAL/ ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

Before disassembling transmission, move the shift lever clockwise as far as it will go and then remove the shift lever.

NOTE: Tag all clutch pack assemblies, as they are removed, for reassembly identification.

CAUTION: Do not intermix clutch discs or plates as the unit might then fail.

(1) Remove the torque converter from the transmission input shaft (Fig. 17).

(2) Measure input shaft end play using Tool 8266. Set up Tool 8266 and a dial indicator as shown in (Fig. 18). Move input shaft in and out to obtain end play reading. End play specifications are 0.13 to 0.64 mm (0.005 to 0.025 inch). Record indicator reading for reference when reassembling the transmission. If endplay exceeds the specified range, the #4 thrust plate needs to be inspected and changed if necessary.

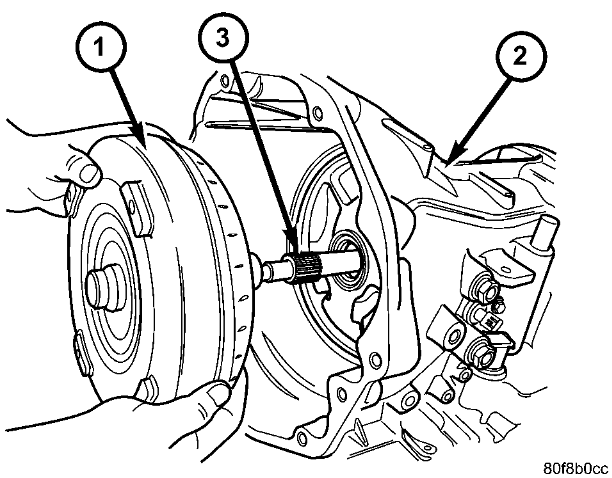


Fig. 17 Remove Torque Converter

1 - TORQUE CONVERTER
2 - TRANSMISSION
3 - INPUT SHAFT

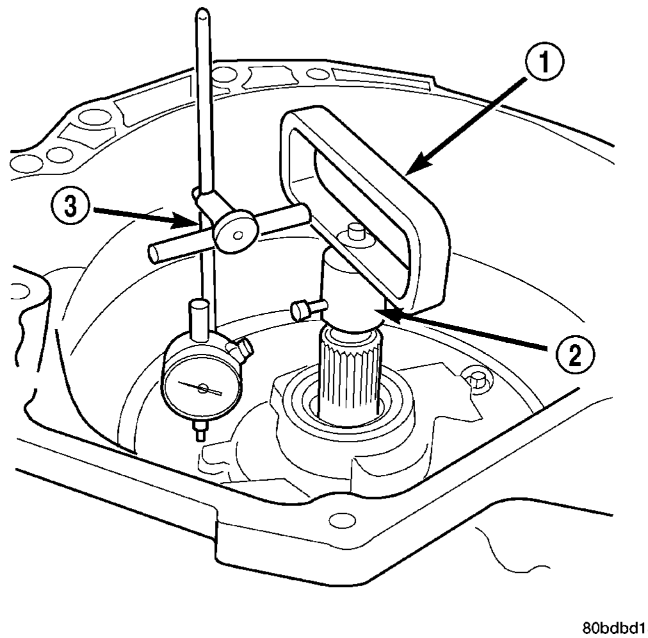


Fig. 18 Measure Input Shaft End Play Using Tool 8266 - Typical

1 - TOOL 8266-8
2 - TOOL 8266-2
3 - TOOL C-3339

NOTE: The four bolts along the bottom of the adapter housing have a sealing patch applied from the factory. Note the locations of these bolts and seperate these bolts for reuse.

(3) Remove the bolts (Fig. 19) that hold the adapter housing onto the transmission case.

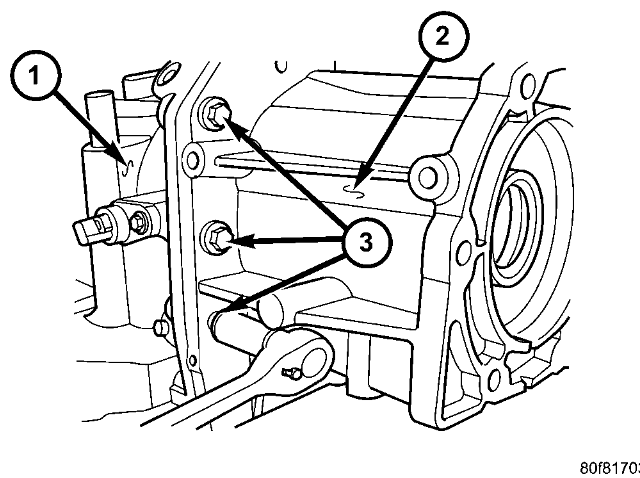


Fig. 19 Remove Adapter Housing Bolts

1 - TRANSMISSION CASE
2 - ADAPTER HOUSING
3 - BOLTS

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(4) Remove the adapter (Fig. 21) housing from the transmission case. There are two pry slots (Fig. 20) located near the bottom corners of the housing for separating the housing from the transmission case.

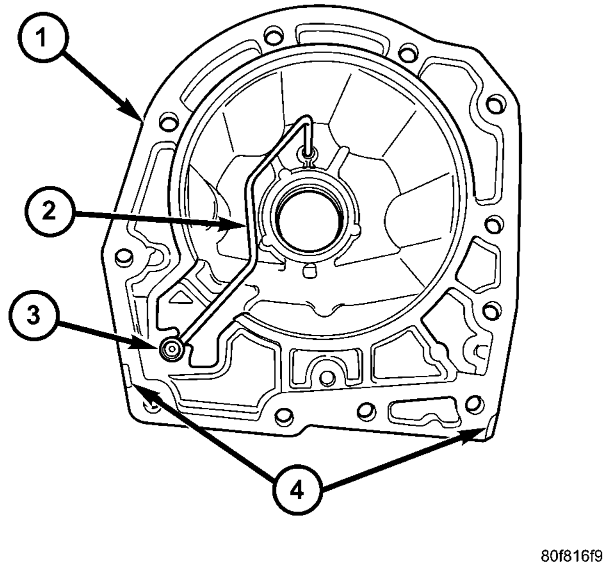


Fig. 20 Lube Tube Grommet

1 - HOUSING
2 - LUBE TUBE
3 - GROMMET
4 - PRY SLOTS

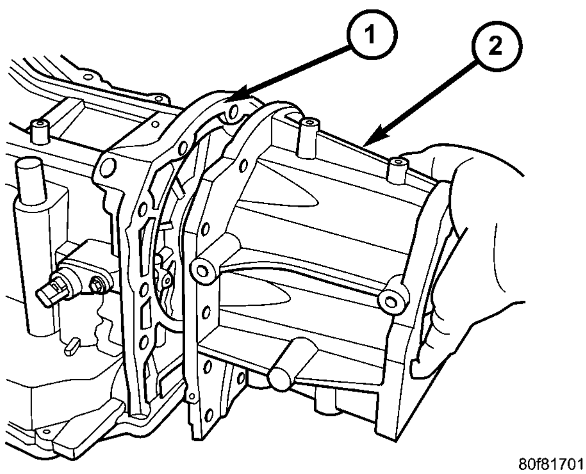


Fig. 21 Remove Adapter Housing

1 - TRANSMISSION CASE
2 - ADAPTER HOUSING

(5) Inspect the lube tube grommet (Fig. 20) for damage. If the grommet lip is damaged, it will need to be replaced.

(6) Using a Slide Hammer C-3752 (Fig. 22), remove the 4X4 stub shaft (Fig. 23) from the transmission output shaft. Inspect the cir-clip on the shaft for damage and replace the clip if necessary.

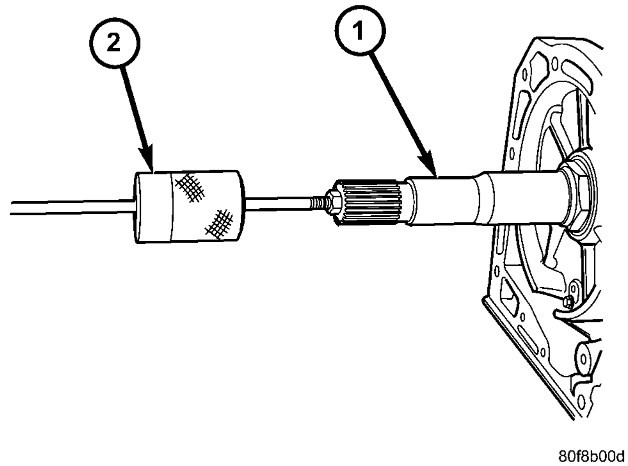


Fig. 22 Remove the 4X4 Stub shaft Using C-3752

1 - 4X4 STUB SHAFT
2 - PULLER C-3752

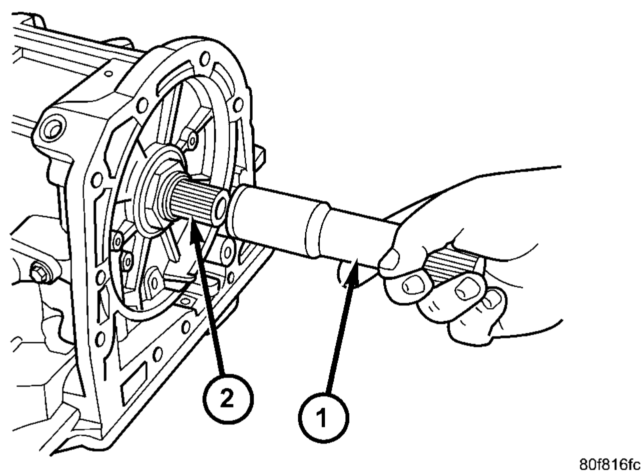


Fig. 23 Remove 4X4 Stub Shaft

1 - STUB SHAFT
2 - OUTPUT SHAFT

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(7) Remove the input speed sensor bolt (Fig. 24).
(8) Remove the output speed sensor bolt (Fig. 25).

NOTE: The speed sensor bolts have a sealing patch applied from the factory. Seperate these bolts for reuse.

(9) Remove the input and output speed sensors (Fig. 26). Identify the speed sensors for re-installation since they are not interchangeable.

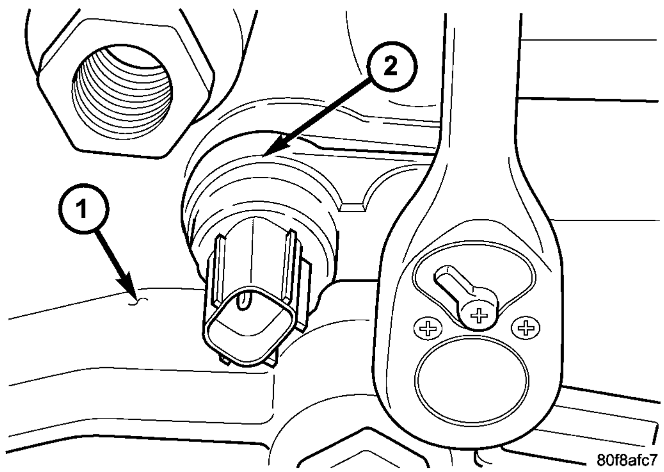


Fig. 24 Remove Input Speed Sensor Bolt

1 - INPUT SPEED SENSOR
2 - TRANSMISSION CASE

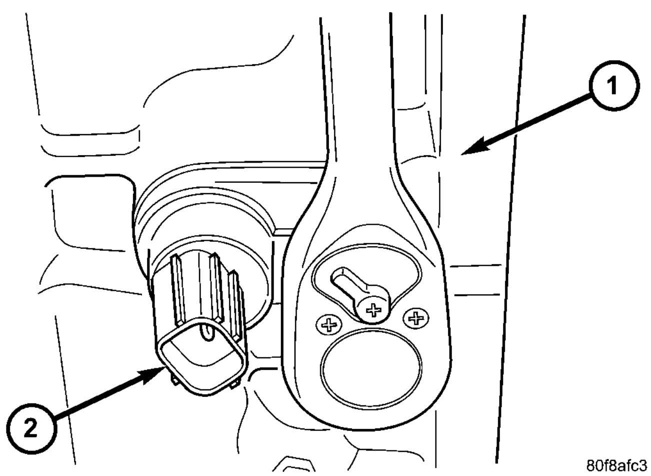


Fig. 25 Remove Output Speed Sensor Bolt

1 - OUTPUT SPEED SENSOR
2 - TRANSMISSION CASE

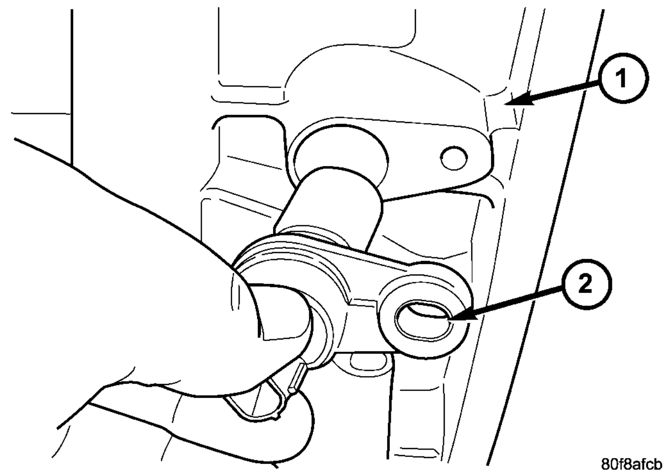


Fig. 26 Remove Output Speed Sensor

1 - OUTPUT SPEED SENSOR
2 - TRANSMISSION CASE

NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Seperate this bolt for reuse.

(10) Remove the transmission oil pan bolts (Fig. 27).

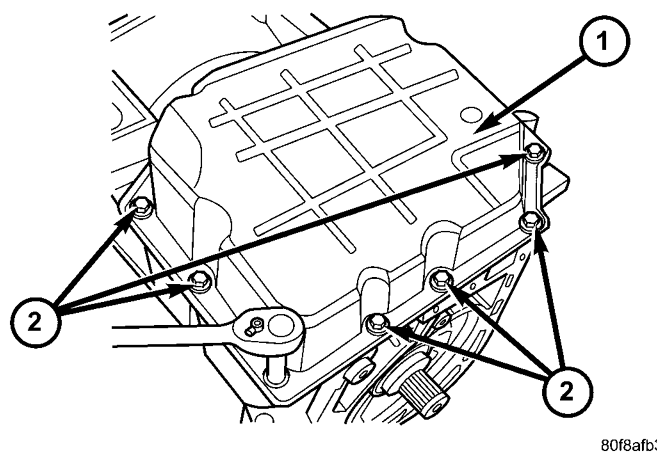


Fig. 27 Remove Transmission Oil Pan Bolts

1 - TRANSMISSION OIL PAN
2 - BOLTS

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(11) Remove the transmission oil pan (Fig. 28).

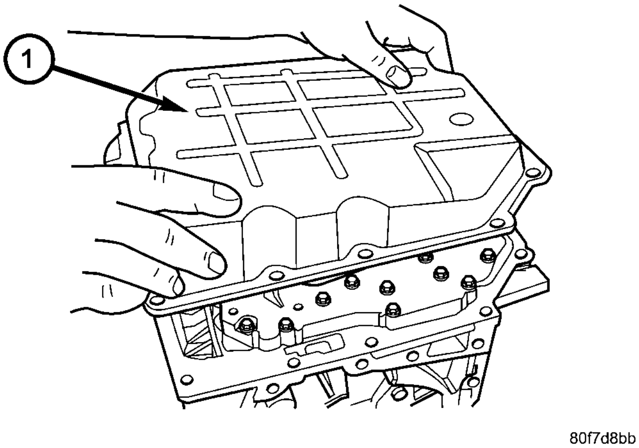


Fig. 28 Remove Transmission Oil Pan

1 - TRANSMISSION OIL PAN

(12) Remove the transmission oil filter screws (Fig. 29).

(13) Remove transmission oil filter (Fig. 30).

(14) Remove the oil filter o-ring from the valve body (Fig. 31).

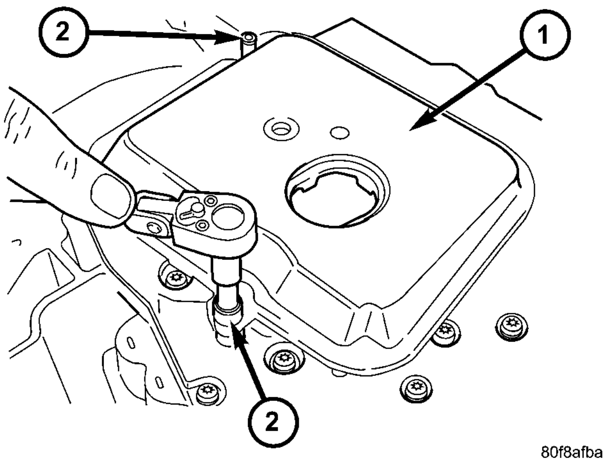


Fig. 29 Remove Oil Filter Screws

1 - OIL FILTER
2 - SCREWS

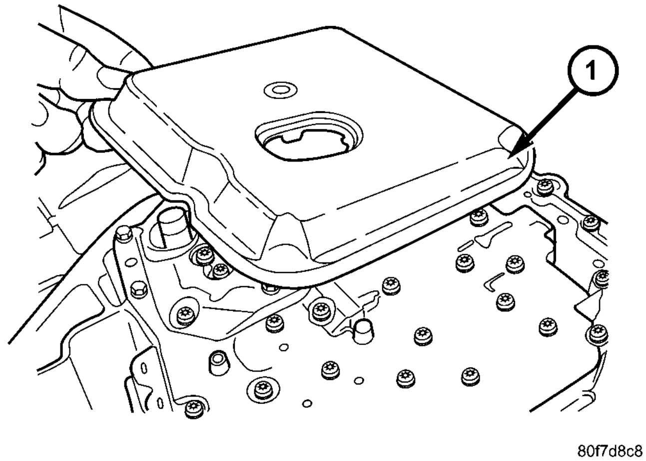


Fig. 30 Remove Transmission Filter

1 - TRANSMISSION FILTER

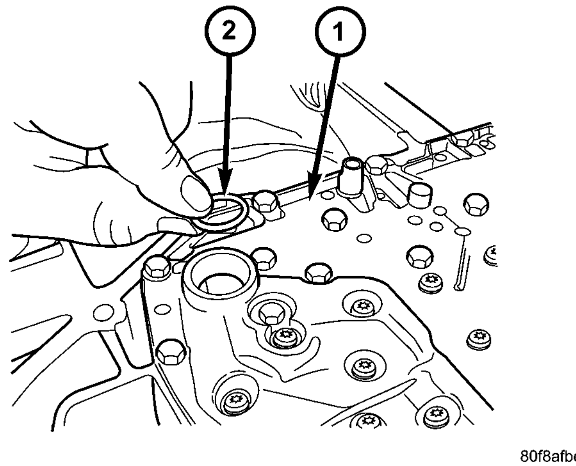


Fig. 31 Remove Oil Filter O-Ring

1 - VALVE BODY
2 - O-RING

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(15) Remove valve body-to-case bolts (Fig. 32).

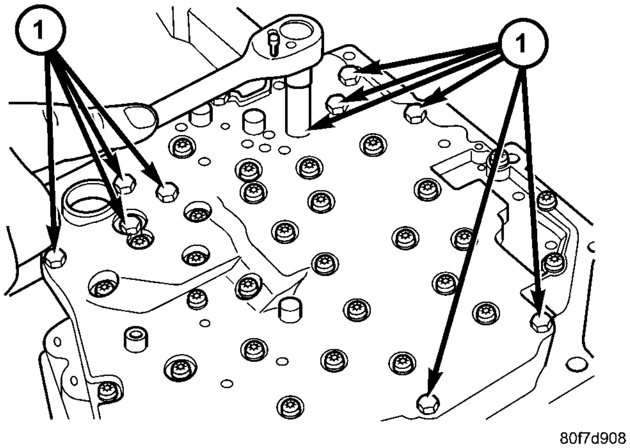


Fig. 32 Remove Valve Body Bolts

1 - BOLTS

CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

(16) Remove valve body from transmission (Fig. 33).

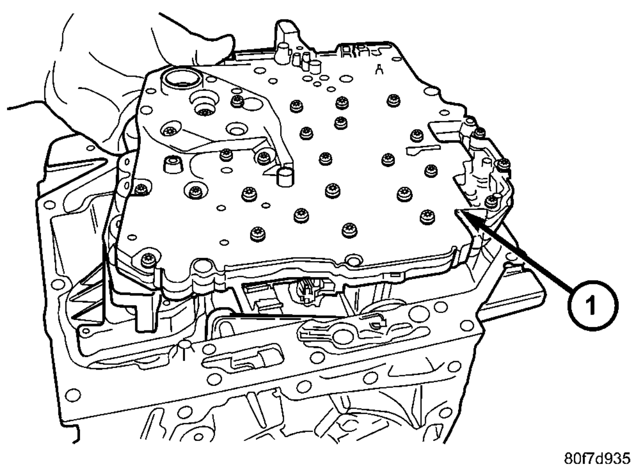


Fig. 33 Remove Valve Body From Transmission

1 - VALVE BODY

(17) Remove underdrive and overdrive accumulators (Fig. 34).

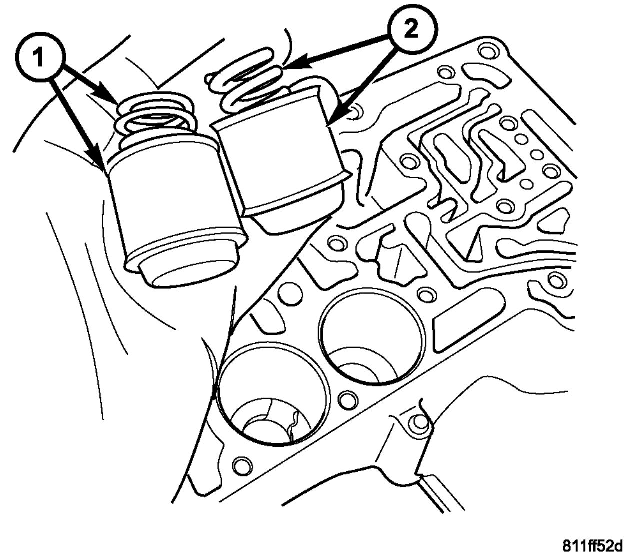


Fig. 34 Underdrive and Overdrive Accumulators

1 - OVERDRIVE PISTON AND SPRING
2 - UNDERDRIVE PISTON AND SPRING

(18) Remove the low/reverse accumulator snap ring (Fig. 35).

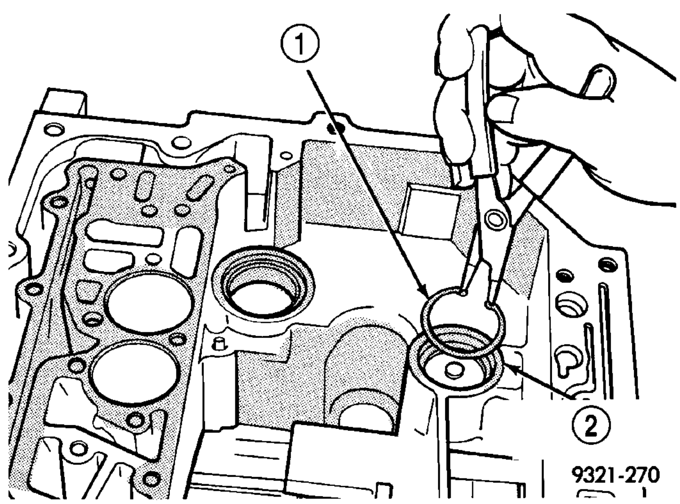


Fig. 35 Remove Low/Reverse Accumulator

1 - SNAP RING
2 - LOW/REVERSE ACCUMULATOR

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(19) Remove the low/reverse accumulator plug (Fig. 36).

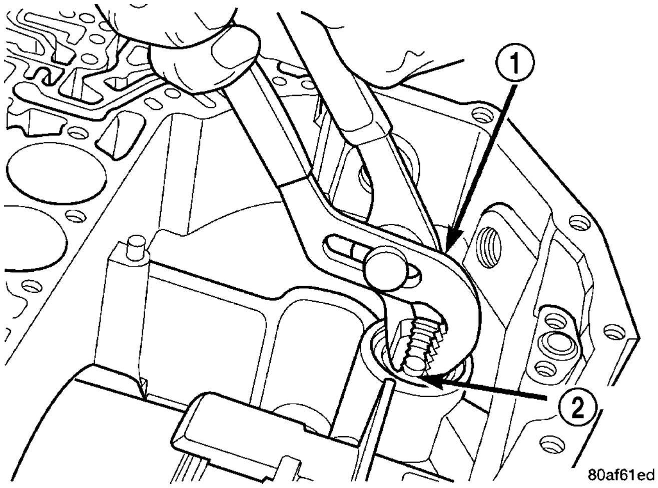


Fig. 36 Remove Low/Reverse Accumulator Plug

1 - ADJUSTABLE PLIERS
2 - PLUG

(20) Remove low/reverse accumulator piston using suitable pliers (Fig. 37). Remove piston and springs (Fig. 38).

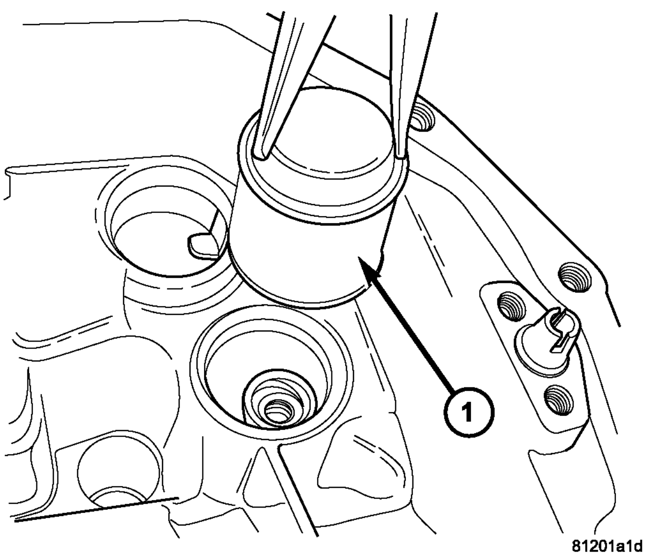


Fig. 37 Low/Reverse Accumulator Piston

1 - ACCUMULATOR PISTON

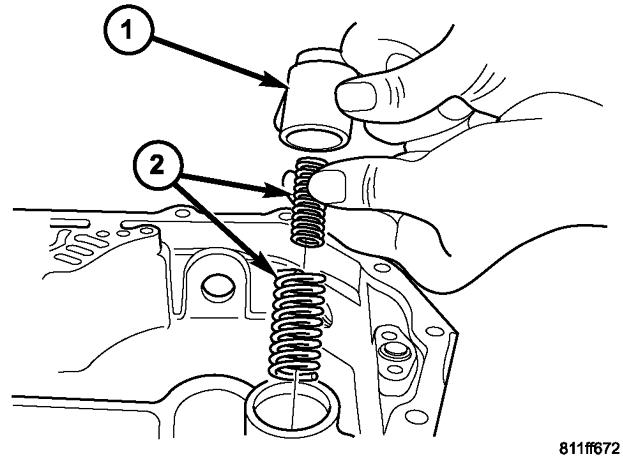


Fig. 38 Low/Reverse Accumulator

1 - PISTON
2 - RETURN SPRINGS

(21) Remove and discard the oil pump-to-case bolts (Fig. 39). The oil pump bolts are not to be reused.

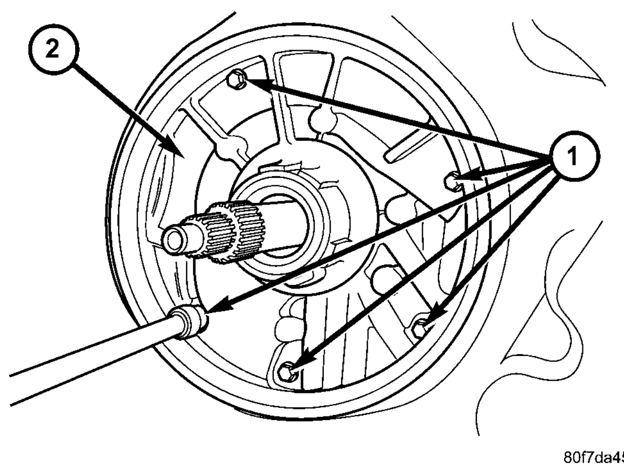


Fig. 39 Remove Oil Pump Attaching Bolts

1 - BOLTS
2 - OIL PUMP

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(22) Remove oil pump using C-3752 Pullers (Fig. 40).

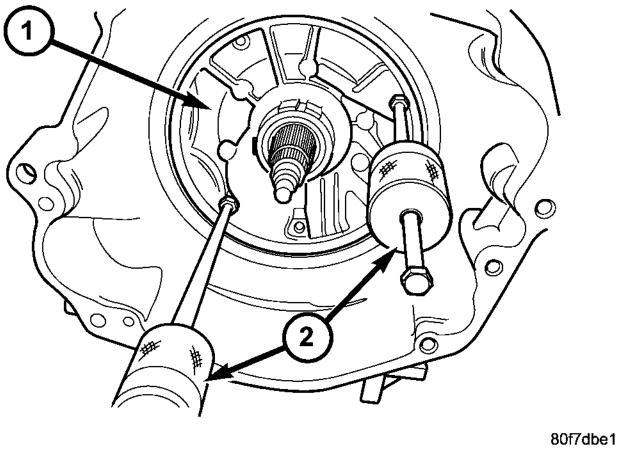


Fig. 40 Oil Pump Pullers

1 - OIL PUMP
2 - PULLERS

(23) Remove oil pump while pushing in on input shaft (Fig. 41).

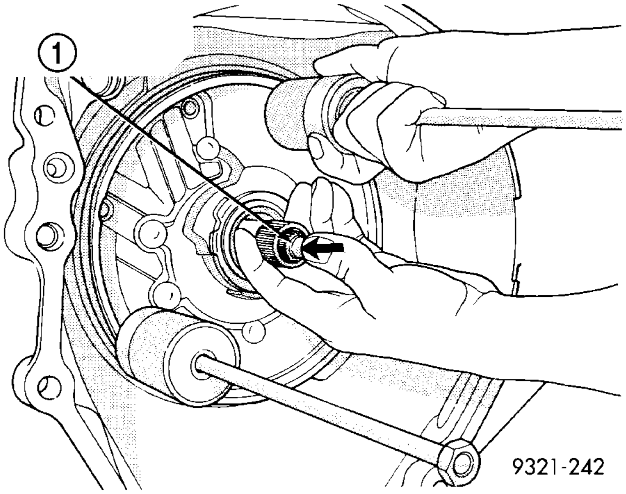


Fig. 41 Remove Oil Pump

1 - “PUSH IN” ON INPUT SHAFT WHILE REMOVING PUMP

(24) Remove oil pump gasket (Fig. 42).

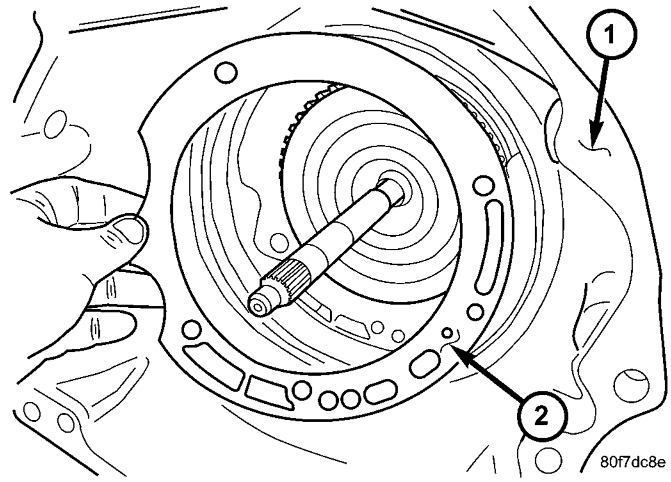


Fig. 42 Remove Oil Pump Gasket

1 - BELLHOUSING
2 - OIL PUMP GASKET

CAUTION: By-pass valve must be replaced if transmission failure occurs.

(25) Remove the cooler by-pass valve (Fig. 43).

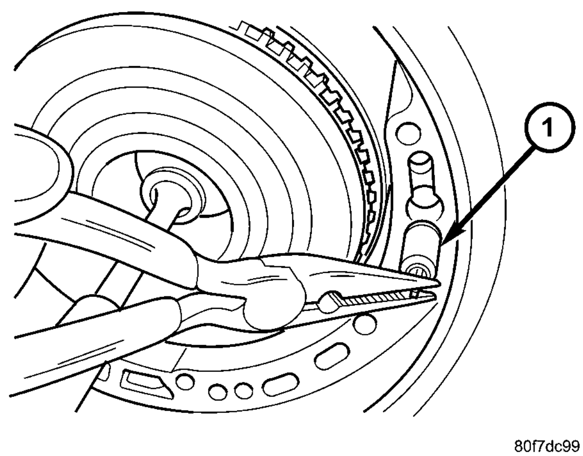


Fig. 43 Remove By-Pass Valve

1 - BYPASS VALVE

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(26) Remove the #1 caged needle bearing (Fig. 44).

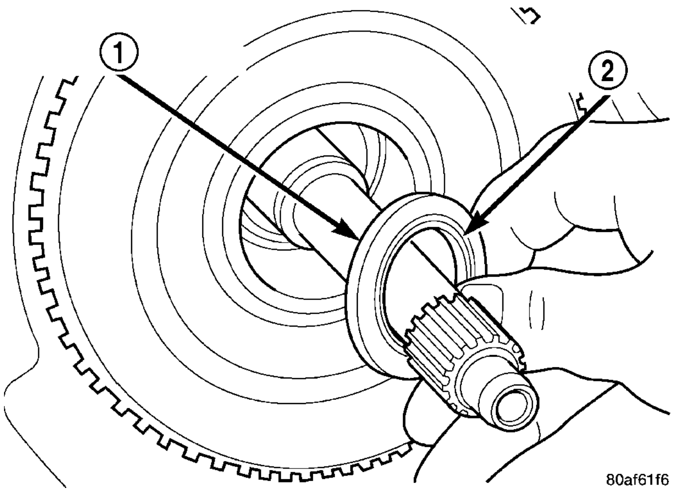


Fig. 44 Remove No. 1 Caged Needle Bearing

1 - #1 CAGED NEEDLE BEARING
2 - NOTE: TANGED SIDE OUT

(27) Remove the input clutch assembly (Fig. 45).

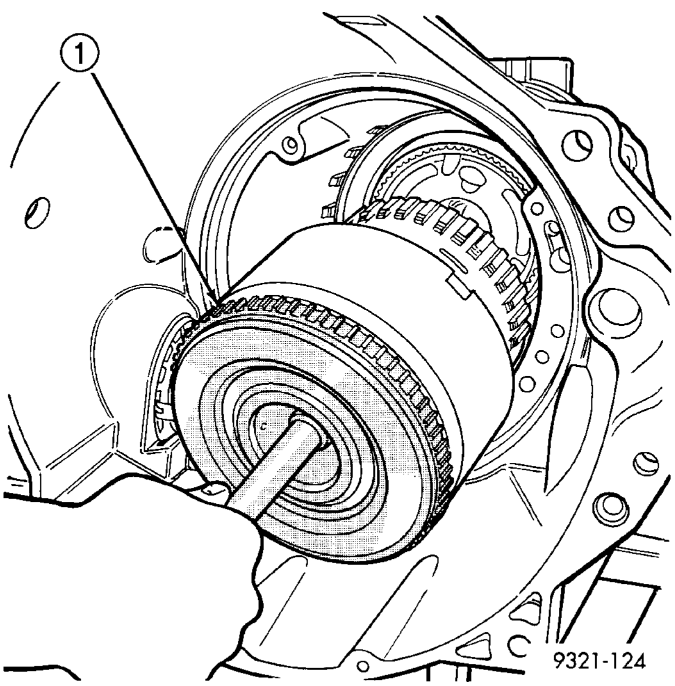


Fig. 45 Remove Input Clutch Assembly

1 - INPUT CLUTCH ASSEMBLY

(28) Remove the #4 thrust plate (Fig. 46).

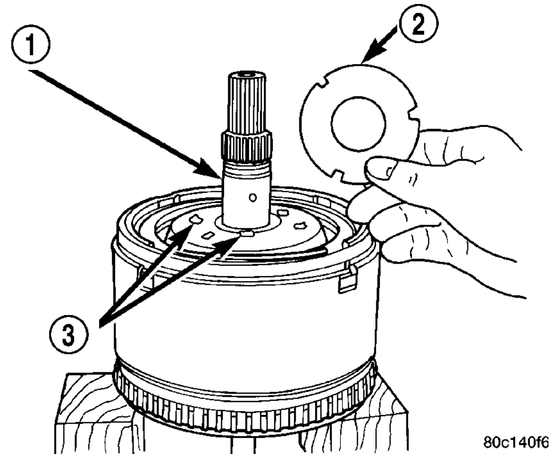


Fig. 46 Remove #4 Thrust Plate

1 - OVERDRIVE SHAFT ASSEMBLY
2 - #4 THRUST PLATE (SELECT)
3 - PETROLATUM FOR RETENTION

(29) Remove the front sun gear assembly and #4 thrust washer (if still in place) (Fig. 47).

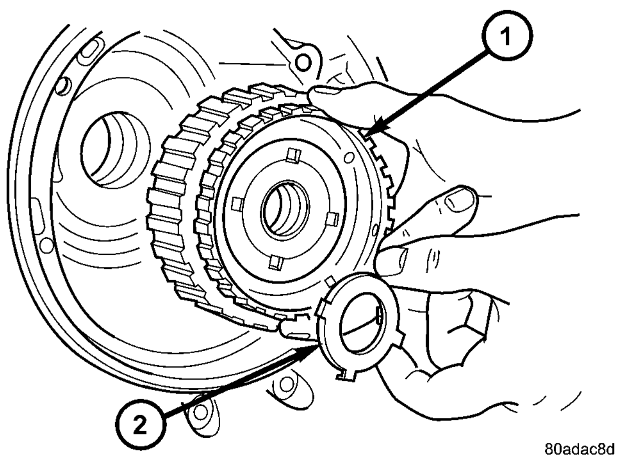


Fig. 47 Remove Front Sun Gear Assembly

1 - FRONT SUN GEAR ASSEMBLY
2 - #4 THRUST WASHER (FOUR TABS)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(30) Remove the front carrier/rear annulus and #6 needle bearing (Fig. 48).

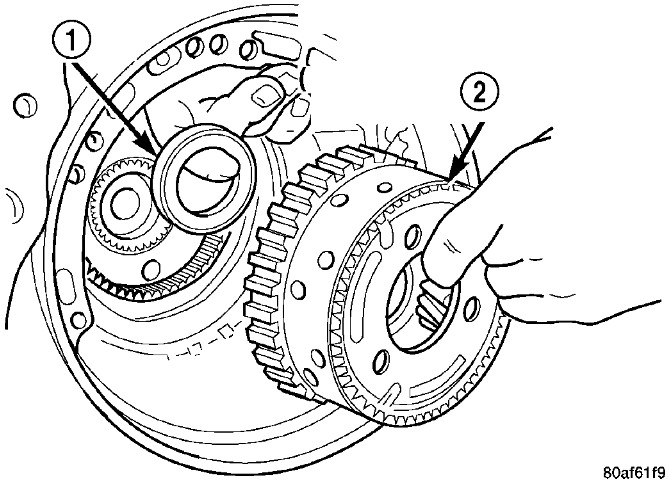


Fig. 48 Remove Front Carrier/Rear Annulus

1 - #6 NEEDLE BEARING
2 - FRONT CARRIER AND REAR ANNULUS ASSEMBLY (TWIST AND PULL OR PUSH TO REMOVE OR INSTALL).

(31) Remove the rear sun gear and #7 needle bearing (Fig. 49) and (Fig. 50).

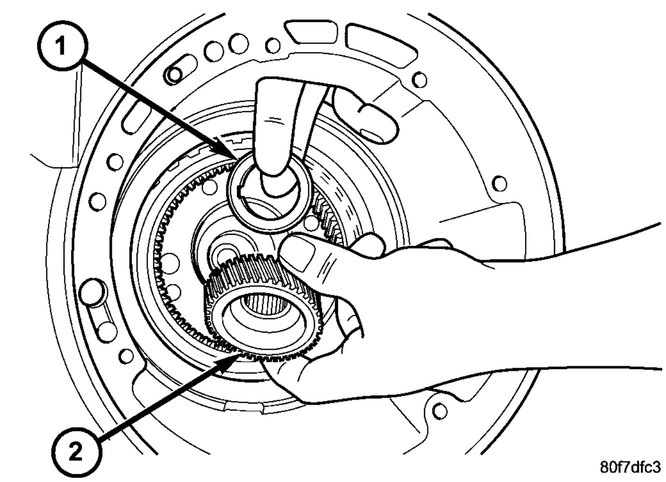


Fig. 49 Remove Rear Sun Gear

1 - #7 NEEDLE BEARING
2 - REAR SUN GEAR

NOTE: The number seven needle bearing has three antireversal tabs and is common with the number five and number two position. The orientation should allow the bearing to seat flat against the rear sun gear (Fig. 50).

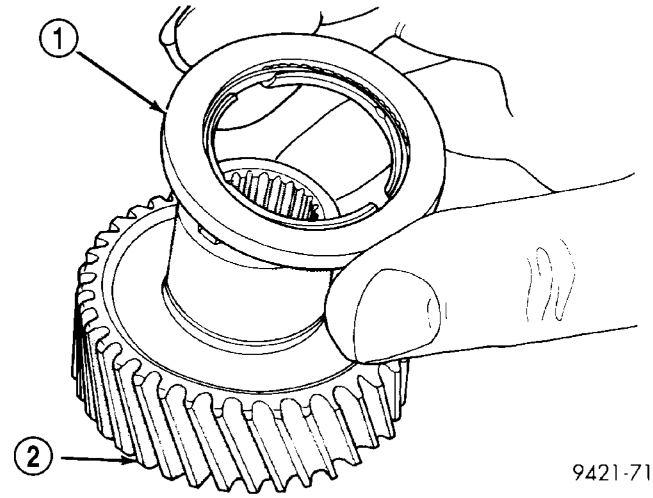


Fig. 50 Number 7 Bearing

1 - #7 BEARING
2 - REAR SUN GEAR

NOTE: Verify that Tool 5058A is centered properly over the 2/4 clutch retainer before compressing. If necessary, fasten the 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

(32) Install and load Tool 5058A to remove the 2/4 clutch retainer snap ring (Fig. 51).

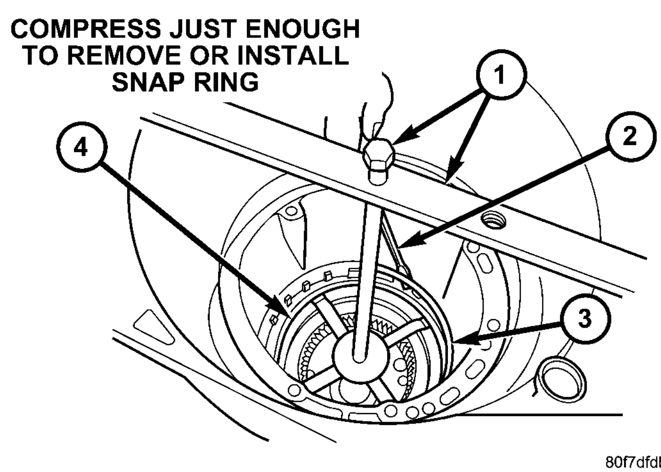


Fig. 51 Remove 2/4 Clutch Retainer Snap Ring

1 - TOOL 5058
2 - SCREWDRIVER
3 - SNAP RING
4 - 2/4 CLUTCH RETAINER

AUTOMATIC TRANSMISSION - 42RLE (Continued)

NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

(33) Remove the 2/4 clutch retainer (Fig. 52) and (Fig. 53).

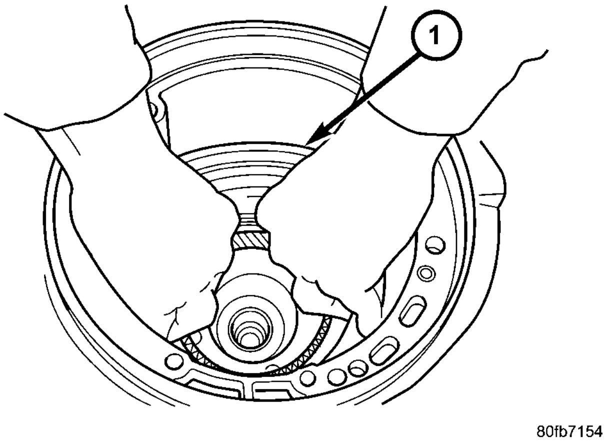


Fig. 52 Remove 2/4 Clutch Retainer

1 - 2/4 CLUTCH RETAINER

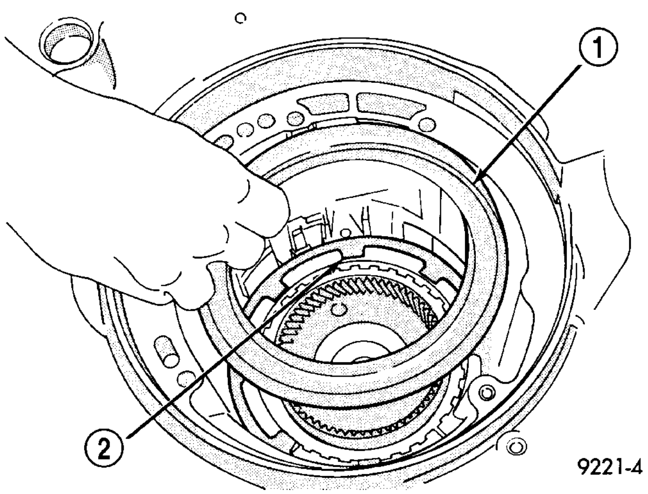


Fig. 53 2/4 Clutch Retainer

1 - 2/4 CLUTCH RETAINER
2 - 2/4 CLUTCH RETURN SPRING

(34) Remove the 2/4 clutch return spring (Fig. 54).

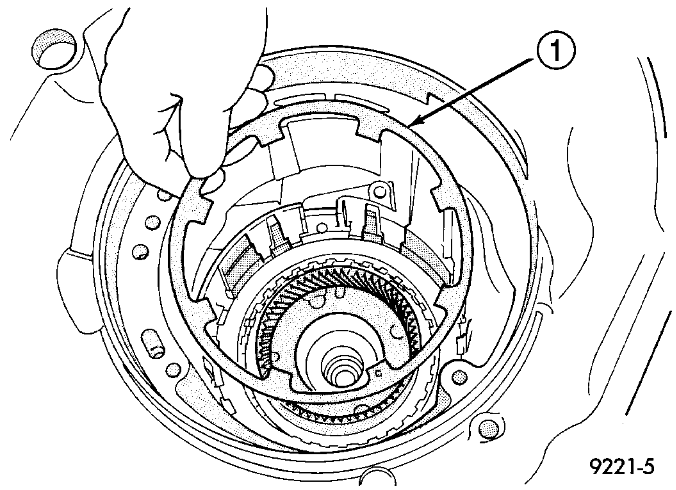


Fig. 54 Remove 2/4 Clutch Return Spring

1 - 2/4 CLUTCH RETURN SPRING

(35) Remove the 2/4 clutch pack (Fig. 55).

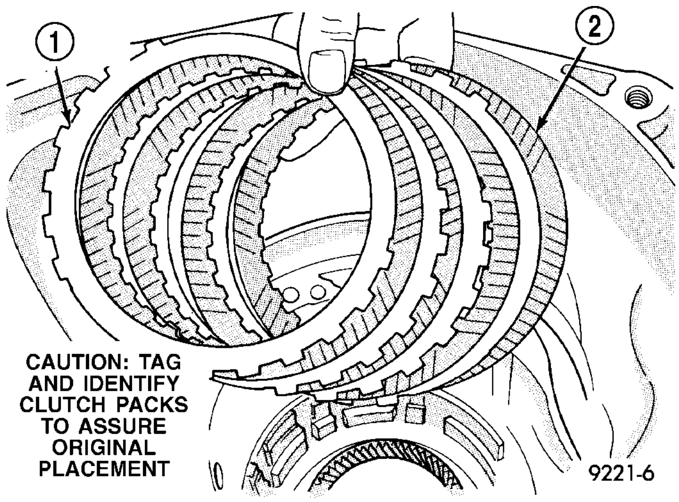


Fig. 55 Remove 2/4 Clutch Pack

1 - CLUTCH PLATE (4)
2 - CLUTCH DISC (4)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(36) Remove the tapered snap ring (Fig. 56).

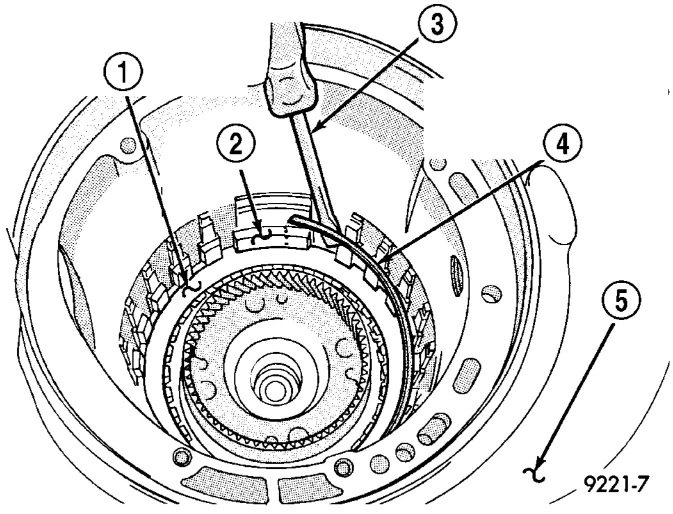


Fig. 56 Remove Tapered Snap Ring

1 - LOW/REVERSE CLUTCH REACTION PLATE
2 - LONG TAB
3 - SCREWDRIVER
4 - LOW/REVERSE TAPERED SNAP RING (TAPERED SIDE UP)
5 - OIL PAN FACE

(37) Remove the low/reverse reaction plate (Fig. 57).

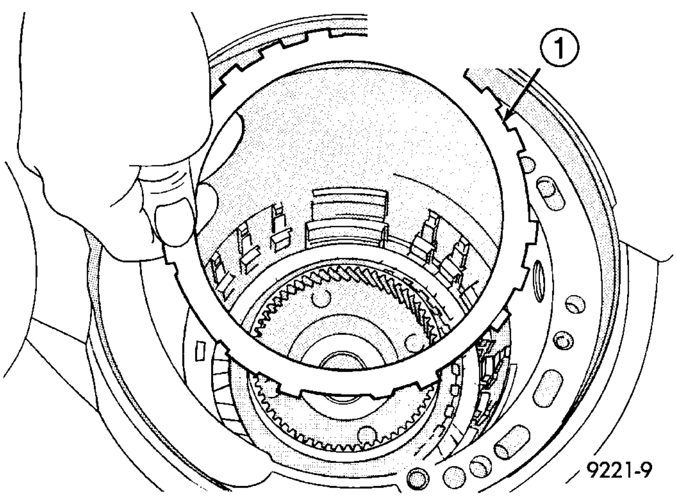


Fig. 57 Remove Low/Reverse Reaction Plate

1 - LOW/REVERSE REACTION PLATE (FLAT SIDE UP)

(38) Remove one (1) low/reverse clutch disc to facilitate snap ring removal (Fig. 58).

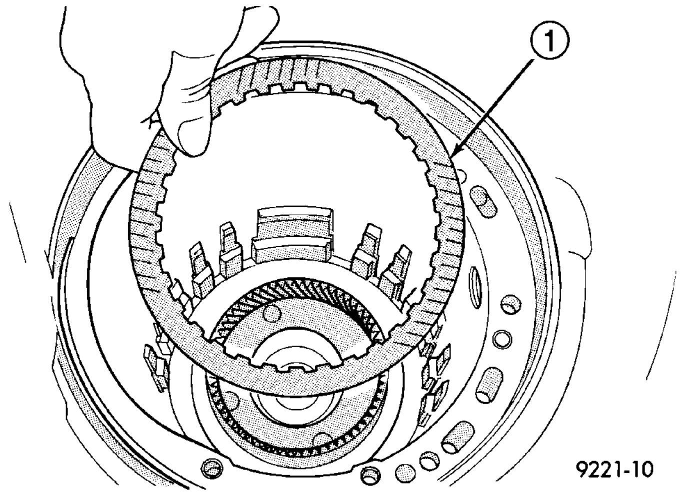


Fig. 58 Remove One Disc

1 - ONE DISC FROM LOW/REVERSE CLUTCH

(39) Remove the low/reverse reaction plate snap ring (Fig. 59).

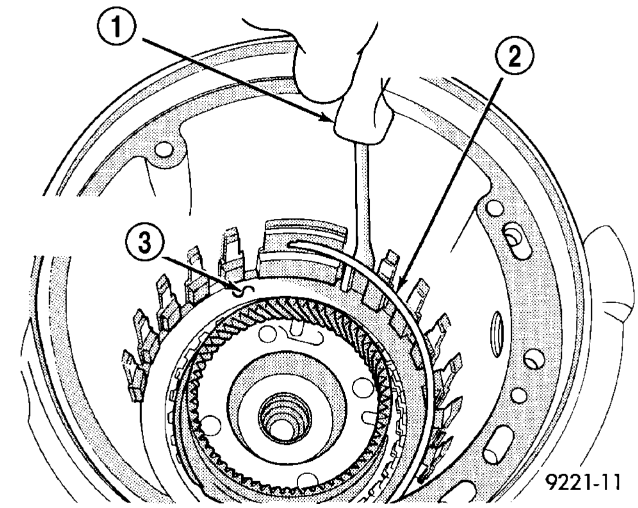


Fig. 59 Remove Low/Reverse Reaction Plate Snap Ring

1 - SCREWDRIVER
2 - LOW/REVERSE REACTION PLATE FLAT SNAP RING
3 - DO NOT SCRATCH CLUTCH PLATE

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(40) Remove the low/reverse clutch pack (Fig. 60).

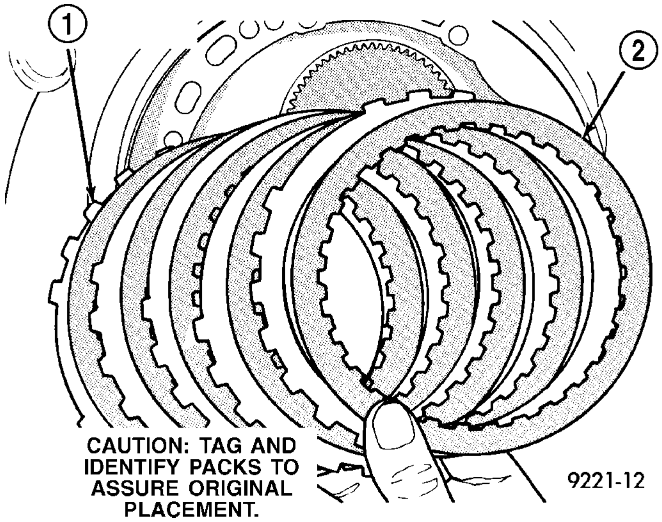


Fig. 60 Remove Low/Reverse Clutch Pack

1 - CLUTCH PLATES (5)
2 - CLUTCH DISCS (5)

CAUTION: Failure to grind and open stakes of the output shaft nut will result in thread damage to the shaft during nut removal.

WARNING: WEAR SAFETY GOGGLES WHILE GRINDING STAKE NUTS.

(41) Using a die grinder or equivalent, grind the stakes in the shoulder of the shaft nuts as shown in (Fig. 61) (Fig. 62). Do not grind all the way through the nut and into the shaft. There are two stakes on each nut.

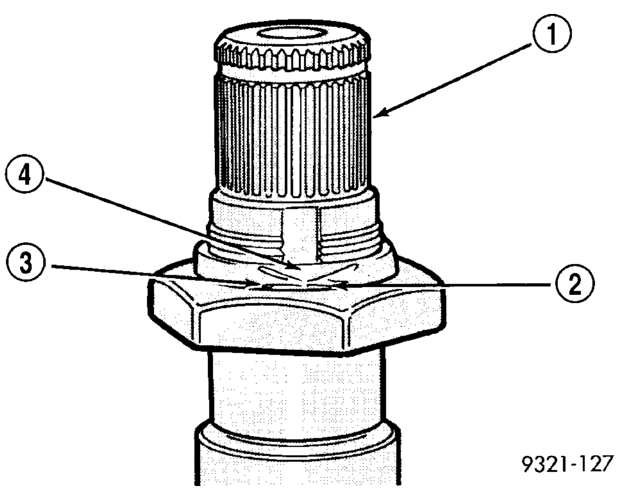


Fig. 61 Grinding Stakes

1 - TRANSFER SHAFT
2 - GRIND HERE
3 - GRIND HERE
4 - NUT STAKE

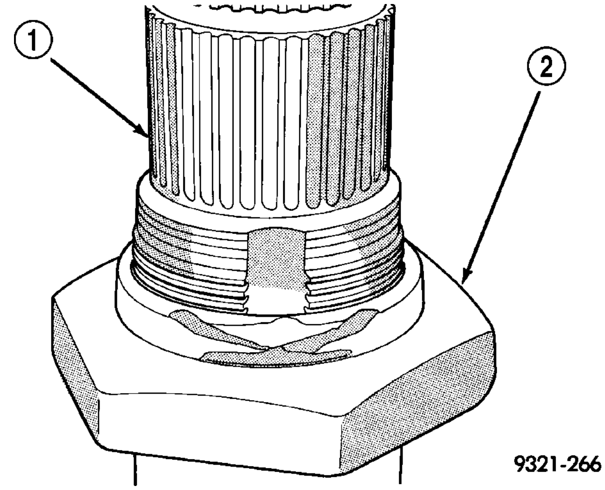


Fig. 62 Stake Grinding Pattern

1 - TRANSFER SHAFT
2 - TRANSFER SHAFT NUT

(42) Using a small chisel, carefully open the stakes on nut (Fig. 63).

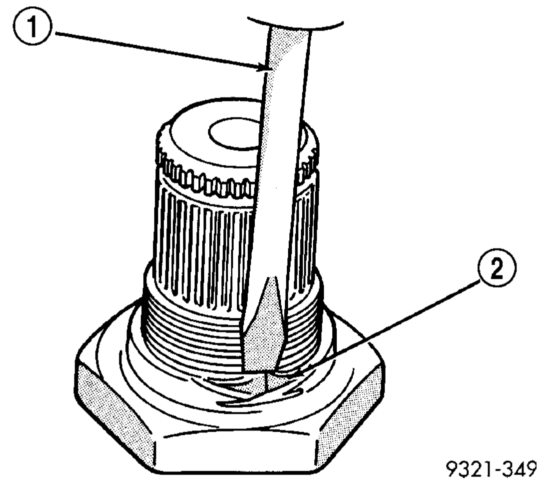


Fig. 63 Opening Nut Stakes

1 - CHISEL
2 - NUT STAKE

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(43) Use special tool 6497 and 6498A to remove the transfer shaft nut or the output shaft nut (Fig. 64).

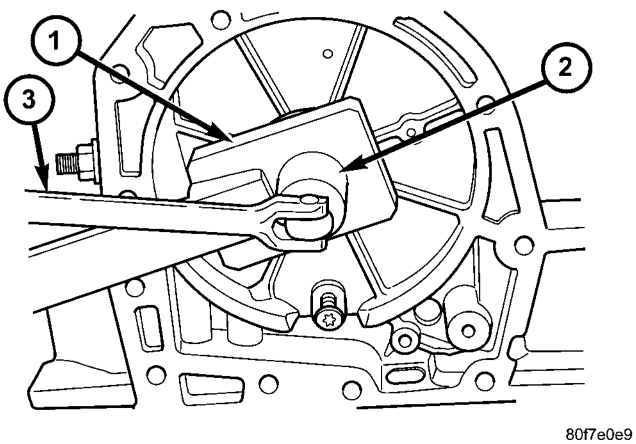


Fig. 64 Remove Output Shaft Nut

1 - SPECIAL TOOL 6497
2 - SPECIAL TOOL 6498A
3 - BREAKER BAR

(44) Remove the output shaft from case using a shop press (Fig. 65).

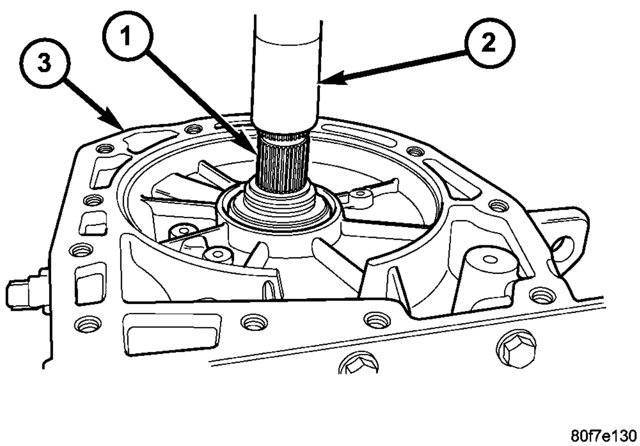


Fig. 65 Use Arbor Press to Remove Output Shaft from Case

1 - OUTPUT SHAFT
2 - ARBOR PRESS
3 - TRANSMISSION CASE

Use special tool 6596 with a shop press to remove the front output shaft bearing cup (Fig. 66).

(45) Use special tool 6597 and handle C-4171 and C-4171-2 to press the rear output shaft bearing cup rearward (Fig. 67).

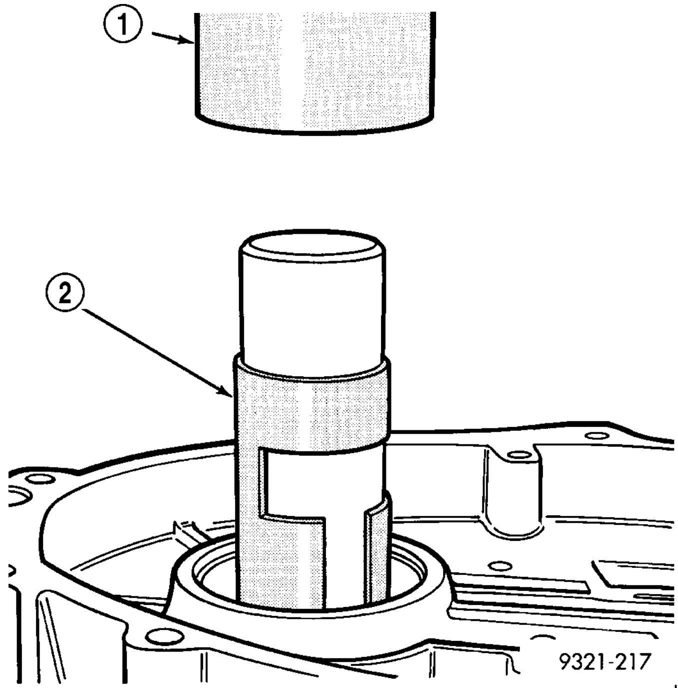


Fig. 66 Remove Front Bearing Cup - Typical

1 - ARBOR PRESS
2 - SPECIAL TOOL 6596

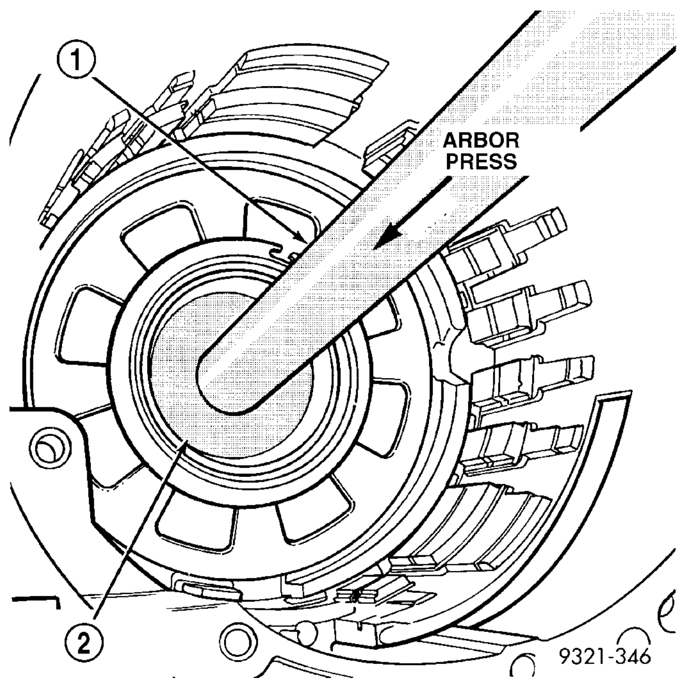


Fig. 67 Remove Rear Bearing Cup

1 - SPECIAL TOOL 4171 AND 4171-2
2 - SPECIAL TOOL 6597

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(46) Remove the rear carrier front bearing cone (Fig. 68).

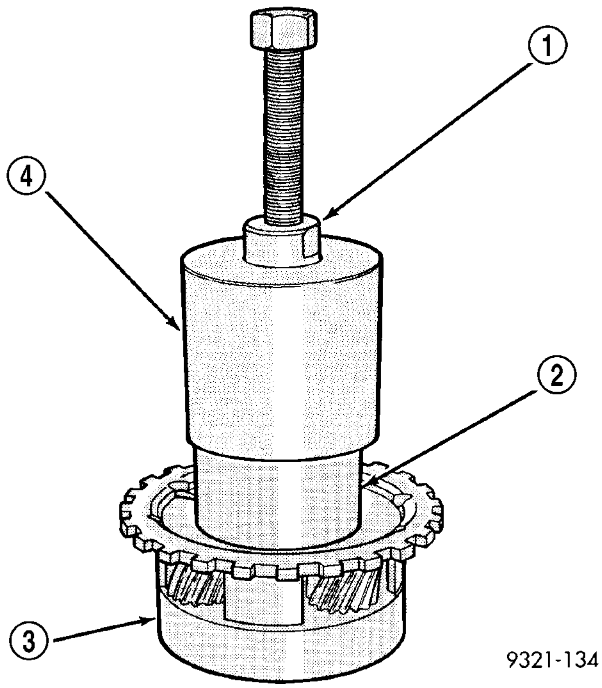


Fig. 68 Remove Rear Carrier Front Bearing Cone

1 - SPECIAL TOOL 5048-1
2 - SPECIAL TOOL 6545
3 - REAR CARRIER
4 - SPECIAL TOOL 5048

(47) Install and load compressor (Fig. 69) as shown in (Fig. 70).

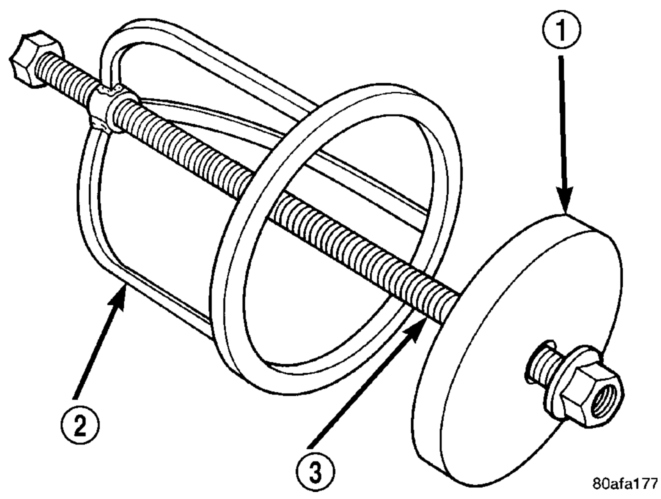


Fig. 69 Low/Reverse Spring Compressor Tool

1 - TOOL 6057
2 - TOOL 5059
3 - TOOL 5058-3

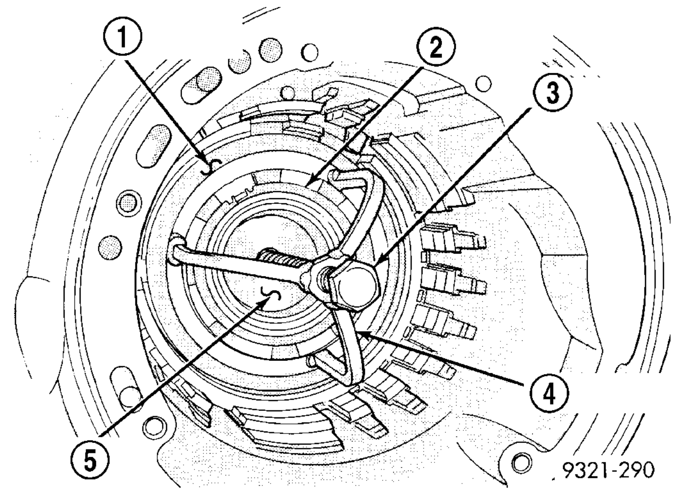


Fig. 70 Compressor Tool in Use

1 - LOW/REVERSE CLUTCH RETURN SPRING
2 - SNAP RING (INSTALL AS SHOWN)
3 - TOOL 5058A-3
4 - TOOL 5059A
5 - SPECIAL TOOL 6057

(48) Remove the low/reverse belleville spring snap ring (Fig. 71).

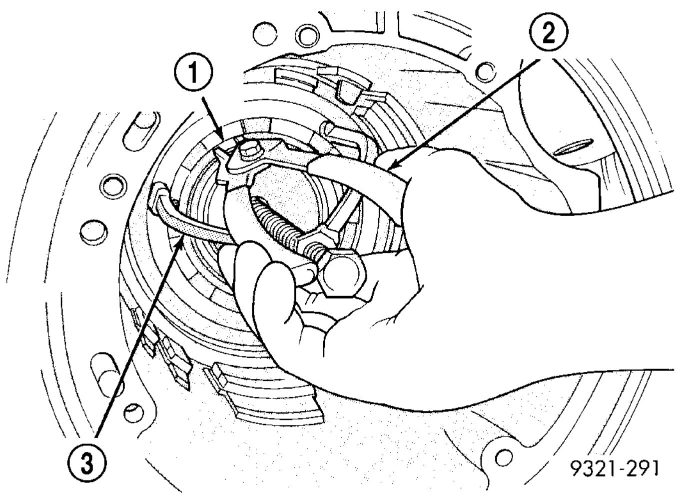


Fig. 71 Remove Snap Ring

1 - SNAP RING OPENING MUST BE BETWEEN SPRING LEVERS (AS SHOWN)
2 - SNAP RING PLIERS
3 - SPECIAL TOOL 5059A

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(49) Remove the low/reverse piston belleville spring (Fig. 72).

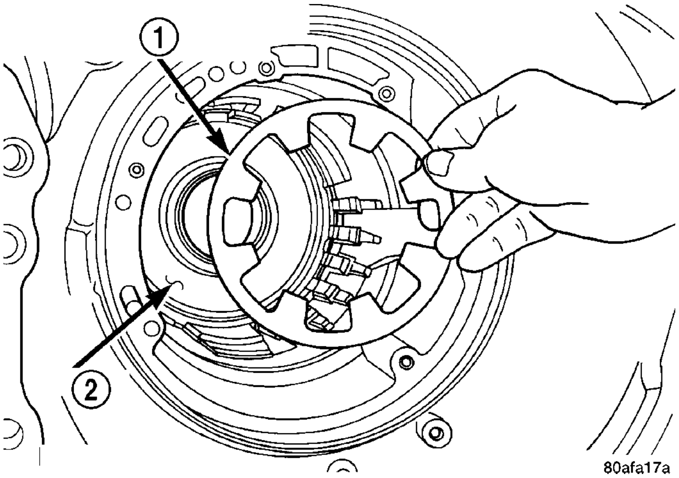


Fig. 72 Low/Reverse Piston Belleville Spring

1 - LOW/REVERSE PISTON RETURN SPRING
2 - PISTON

(50) Remove the park sprag pivot retaining screw.
(51) Drive out the anchor shaft using suitable punch (Fig. 73).

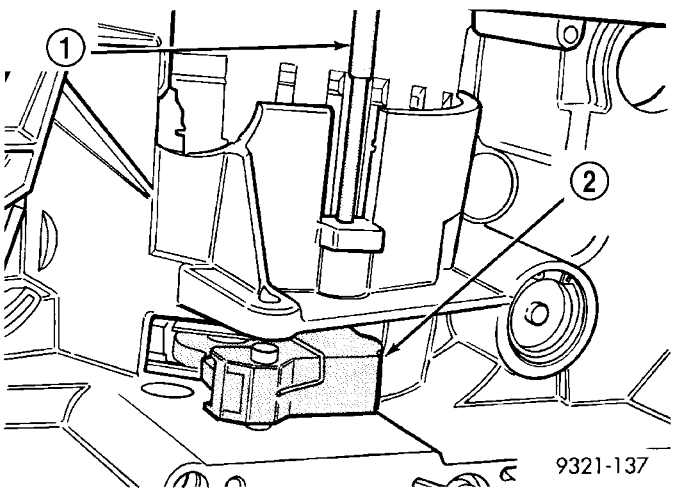


Fig. 73 Anchor Shaft Removal

1 - PIN PUNCH
2 - GUIDE BRACKET ASSEMBLY

(52) Remove the guide bracket pivot shaft (Fig. 74). Inspect all components (Fig. 75) for wear and replace if necessary.

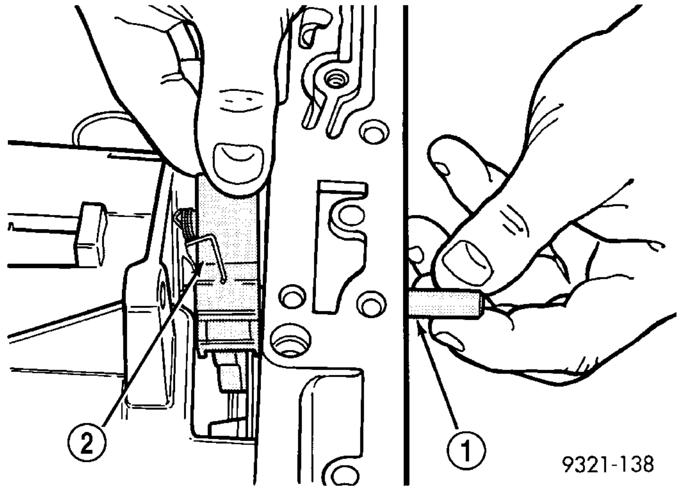


Fig. 74 Remove Guide Bracket Pivot Shaft

1 - PIVOT PIN
2 - GUIDE BRACKET ASSEMBLY

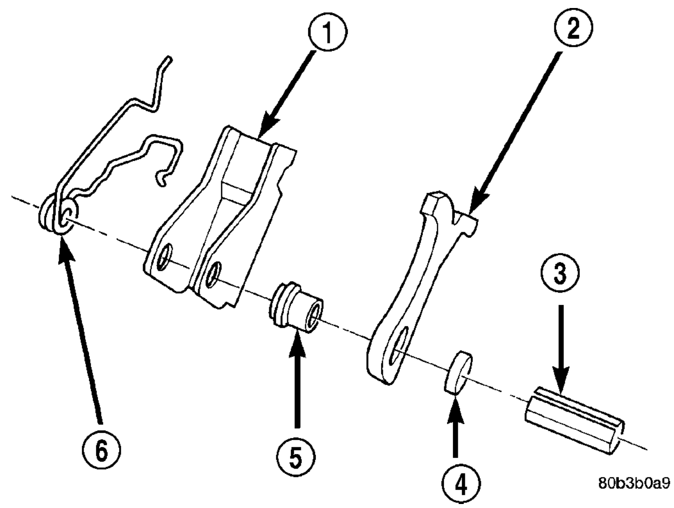


Fig. 75 Guide Bracket Disassembled

1 - GUIDE BRACKET
2 - PAWL
3 - SPLIT SLEEVE
4 - SPACER
5 - STEPPED SPACER
6 - ANTIRATCHET SPRING

AUTOMATIC TRANSMISSION - 42RLE (Continued)

NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

(53) Remove the low/reverse clutch piston (Fig. 76).

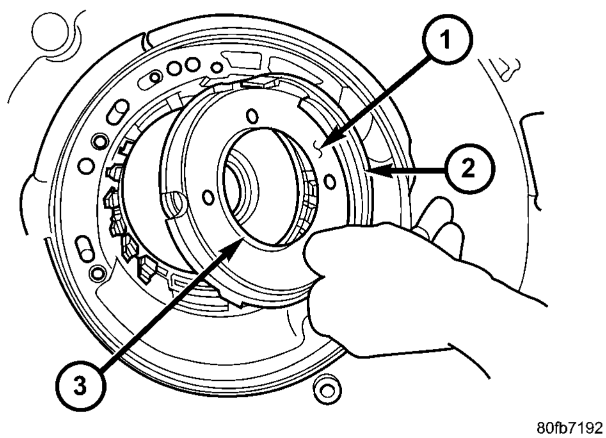


Fig. 76 Remove Low/Reverse Clutch Piston

1 - LOW/REVERSE CLUTCH PISTON
2 - BONDED SEAL
3 - BONDED SEAL

(54) Remove the low/reverse piston retainer screws.

(55) Remove low/reverse piston retainer (Fig. 77).

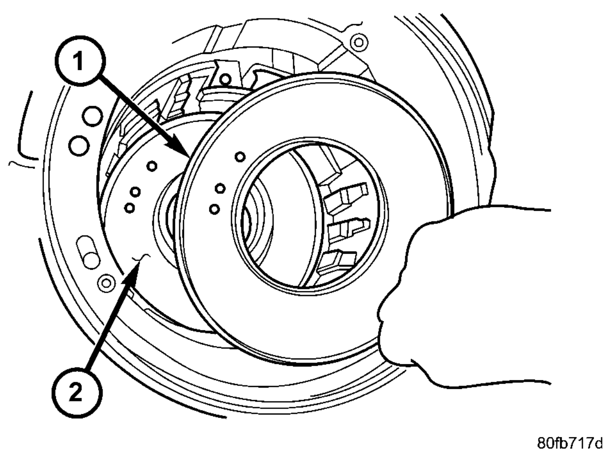


Fig. 77 Remove Piston Retainer

1 - LOW/REVERSE CLUTCH PISTON RETAINER
2 - GASKET

(56) Remove the low/reverse piston retainer gasket (Fig. 78).

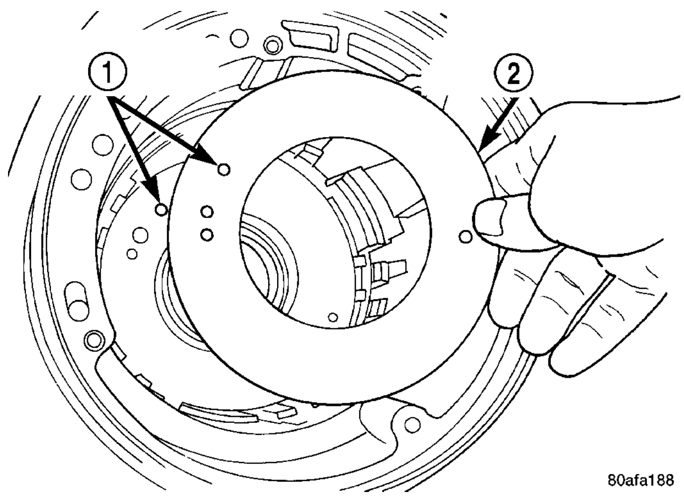


Fig. 78 Remove Piston Retainer Gasket

1 - GASKET HOLES MUST LINE UP
2 - LOW/REVERSE CLUTCH PISTON RETAINER GASKET

ASSEMBLY

NOTE: If the transmission assembly is being reconditioned (clutch/seal replacement) or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE).

(1) Install the output bearing cups using Special Tool - 5050A (Fig. 79).

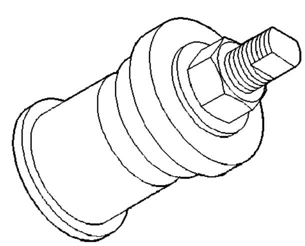


Fig. 79 Bearing Cup Installation Special Tool - 5050A

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(2) Install low/reverse piston retainer gasket (Fig. 80).

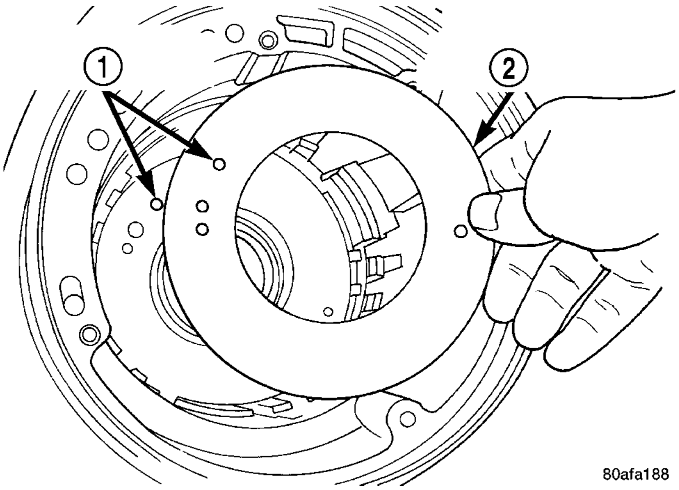


Fig. 80 Install Piston Retainer Gasket

1 - GASKET HOLES MUST LINE UP
2 - LOW/REVERSE CLUTCH PISTON RETAINER GASKET

(3) Install low/reverse piston retainer (Fig. 81).

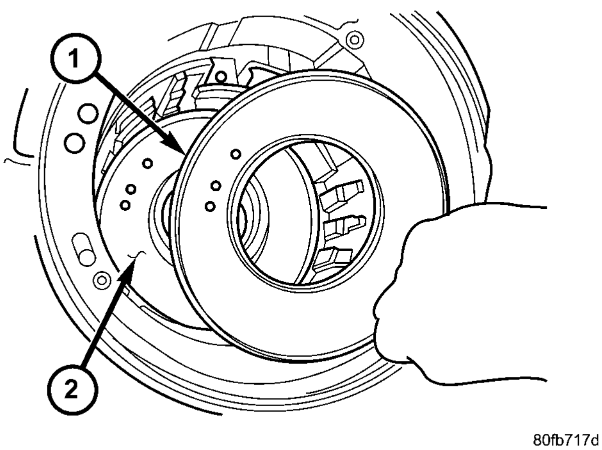


Fig. 81 Install Piston Retainer

1 - LOW/REVERSE CLUTCH PISTON RETAINER
2 - GASKET

(4) Install low/reverse piston retainer-to-case screws (Fig. 82) and torque to 5 N·m (45 in. lbs.).

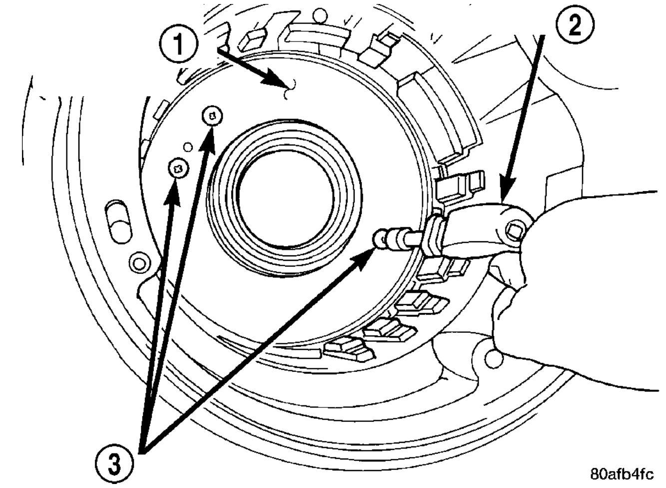


Fig. 82 Install Retainer Attaching Screws

1 - LOW/REVERSE CLUTCH PISTON RETAINER
2 - SCREWDRIVER
3 - TORX-LOC SCREWS

NOTE: The Low/Reverse Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

(5) Install low/reverse clutch piston (Fig. 83).

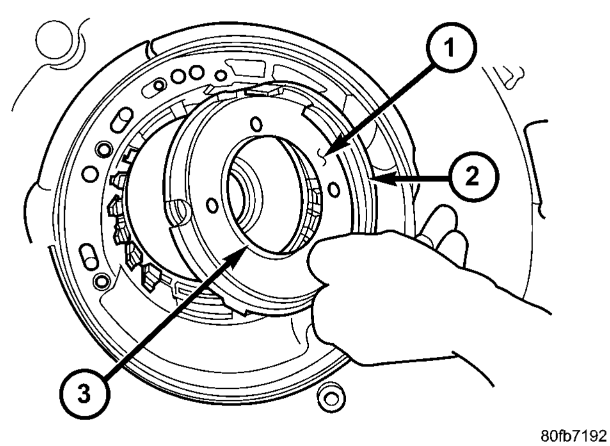


Fig. 83 Install Low/Reverse Clutch Piston

1 - LOW/REVERSE CLUTCH PISTON
2 - BONDED SEAL
3 - BONDED SEAL

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(6) Assemble guide bracket assembly as shown in (Fig. 84) (Fig. 85).

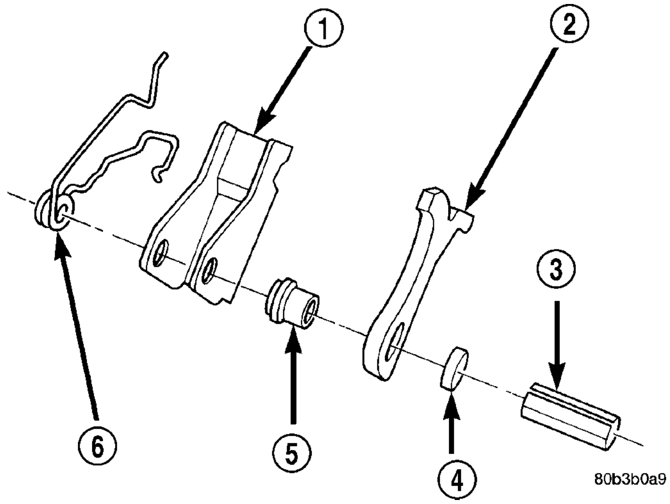


Fig. 84 Guide Bracket Assembly

1 - GUIDE BRACKET
2 - PAWL
3 - SPLIT SLEEVE
4 - SPACER
5 - STEPPED SPACER
6 - ANTIRATCHET SPRING

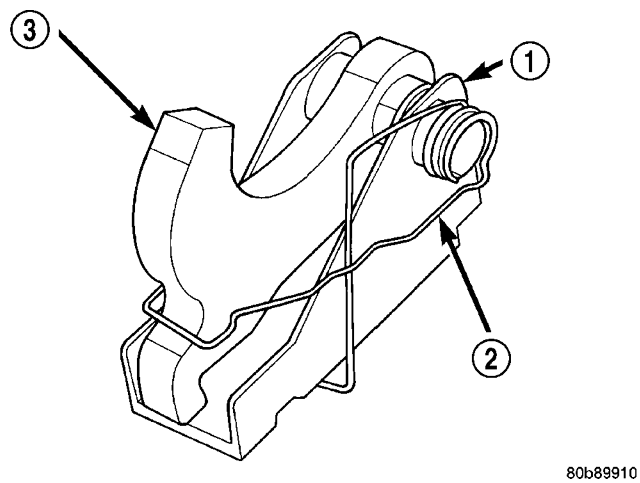


Fig. 85 Guide Bracket

1 - GUIDE BRACKET
2 - ANTIRATCHET SPRING (MUST BE ASSEMBLED AS SHOWN)
3 - PAWL

(7) Install guide bracket pivot shaft (Fig. 86).

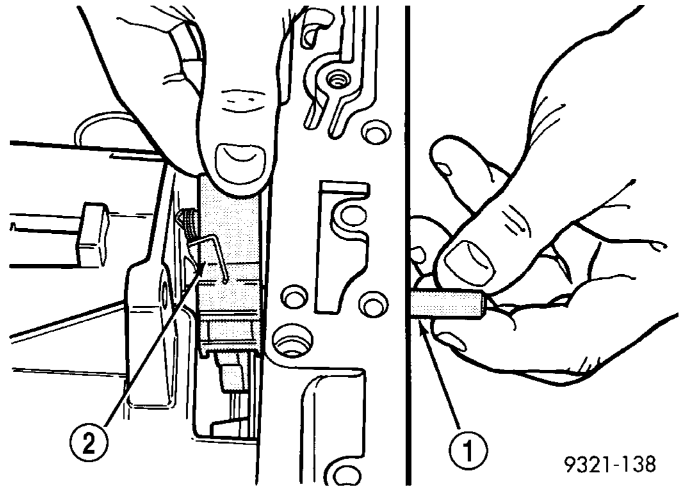


Fig. 86 Install Guide Bracket Pivot Shaft

1 - PIVOT PIN
2 - GUIDE BRACKET ASSEMBLY

CAUTION: When installing, be sure guide bracket and split sleeve touch the rear of the transmission case.

(8) Install park sprag pivot retaining screw and torque to 4.5 N·m (40 in. lbs.).

(9) Install low/reverse piston belleville spring into position (Fig. 87).

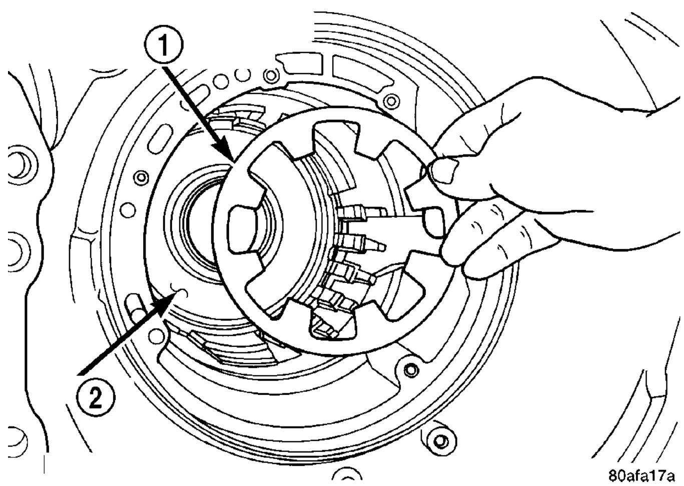


Fig. 87 Install Low/Reverse Piston Return Spring

1 - LOW/REVERSE PISTON RETURN SPRING
2 - PISTON

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(10) Install and load low/reverse spring compressor tool as shown in (Fig. 88) (Fig. 89) to facilitate snap ring installation.

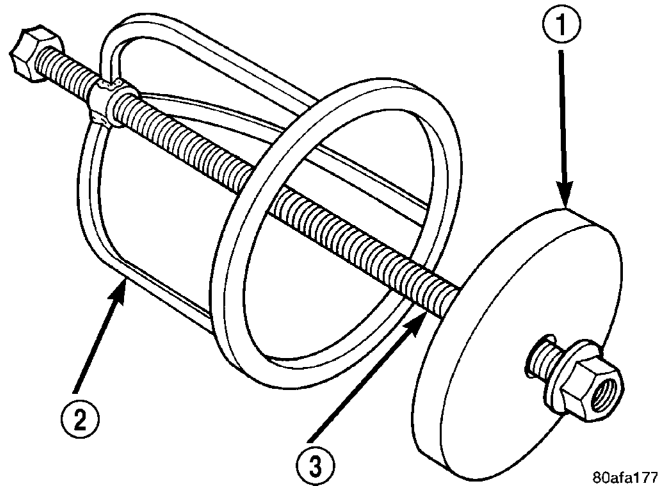


Fig. 88 Low/Reverse Spring Compressor Tool

1 - TOOL 6057
2 - TOOL 5059
3 - TOOL 5058-3

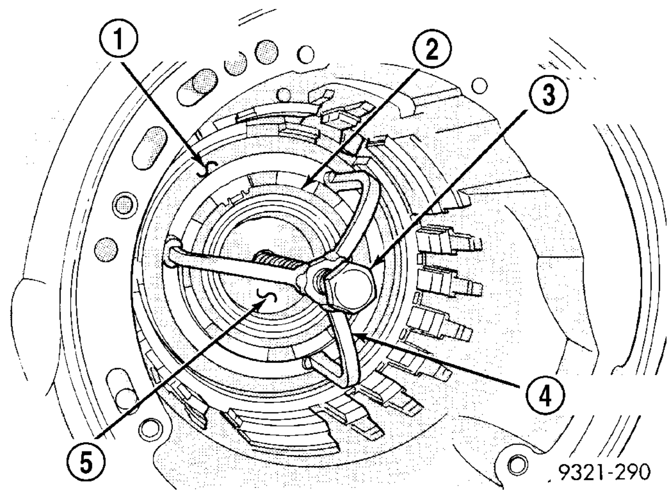


Fig. 89 Compressor Tool in Use

1 - LOW/REVERSE CLUTCH RETURN SPRING
2 - SNAP RING (INSTALL AS SHOWN)
3 - TOOL 5058A-3
4 - TOOL 5059A
5 - SPECIAL TOOL 6057

(11) Install snap ring and remove compressor tool (Fig. 90).

(12) Install rear carrier front bearing cone (Fig. 91).

(13) Check output bearing preload. **Output bearing preload must be checked and/or adjusted if any of the following items have been replaced:**

- Output shaft (rear carrier assembly)
- Output shaft bearings
- Transmission case

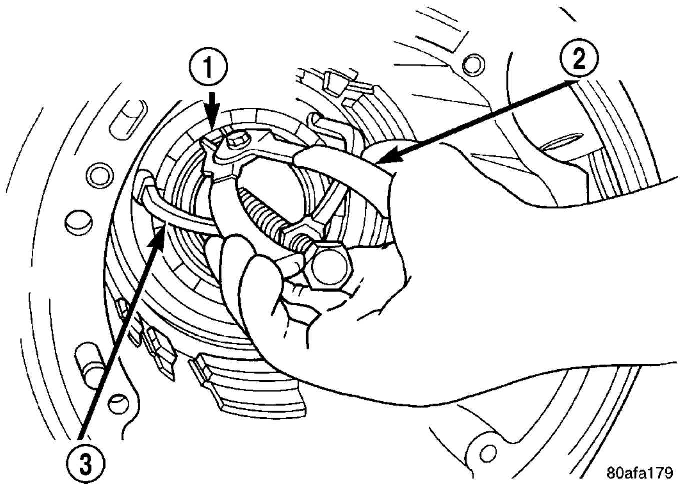


Fig. 90 Install Snap Ring

1 - SNAP RING OPENING MUST BE BETWEEN SPRING LEVERS (AS SHOWN)
2 - SNAP RING PLIERS
3 - TOOL 6057

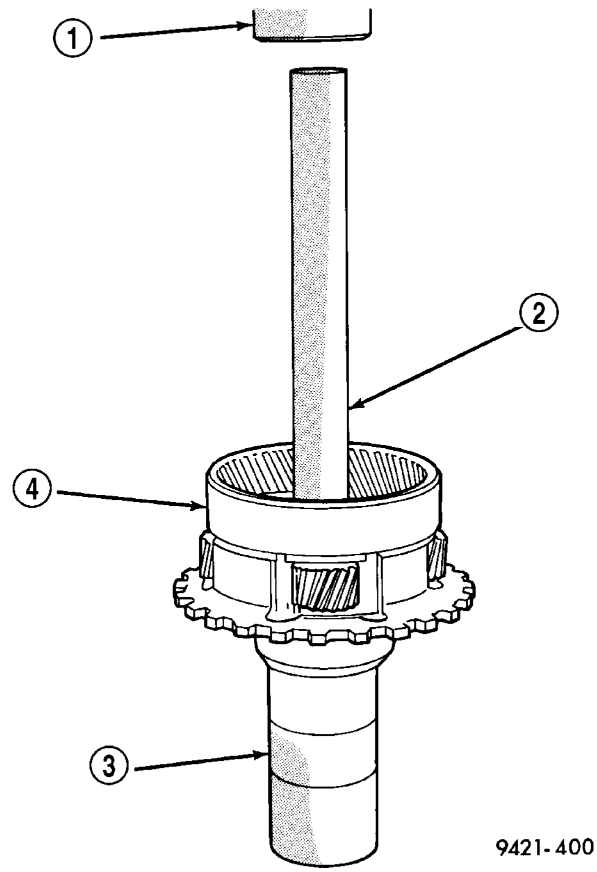


Fig. 91 Install Rear Carrier Front Bearing Cone

1 - ARBOR PRESS
2 - SPECIAL TOOL C-4171
3 - SPECIAL TOOL 6052
4 - REAR CARRIER

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(a) **PRELOAD CHECK/SHIM SELECTION:** Install rear output shaft bearing cone and special tool 6618A (Fig. 92).

(b) Install special tool 6618A (Fig. 93). Lightly tighten retaining screws. Screws should be below the plate surface, but do not snug screws.

(c) Turn case over on arbor press so that the plate is resting on the press base. **CAUTION: The output shaft will extend through the hole of tool 6618A. Ensure your press table has clearance for the output shaft.**

(d) Install shim on output shaft (Fig. 94). Apply small amount of petrolatum onto the shim to hold it in place. Use the original shim as a starting point. If original shim is not available, use the thickest shim available.

(e) Install output shaft/rear carrier into rear bearing. The shaft must be pressed into position. Use special tool MD-998911 (Disc) and C- 4171 and C4171-2 (Handle) to press shaft into rear bearing (Fig. 95).

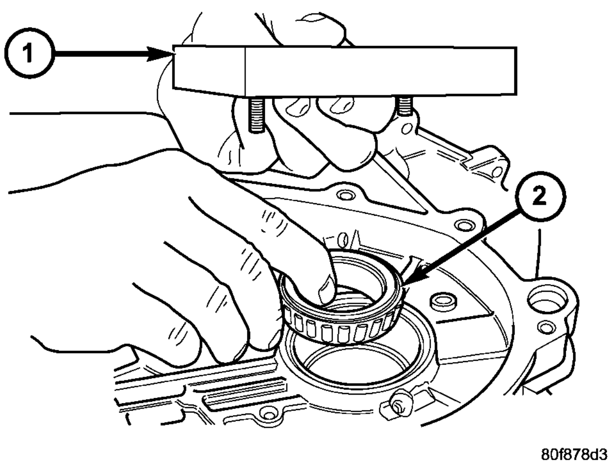


Fig. 92 Bearing Installation

1 - SPECIAL TOOL 6618-A
2 - REAR OUTPUT SHAFT BEARING

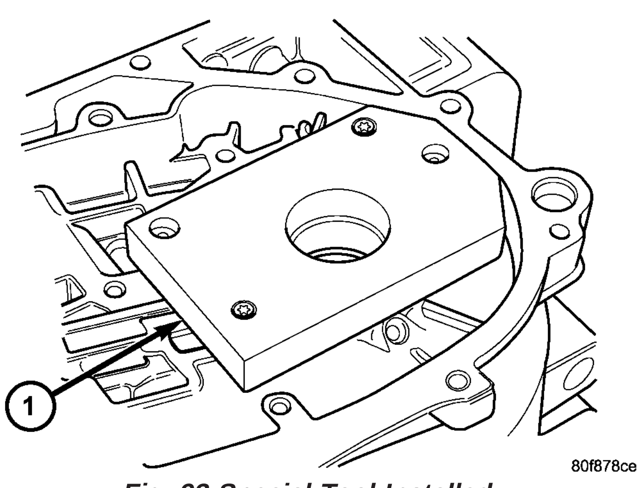


Fig. 93 Special Tool Installed

1 - SPECIAL TOOL 6618-A

(f) **Do not re-use old output shaft nut because the removed stake weakens the nut flange.** Using special tools 6497 and 6498-A, install new output shaft nut. Do not reuse old output shaft nut. Tighten new output shaft nut to 271 N·m (200 ft. lbs.).

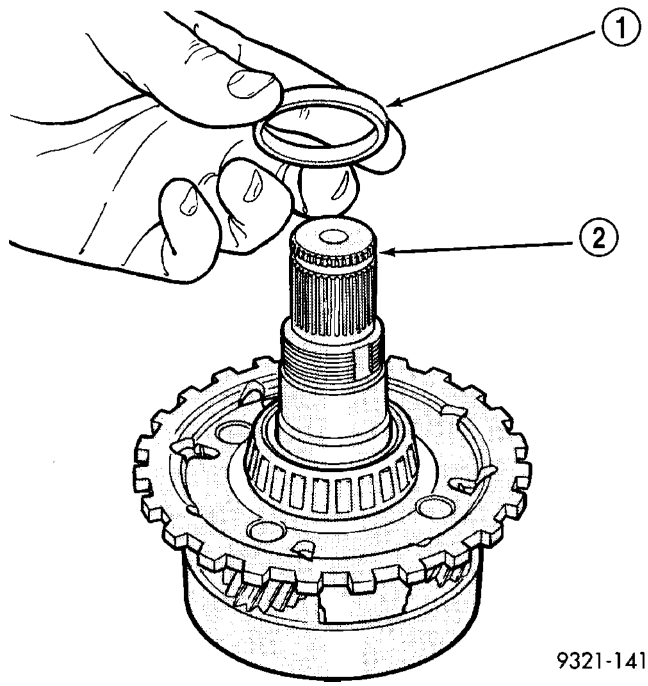


Fig. 94 Shim Installation

1 - SHIM
2 - OUTPUT SHAFT

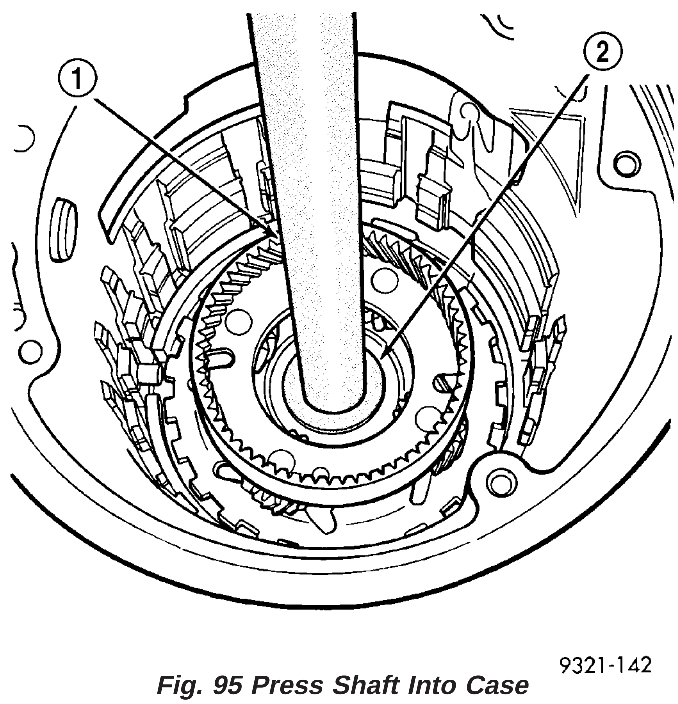


Fig. 95 Press Shaft Into Case

1 - SPECIAL TOOL C-4171 AND C-4171-2
2 - SPECIAL TOOL MD-998911

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(g) Check the turning torque of the output shaft (Fig. 96). The shaft should have 1 to 8 in. lbs. of turning torque. If the turning torque is **higher than** 8 in. lbs., install a thicker shim. If turning torque is **less than** 1 in. lb., install a thinner shim. Make sure there is no end play.

(h) The new nut must be staked after the correct turning torque is obtained (Fig. 97) (Fig. 98). Use special tool 6639 to stake output shaft nut. **CAUTION: Failure to stake nut could allow the nut to back-off during use.**

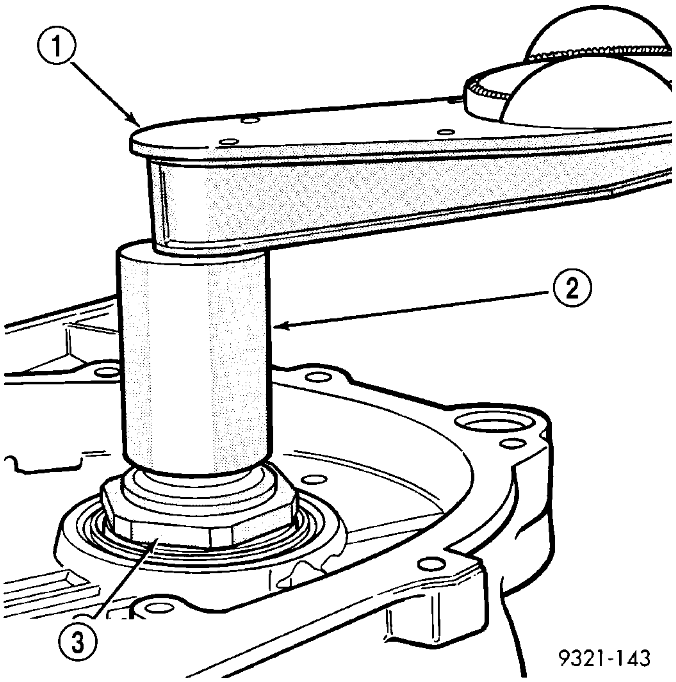


Fig. 96 Checking Turning Torque

1 - TORQUE WRENCH
2 - SPECIAL TOOL 6498-A
3 - OUTPUT SHAFT NUT

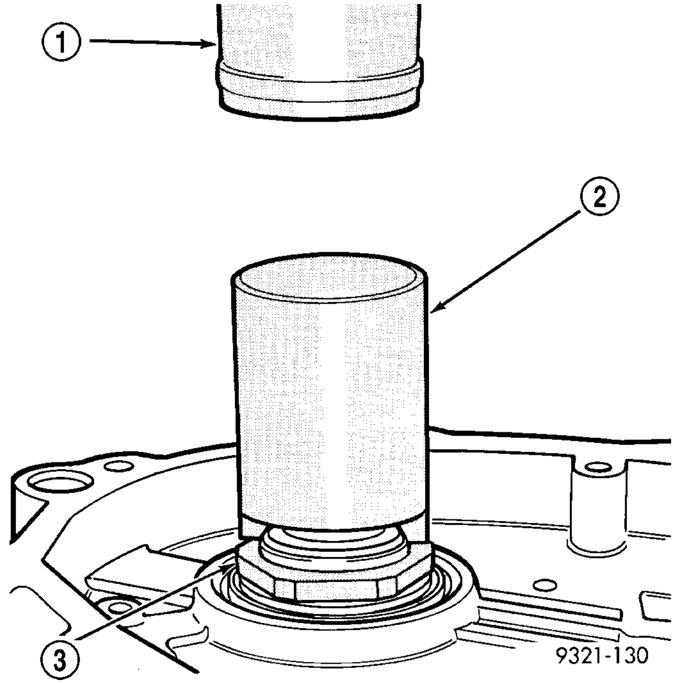


Fig. 97 Staking Output Shaft Nut - Typical

1 - ARBOR PRESS
2 - STAKING TOOL - 6639
3 - NEW NUT

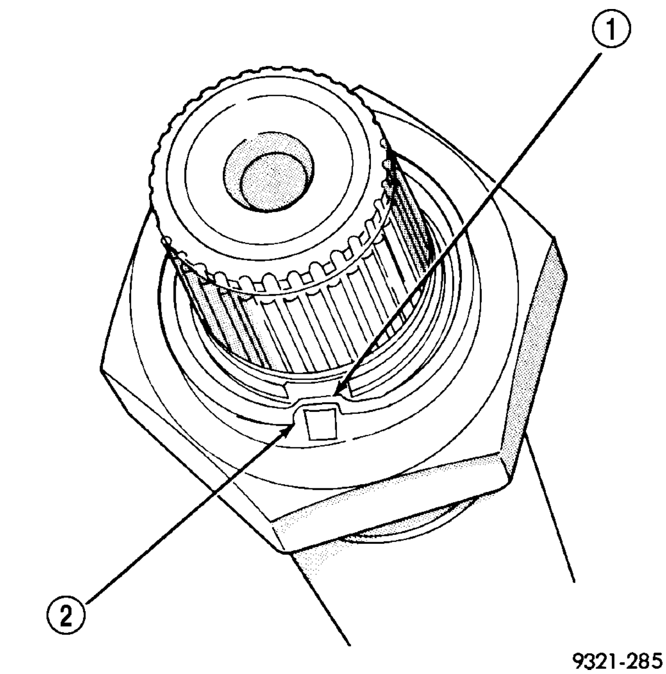


Fig. 98 Properly Staked Nut

1 - BOTTOMED IN SLOT
2 - CORRECTLY STAKED NUT

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(14) Install low/reverse clutch pack (Fig. 99). Leave uppermost disc out to facilitate snap ring installation.

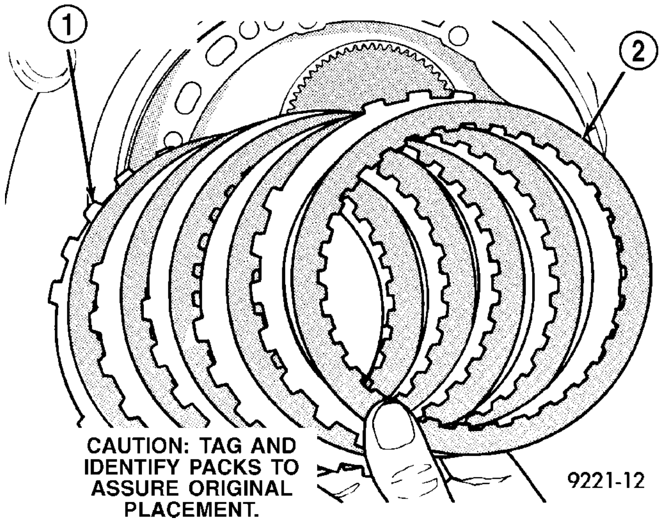


Fig. 99 Install Low/Reverse Clutch Pack

1 - CLUTCH PLATES (5)
2 - CLUTCH DISCS (5)

(15) Install low/reverse reaction plate snap ring (Fig. 100).

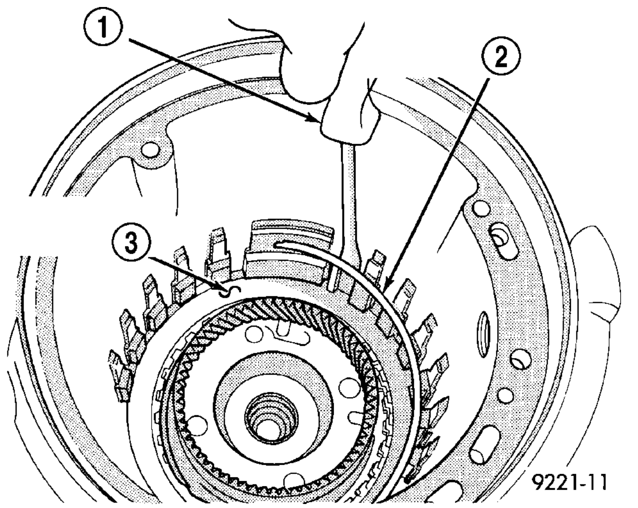


Fig. 100 Install Low/Reverse Reaction Plate Snap Ring

1 - SCREWDRIVER
2 - LOW/REVERSE REACTION PLATE FLAT SNAP RING
3 - DO NOT SCRATCH CLUTCH PLATE

(16) Install one low/reverse clutch disc (Fig. 101).

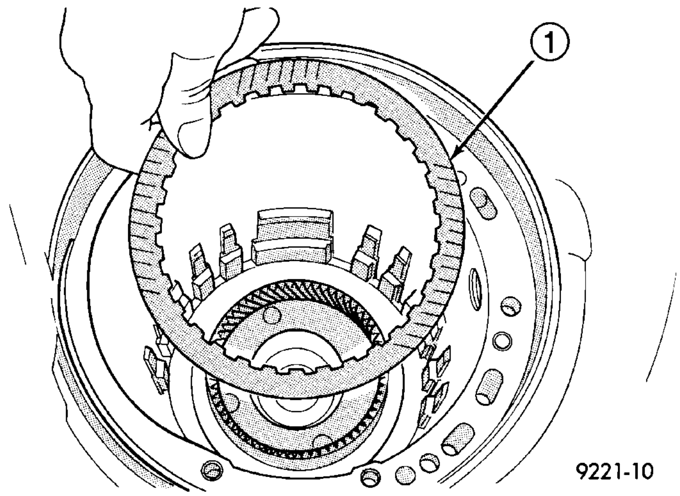


Fig. 101 Install One Disc

1 - ONE DISC FROM LOW/REVERSE CLUTCH

(17) Install low/reverse reaction plate with flat side up (Fig. 102).

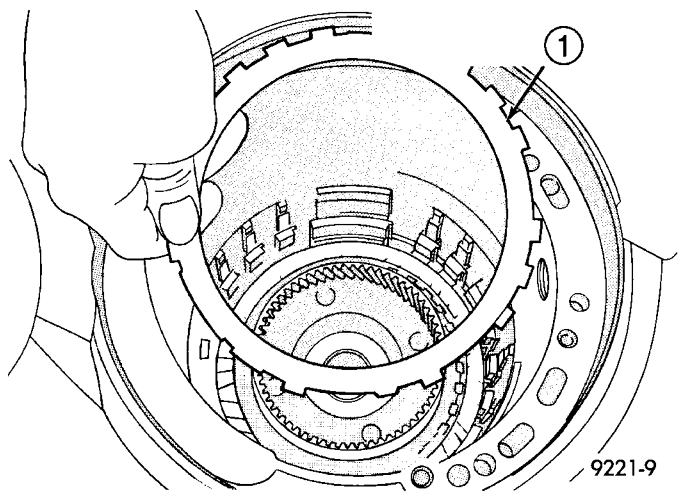


Fig. 102 Install Low/Reverse Reaction Plate

1 - LOW/REVERSE REACTION PLATE (FLAT SIDE UP)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(18) Install a new tapered snap ring (tapered side out) (Fig. 103). Make sure that the snap ring ends are oriented as shown (Fig. 104)

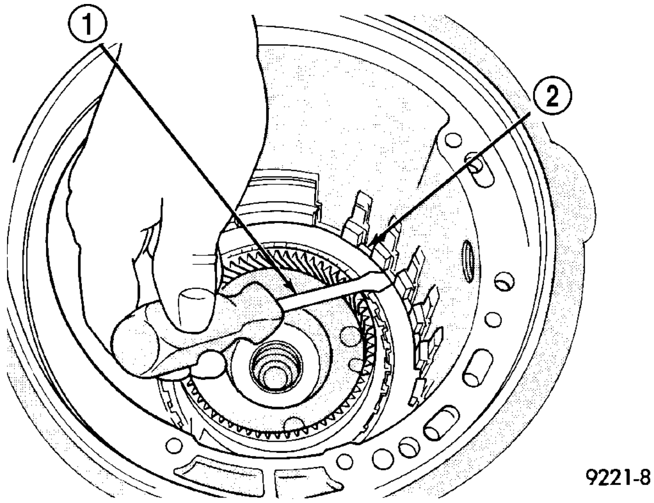


Fig. 103 Snap Ring Installed

1 - SCREWDRIVER
2 - TAPERED SNAP RING (INSTALL AS SHOWN)

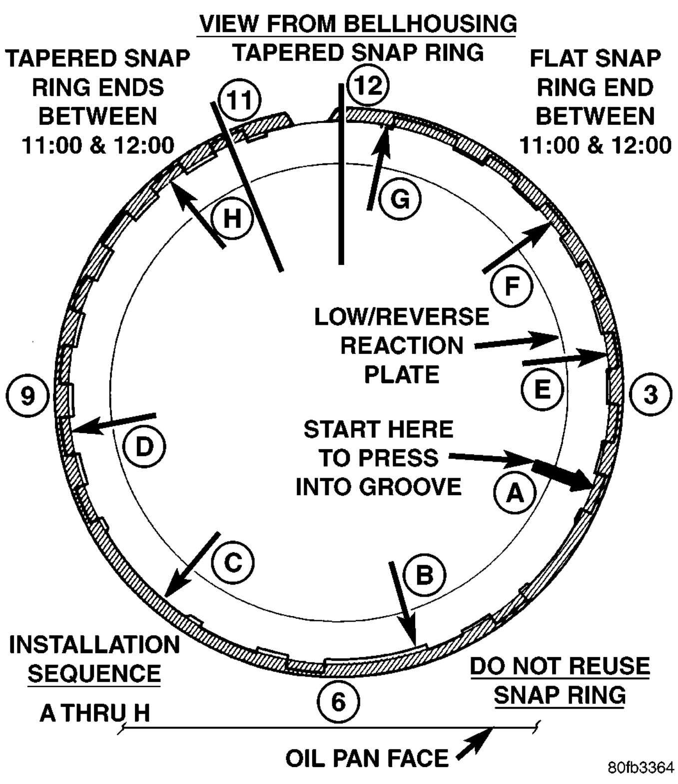


Fig. 104 Tapered Snap Ring Instructions

(19) Measure low/reverse clutch pack. Set up dial indicator as shown in (Fig. 105). Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **Low/Reverse clutch pack clearance is 0.84 to 1.60 mm (0.033 to 0.063 inch).**

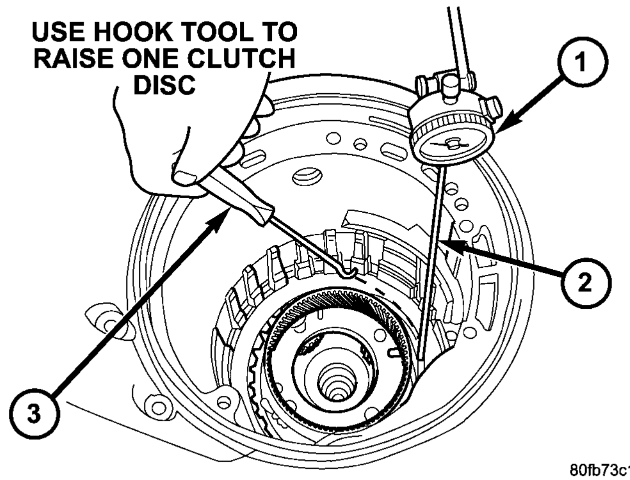


Fig. 105 Check Low/Reverse Clutch Clearance

1 - DIAL INDICATOR
2 - DIAL INDICATOR TIP TOOL 6268
3 - HOOK TOOL

(20) Select the proper low/reverse reaction plate to achieve specifications.

(21) Install 2/4 clutch pack (Fig. 106).

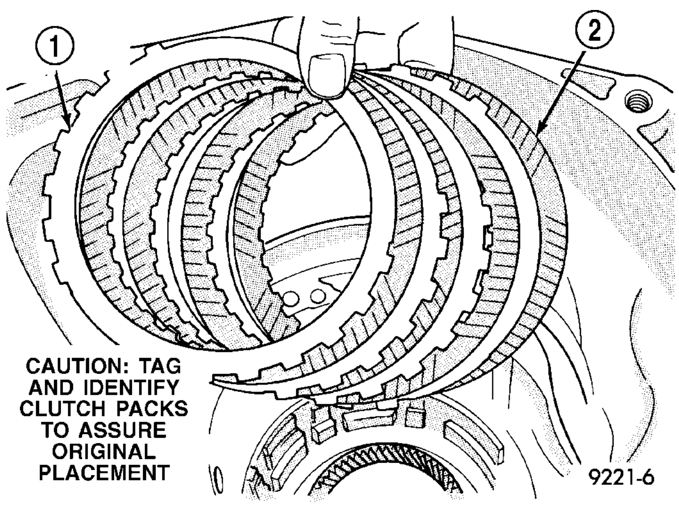


Fig. 106 Install 2/4 Clutch Pack

1 - CLUTCH PLATE (4)
2 - CLUTCH DISC (4)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

NOTE: The 2/4 Clutch Piston has bonded seals which are not individually serviceable. Seal replacement requires replacement of the piston assembly.

(22) Install 2/4 clutch belleville spring (Fig. 107) (Fig. 108).

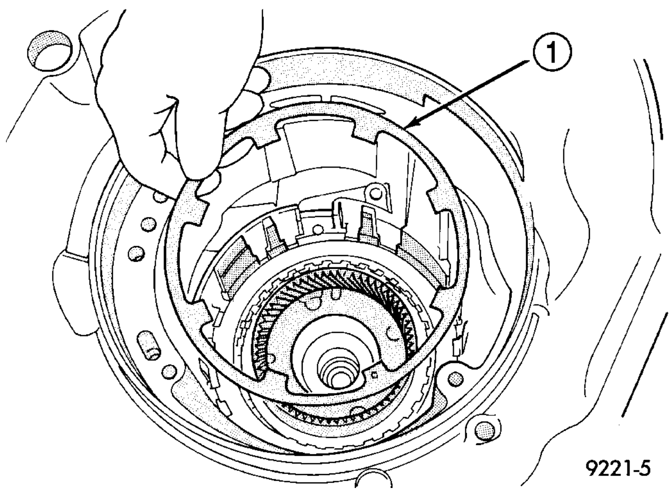


Fig. 107 Install 2/4 Clutch Return Spring

1 - 2/4 CLUTCH RETURN SPRING

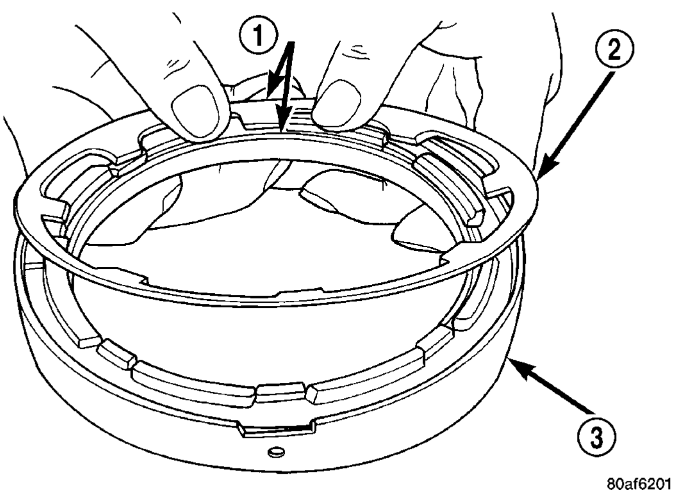


Fig. 108 Proper Orientation of 2/4 Clutch

1 - NOTE POSITION
2 - RETURN SPRING
3 - 2/4 CLUTCH RETAINER

(23) Install 2/4 clutch retainer (Fig. 109).

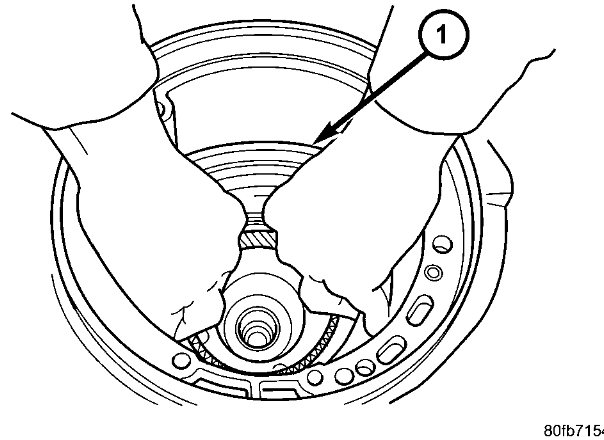


Fig. 109 Install 2/4 Clutch Retainer

1 - 2/4 CLUTCH RETAINER

NOTE: Verify that Tool 5058A is centered properly over the 2/4 clutch retainer before compressing. If necessary, fasten the 5058A bar to the bellhousing flange with any combination of locking pliers and bolts to center the tool properly.

(24) Set up Tool 5058 as shown in (Fig. 110). Compress 2/4 clutch just enough to facilitate snap ring installation.

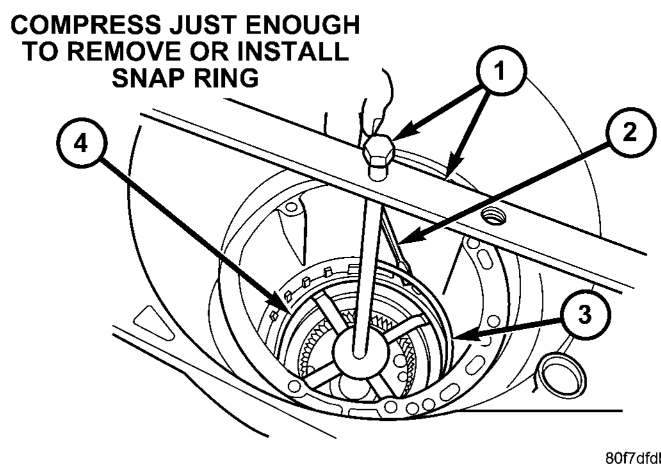


Fig. 110 Remove 2/4 Clutch Retainer Snap Ring

1 - TOOL 5058
2 - SCREWDRIVER
3 - SNAP RING
4 - 2/4 CLUTCH RETAINER

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(25) **Measure 2/4 clutch clearance:** Set up dial indicator as shown in (Fig. 111). Press down clutch pack with finger and zero dial indicator. Record measurement in four (4) places and take average reading. **The 2/4 clutch pack clearance is 0.76 to 2.64 mm (0.030 to 0.104 inch).** If not within specifications, the clutch is not assembled properly or is excessively worn. **There is no adjustment for the 2/4 clutch clearance.**

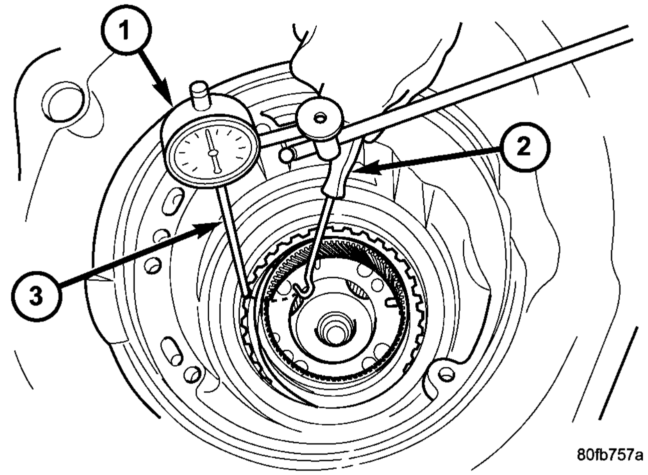


Fig. 111 Check 2/4 Clutch Clearance

1 - DIAL INDICATOR
2 - HOOK TOOL
3 - DIAL INDICATOR TIP TOOL 6268

(26) Install the #7 needle bearing to the rear sun gear (Fig. 112). **The number 7 needle bearing has three antireversal tabs and is common with the number 5 and number 2 position. The orientation should allow the bearing to seat flat against the rear sun gear. A small amount of petrolatum can be used to hold the bearing to the rear sun gear.**

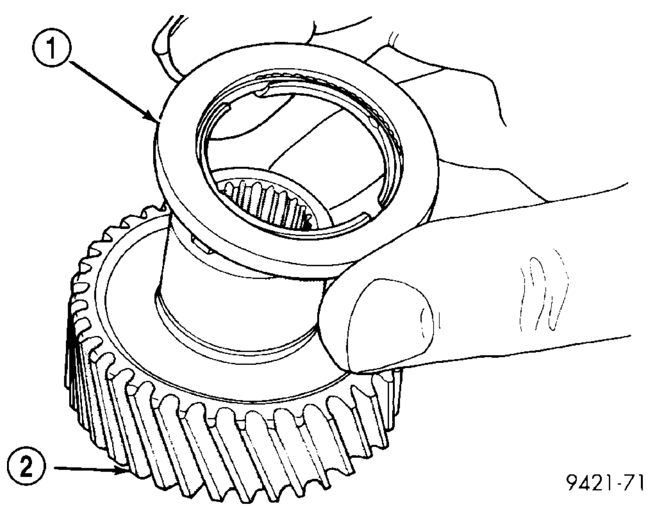


Fig. 112 Number 7 Bearing

1 - #7 BEARING
2 - REAR SUN GEAR

(27) Install rear sun gear and #7 needle bearing (Fig. 113).

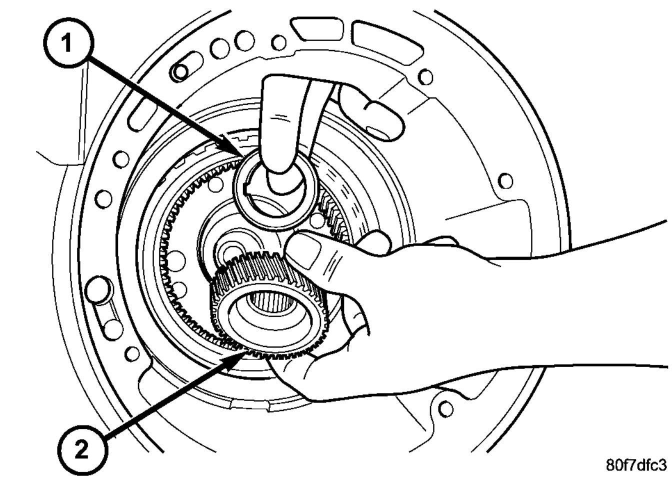


Fig. 113 Install Rear Sun Gear

1 - #7 NEEDLE BEARING
2 - REAR SUN GEAR

(28) Install front carrier/rear annulus assembly and #6 needle bearing (Fig. 114).

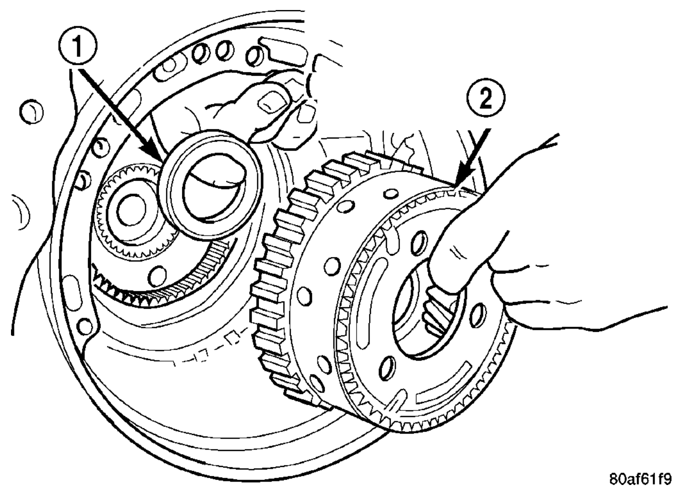


Fig. 114 Install Front Carrier/Rear Annulus

1 - #6 NEEDLE BEARING
2 - FRONT CARRIER AND REAR ANNULUS ASSEMBLY (TWIST AND PULL OR PUSH TO REMOVE OR INSTALL).

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(29) Install front sun gear assembly and #4 thrust washer (Fig. 115).

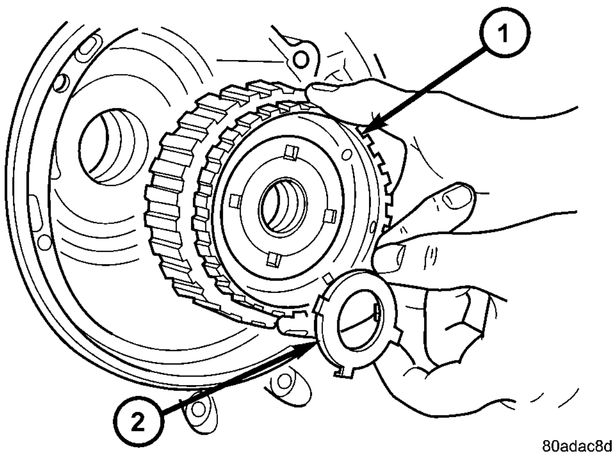


Fig. 115 Install Front Sun Gear Assembly

1 - FRONT SUN GEAR ASSEMBLY
2 - #4 THRUST WASHER (FOUR TABS)

(30) **Determine proper #4 thrust plate thickness.**

(a) Select the thinnest #4 thrust plate thickness.

(b) Install #4 thrust plate (Fig. 116) using petrolatum to hold into position.

(c) Install input clutch assembly. Ensure the input clutch assembly is completely seated by viewing position through input speed sensor hole. **If the speed sensor tone wheel is not centered in the opening, the input clutch assembly is not seated properly.**

(d) Remove the oil pump o-ring (Fig. 117) and install oil pump and gasket to transmission. Tighten the oil pump bolts to 30 N·m (265 in. lbs.). **Use screw-in dowels or phillips-head screwdrivers to align pump to case. Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.**

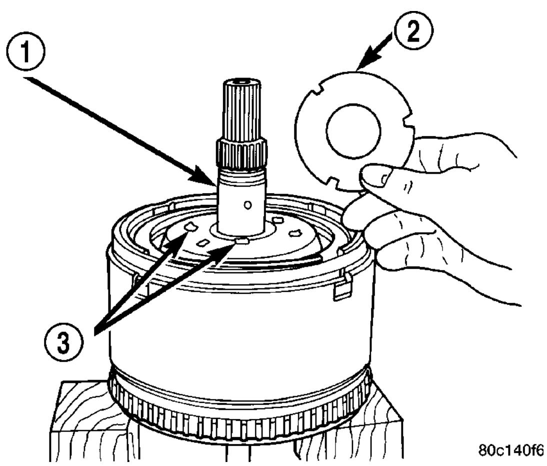


Fig. 116 Install #4 Thrust Plate

1 - OVERDRIVE SHAFT ASSEMBLY
2 - #4 THRUST PLATE (SELECT)
3 - PETROLATUM FOR RETENTION

(e) Measure the input shaft end play with the transmission in the vertical position. This will ensure that the measurement will be accurate.

(f) Set up and measure endplay using End Play Set 8266 and Dial Indicator Set C3339 as shown in (Fig. 118).

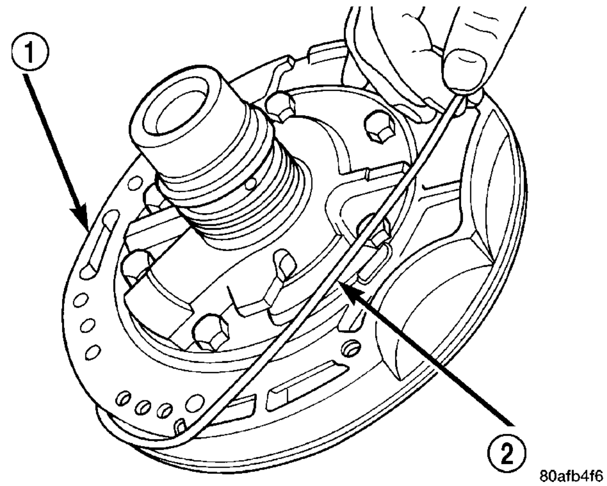


Fig. 117 Remove Oil Pump O-Ring

1 - OIL PUMP ASSEMBLY
2 - O-RING

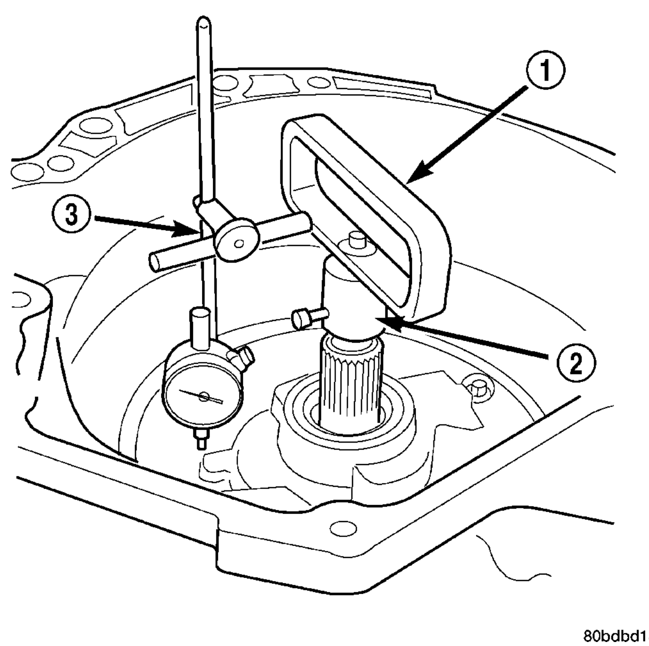


Fig. 118 Measure Input Shaft End Play Using Tool 8266 - Typical

1 - TOOL 8266-8
2 - TOOL 8266-2
3 - TOOL C-3339

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(g) Measure input shaft end play. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** For example, if end play reading is 0.055 inch, select No. 4 Thrust Plate which is 0.071 to 0.074 thick. This should provide an input shaft end play reading of 0.020 inch, which is within specifications.

(h) Remove oil pump, gasket, and input clutch assembly to gain access to and install proper #4 thrust plate.

(31) Install input clutch assembly with proper thrust plate (Fig. 119).

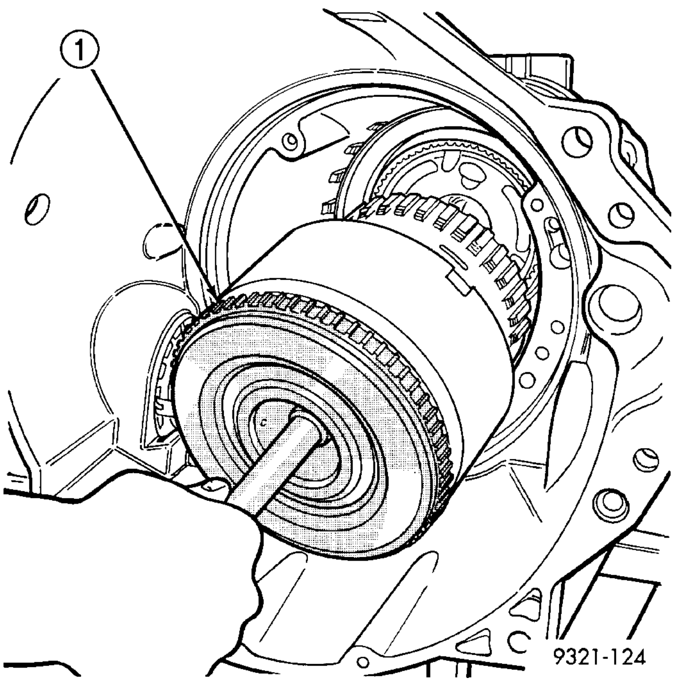


Fig. 119 Install Input Clutch Assembly

1 - INPUT CLUTCH ASSEMBLY

(32) Install #1 caged needle bearing (Fig. 120).

(33) Replace cooler by-pass valve if transmission failure has occurred (Fig. 121).

CAUTION: By-pass valve MUST be replaced if transmission failure occurs.

NOTE: To align oil pump, gasket, and case during installation, use threaded dowels or phillips screwdrivers.

(34) Install oil pump gasket (Fig. 122).

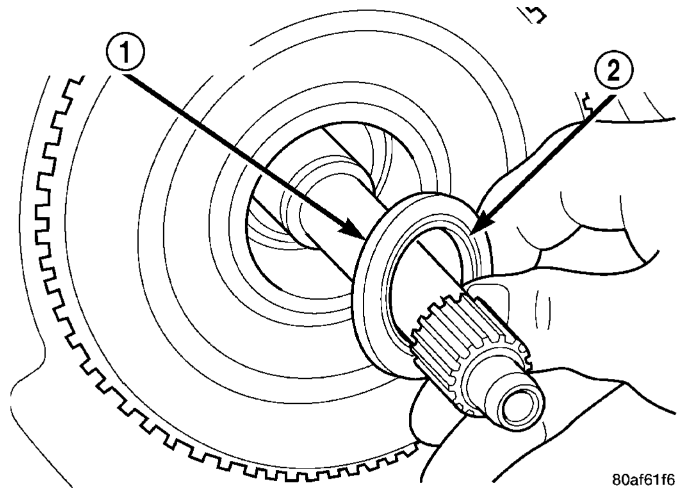


Fig. 120 Install No. 1 Caged Needle Bearing

1 - #1 CAGED NEEDLE BEARING
2 - NOTE: TANGED SIDE OUT

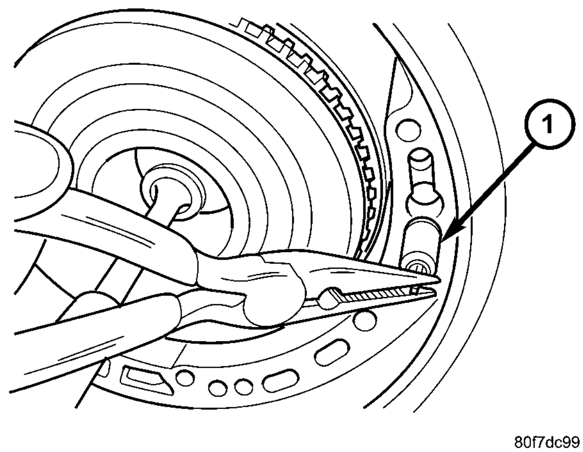


Fig. 121 Install By-Pass Valve

1 - BYPASS VALVE

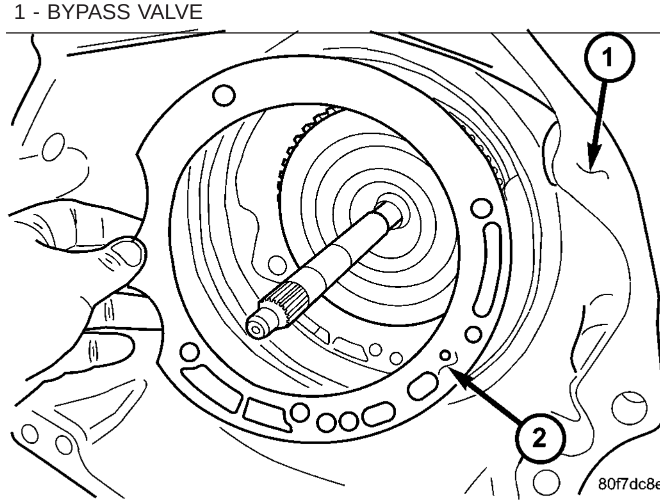


Fig. 122 Install Oil Pump Gasket

1 - BELLHOUSING
2 - OIL PUMP GASKET

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(35) Install oil pump and torque the new oil pump-to-case bolts to 30 N·m (265 in. lbs.) (Fig. 123). Do not reuse original oil pump bolts.

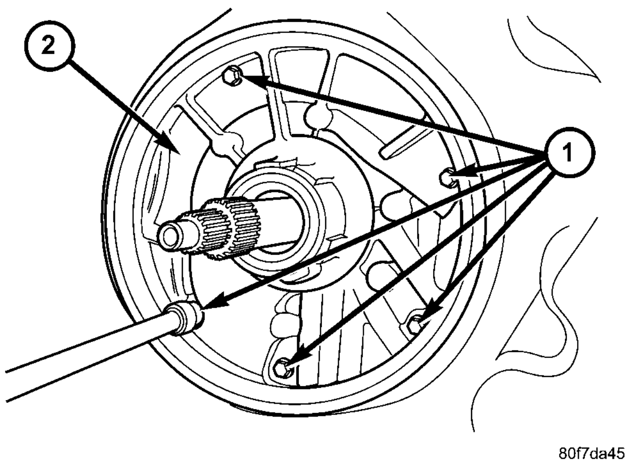


Fig. 123 Install Oil Pump Attaching Bolts

1 - BOLTS
2 - OIL PUMP

(36) Install low/reverse accumulator as shown in (Fig. 124).

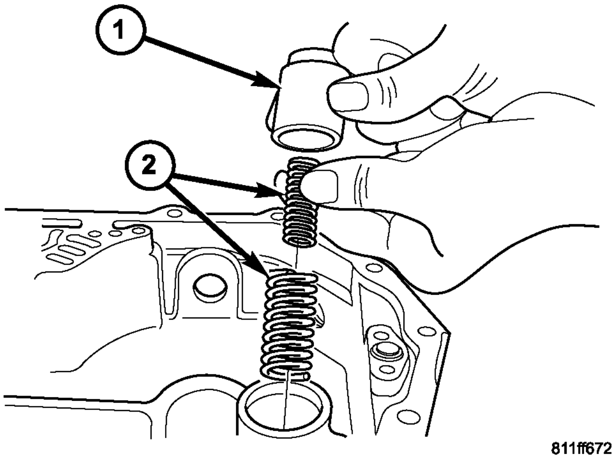


Fig. 124 Low/Reverse Accumulator

1 - PISTON
2 - RETURN SPRINGS

(37) Install low/reverse accumulator plug (Fig. 125).

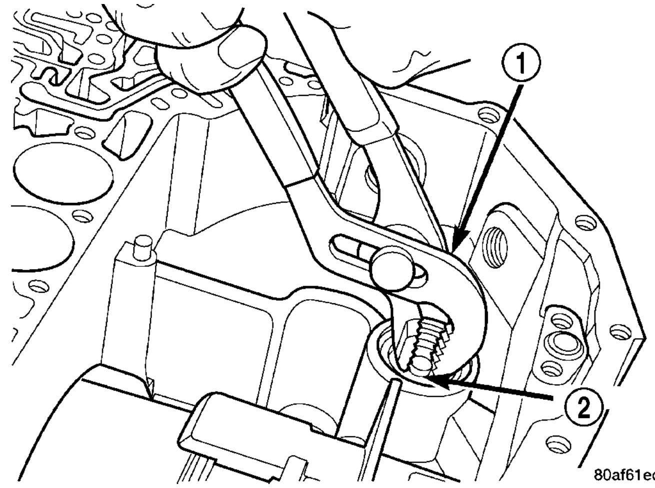


Fig. 125 Install Low/Reverse Accumulator Plug

1 - ADJUSTABLE PLIERS
2 - PLUG

(38) Install low/reverse accumulator snap ring (Fig. 126).

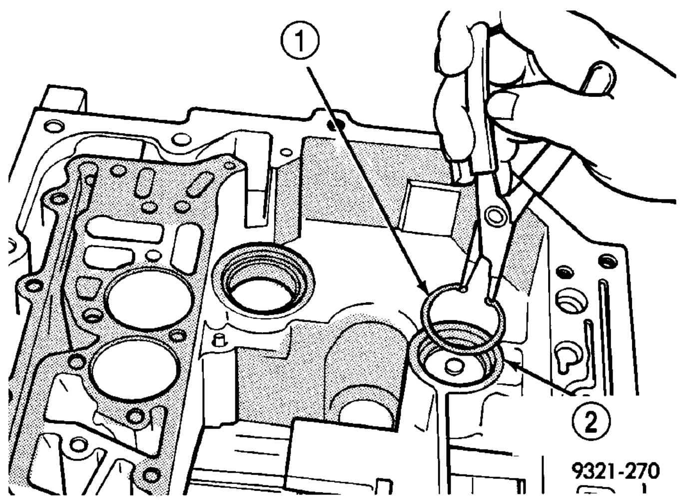


Fig. 126 Install Low/Reverse Accumulator Snap Ring

1 - SNAP RING
2 - LOW/REVERSE ACCUMULATOR

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(39) Install underdrive and overdrive accumulators and springs (Fig. 127).

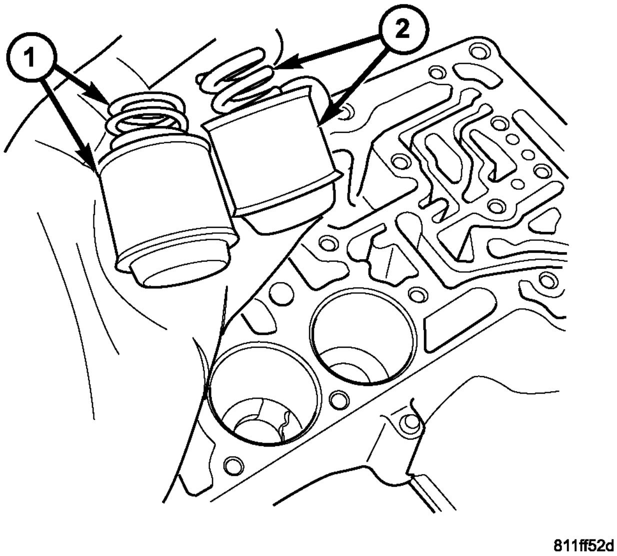


Fig. 127 Underdrive and Overdrive Accumulators

1 - OVERDRIVE PISTON AND SPRING
2 - UNDERDRIVE PISTON AND SPRING

CAUTION: Do not handle the valve body by the manual shaft. Damage could result.

(40) Install valve body into place as shown in (Fig. 128).

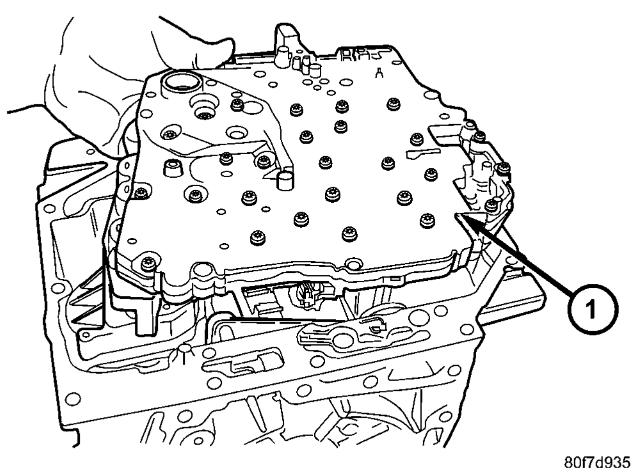


Fig. 128 Install Valve Body Onto Transmission

1 - VALVE BODY

(41) Install seven (7) valve body-to-case bolts (Fig. 129) and torque to 12 N·m (105 in. lbs.).

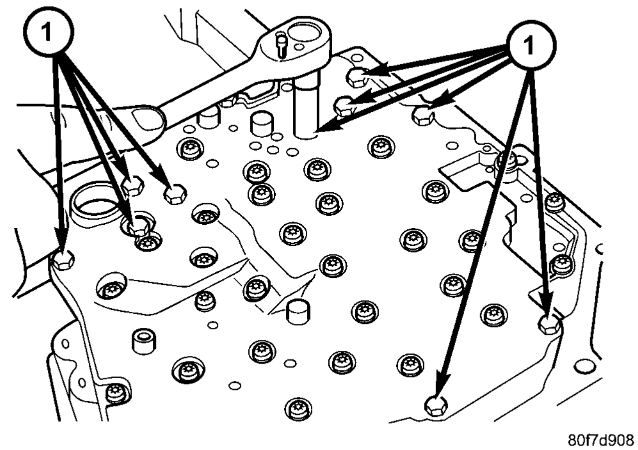


Fig. 129 Install Valve Body Bolts (7)

1 - BOLTS

(42) Install transmission oil filter (Fig. 130). Tighten the bolts to 5 N·m (45 in. lbs.)

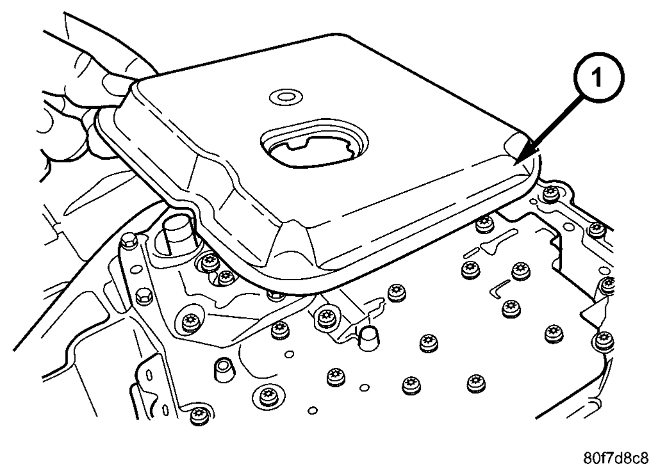


Fig. 130 Install Transmission Filter

1 - TRANSMISSION FILTER

AUTOMATIC TRANSMISSION - 42RLE (Continued)

NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits (Fig. 131), it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

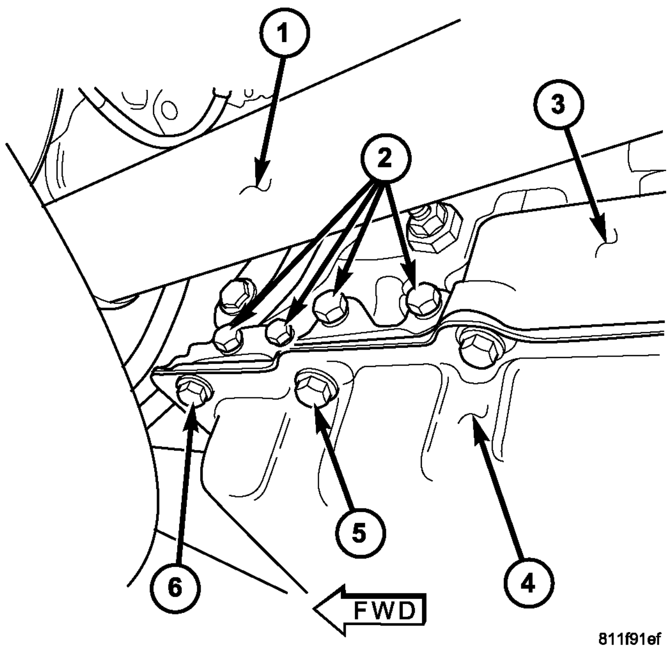


Fig. 131 Pan Fastener

1 - FRONT DRIVESHAFT
2 - PRESSURE PORTS
3 - TRANSMISSION CASE
4 - TRANSMISSION OIL PAN
5 - SECOND TRANSMISSION OIL PAN BOLT ON LEFT SIDE
6 - FIRST TRANSMISSION OIL PAN BOLT

(43) Install transmission oil pan (Fig. 132) with a bead of Mopar® ATF RTV. Torque oil pan-to-case bolts to 20 N·m (14.5 ft. lbs.).

NOTE: Before installing either speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

(44) Install both speed sensors into transmission case (Fig. 133). Torque the speed sensor bolts to 9

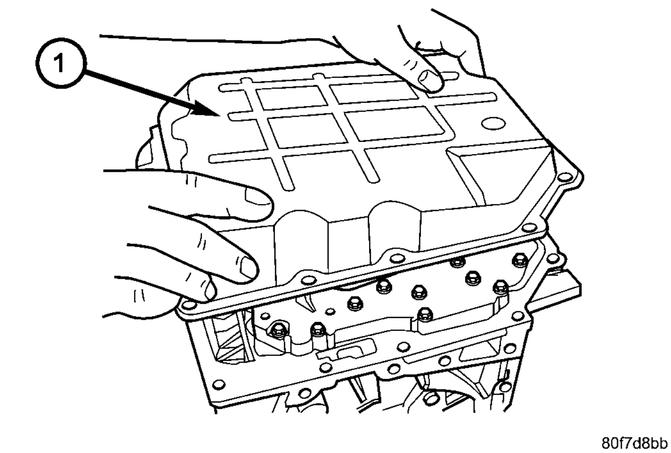


Fig. 132 Install Transmission Oil Pan

1 - TRANSMISSION OIL PAN

N·m (80 in. lbs.).

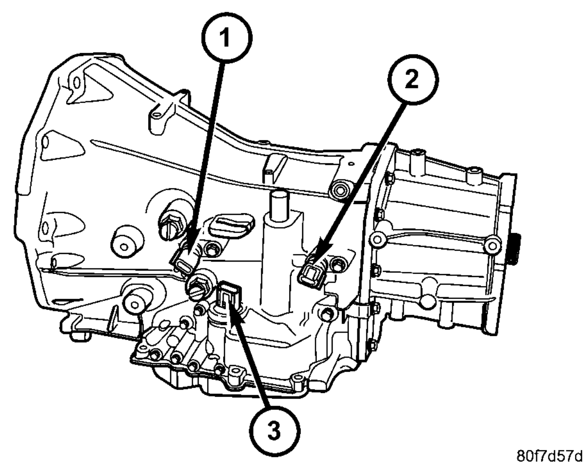


Fig. 133 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(45) As a final check of the transmission, measure the input shaft end play. This will indicate when a #4 thrust plate change is required. The #4 thrust plate is located behind the overdrive clutch hub. Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft (Fig. 134). Move input shaft in and out to obtain end play reading. **Input shaft end play must be 0.127 to 0.635 mm (0.005 to 0.025 inch).** If not within specifications, make the necessary thrust plate adjustment.

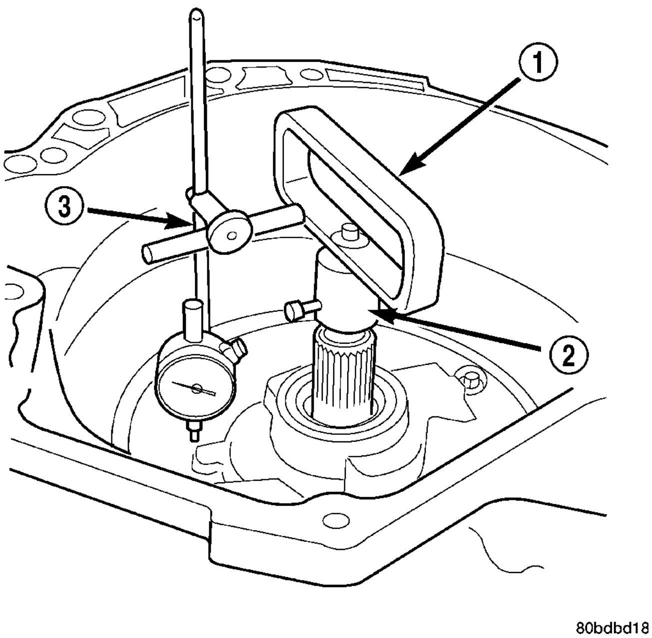


Fig. 134 Measure Input Shaft End Play Using Tool 8266 - Typical

1 - TOOL 8266-8
2 - TOOL 8266-2
3 - TOOL C-3339

(46) Inspect the lube tube grommet (Fig. 135) for damage. If the grommet lip is damaged, it will need to be replaced.

(47) Install the 4X4 stub shaft onto the transmission output shaft.

(48) Place a bead of Mopar® ATF RTV on the rear surface of the transmission case for the adapter housing.

(49) Install the adapter (Fig. 136) housing onto the transmission case.

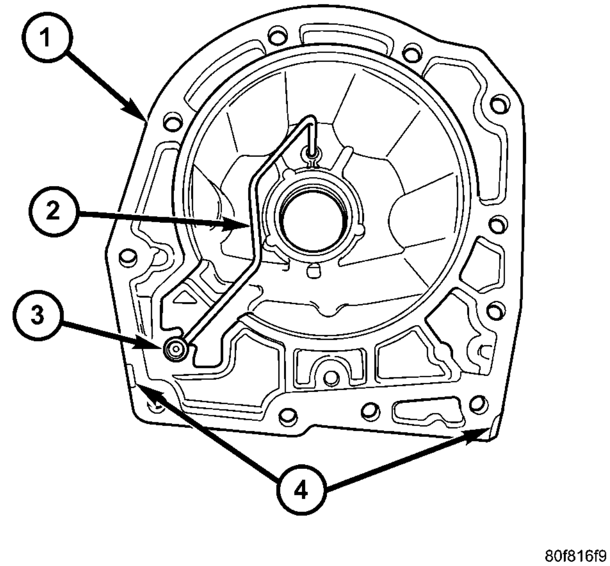


Fig. 135 Lube Tube Grommet

1 - HOUSING
2 - LUBE TUBE
3 - GROMMET
4 - PRY SLOTS

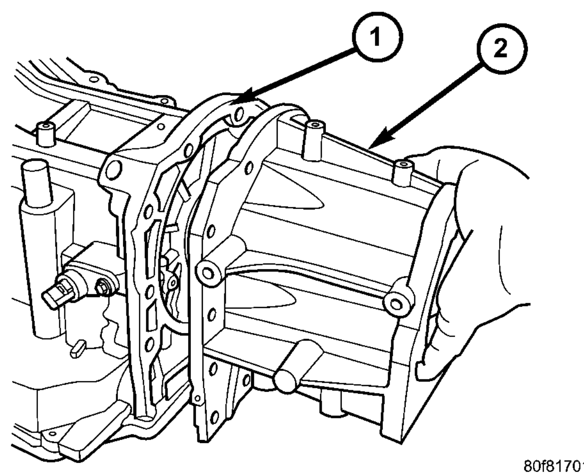


Fig. 136 Install Adapter Housing

1 - TRANSMISSION CASE
2 - ADAPTER HOUSING

AUTOMATIC TRANSMISSION - 42RLE (Continued)

NOTE: Before installing the lowermost four adapter housing bolts (Fig. 137), it will be necessary to replentish the sealing patch on the bolts using Mopar® Lock & Seal Adhesive.

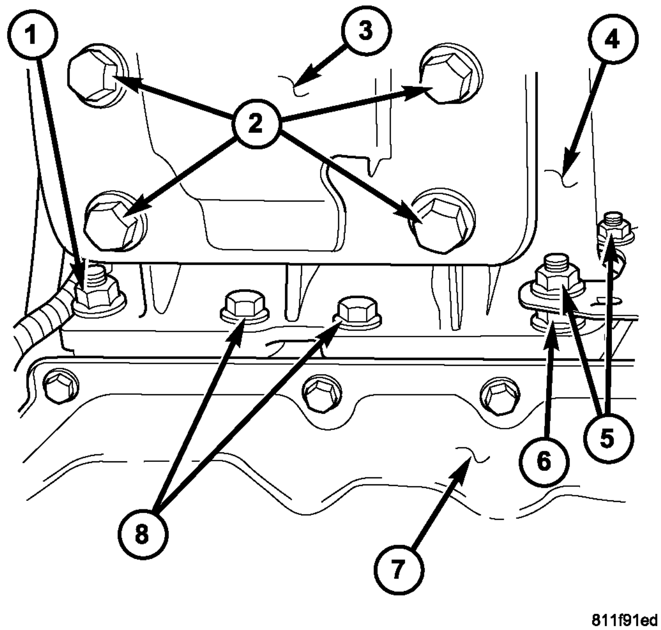


Fig. 137 Adapter Housing Fasteners

1 - STUD, ADAPTER/EXTENSION
2 - TRANSMISSION MOUNT FASTENERS (4)
3 - TRANSMISSION MOUNT
4 - TRANSMISSION CASE
5 - NUT, EXHAUST HANGER BRACKET (2)
6 - STUD, ADAPTER/EXTENSION
7 - TRANSMISSION OIL PAN
8 - BOLT, ADAPTER/EXTENSION (2)

(50) Install the bolts (Fig. 138) that hold the adapter housing onto the transmission case. Be sure to install any stud bolts to their original locations. Tighten the bolts to 54 N·m (40 ft.lbs.).

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) Lubricate converter drive hub and oil pump seal lip with transmission fluid.

(3) Align converter and oil pump.

(4) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(5) Check converter seating with steel scale and straightedge (Fig. 139). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(6) Temporarily secure converter with C-clamp.

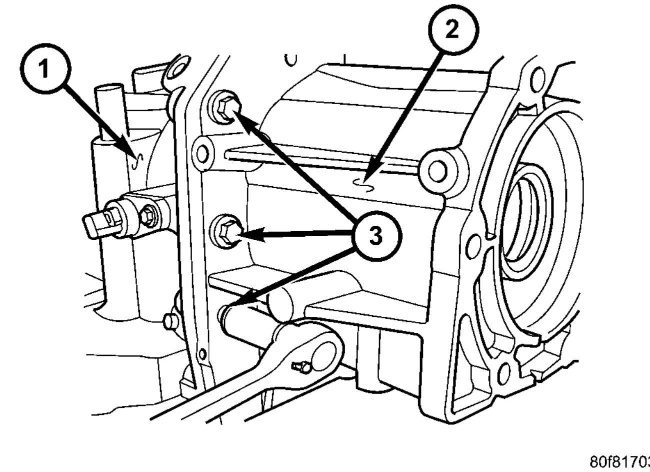


Fig. 138 Install Adapter Housing Bolts

1 - TRANSMISSION CASE
2 - ADAPTER HOUSING
3 - BOLTS

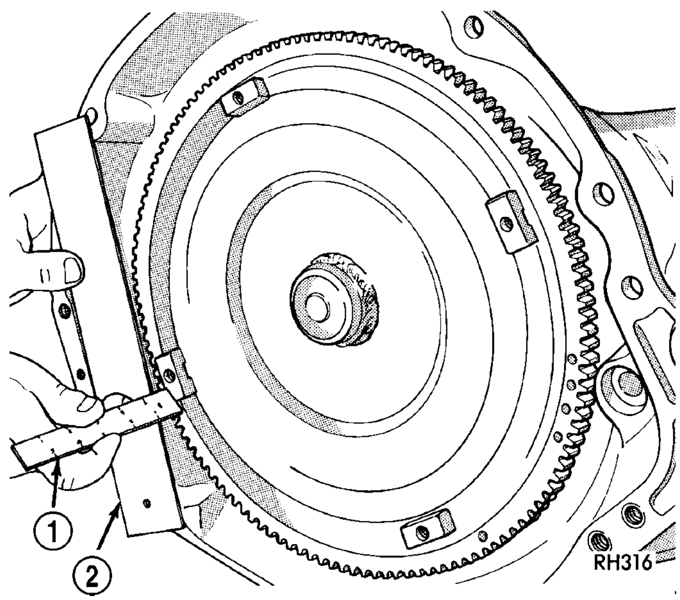


Fig. 139 Checking Converter Seating - Typical

1 - SCALE
2 - STRAIGHTEDGE

(7) Lightly grease crankshaft flange hole.

(8) Position transmission on jack and secure it with safety chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(10) Raise transmission and align converter with drive plate and converter housing with engine block.

(11) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(12) 22Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(13) Install and tighten bolts that attach transmission converter housing to engine block.

CAUTION: Be sure the converter housing is fully seated on the engine block dowels before tightening any bolts.

(14) Install torque converter attaching bolts. Tighten bolts to 88 N·m (65 ft. lbs.).

(15) On 4.0L engine equipped vehicles, install the crankshaft position sensor (Fig. 140).

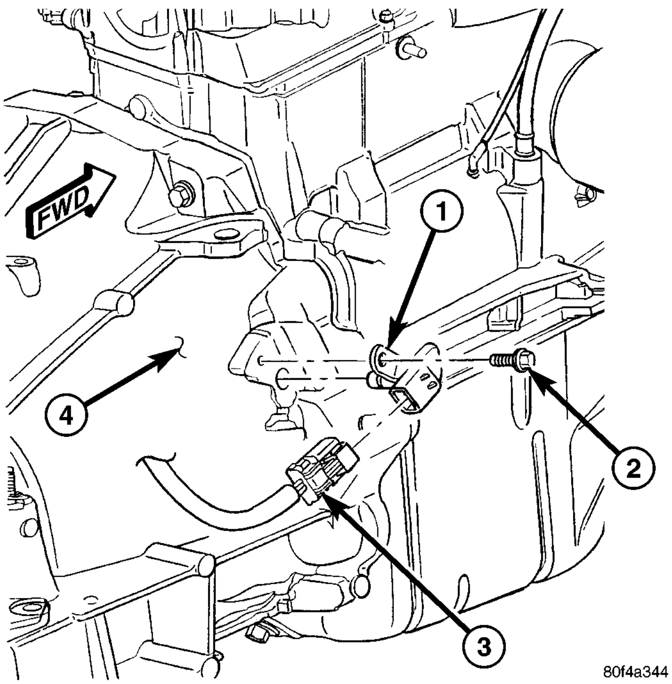


Fig. 140 Crankshaft Position Sensor

1 - CRANKSHAFT POSITION SENSOR
2 - MOUNTING BOLT
3 - ELECTRICAL CONNECTOR
4 - TRANSMISSION BELLHOUSING

(16) Install transmission fill tube and seal. Install new fill tube seal in transmission before installation.

(17) Connect transmission cooler lines to transmission.

(18) Install transfer case onto transmission. (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION)

(19) Install skid plate (Fig. 141) and attach transmission rear support to skid plate. (Refer to 13 - FRAME & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)

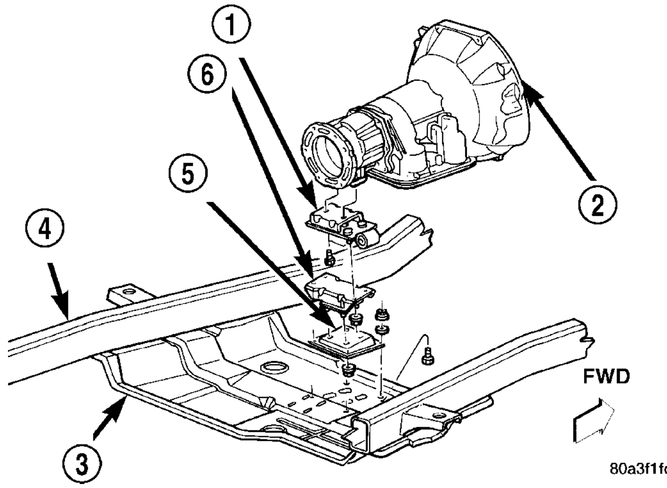


Fig. 141 Transmission Mount - Automatic Transmission

1 - TRANSMISSION SUPPORT BRACKET
2 - AUTOMATIC TRANSMISSION
3 - SKID PLATE
4 - FRAME
5 - TRANSMISSION MOUNT SUPPORT BRACKET
6 - CUSHION

(20) Remove engine support fixture.

(21) Remove transmission jack.

(22) Connect input and output speed sensor wires (Fig. 142).

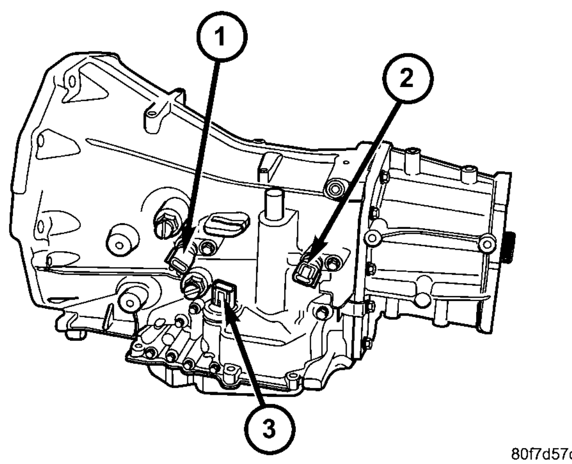


Fig. 142 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

AUTOMATIC TRANSMISSION - 42RLE (Continued)

(23) Connect wires to the transmission range sensor (Fig. 142) and the solenoid/pressure switch assembly (Fig. 143).

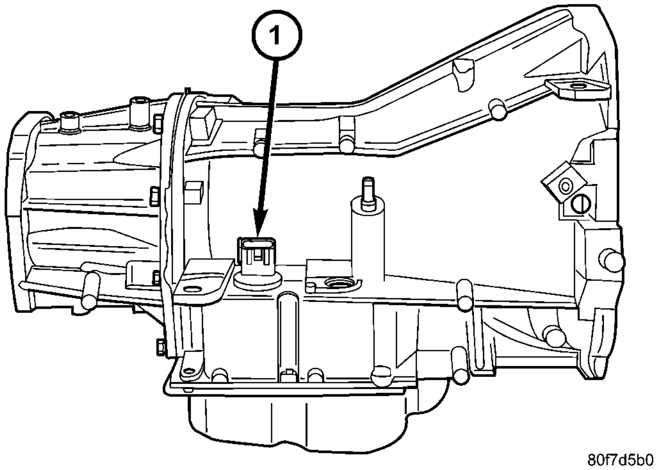


Fig. 143 Solenoid/Pressure Switch Assembly

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY CONNECTOR

(24) Install converter housing access cover.

(25) Install exhaust pipes and support brackets, if removed.

(26) Install starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION) and cooler line bracket.

(27) Install new plastic retainer grommet on any shift linkage rod or lever that was disconnected. Grommets should not be reused. Use pry tool to remove rod from grommet and cut away old grommet. Use pliers to snap new grommet into lever and to snap rod into grommet at assembly.

(28) Connect gearshift cable.

(29) Connect transfer case shift linkage.

(30) Adjust gearshift linkage, if necessary.

(31) Align and connect propeller shaft(s). (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

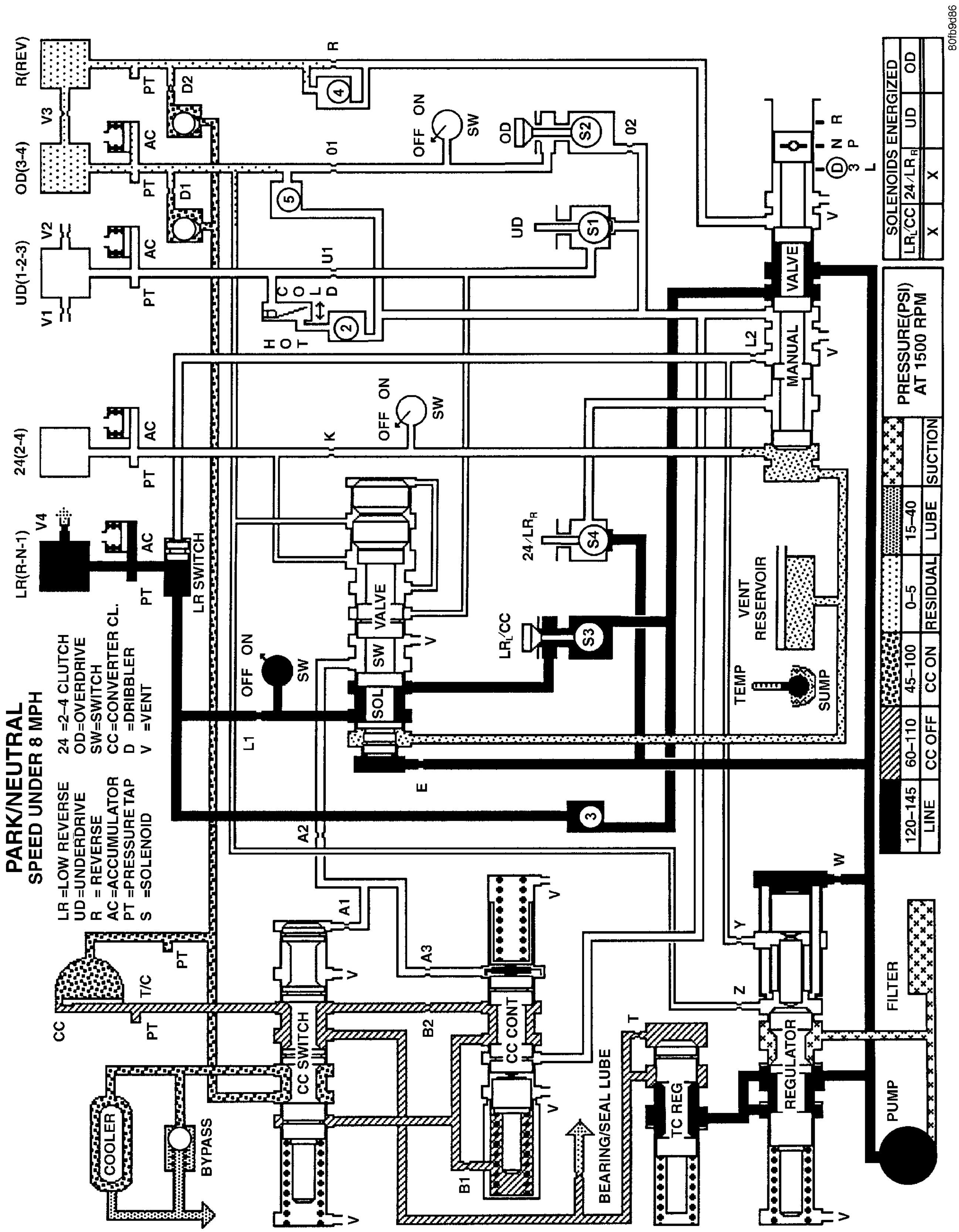
(32) Fill transfer case to bottom edge of fill plug hole.

(33) Lower vehicle and connect battery negative cable.

(34) Fill transmission to correct level with Mopar® ATF +4.

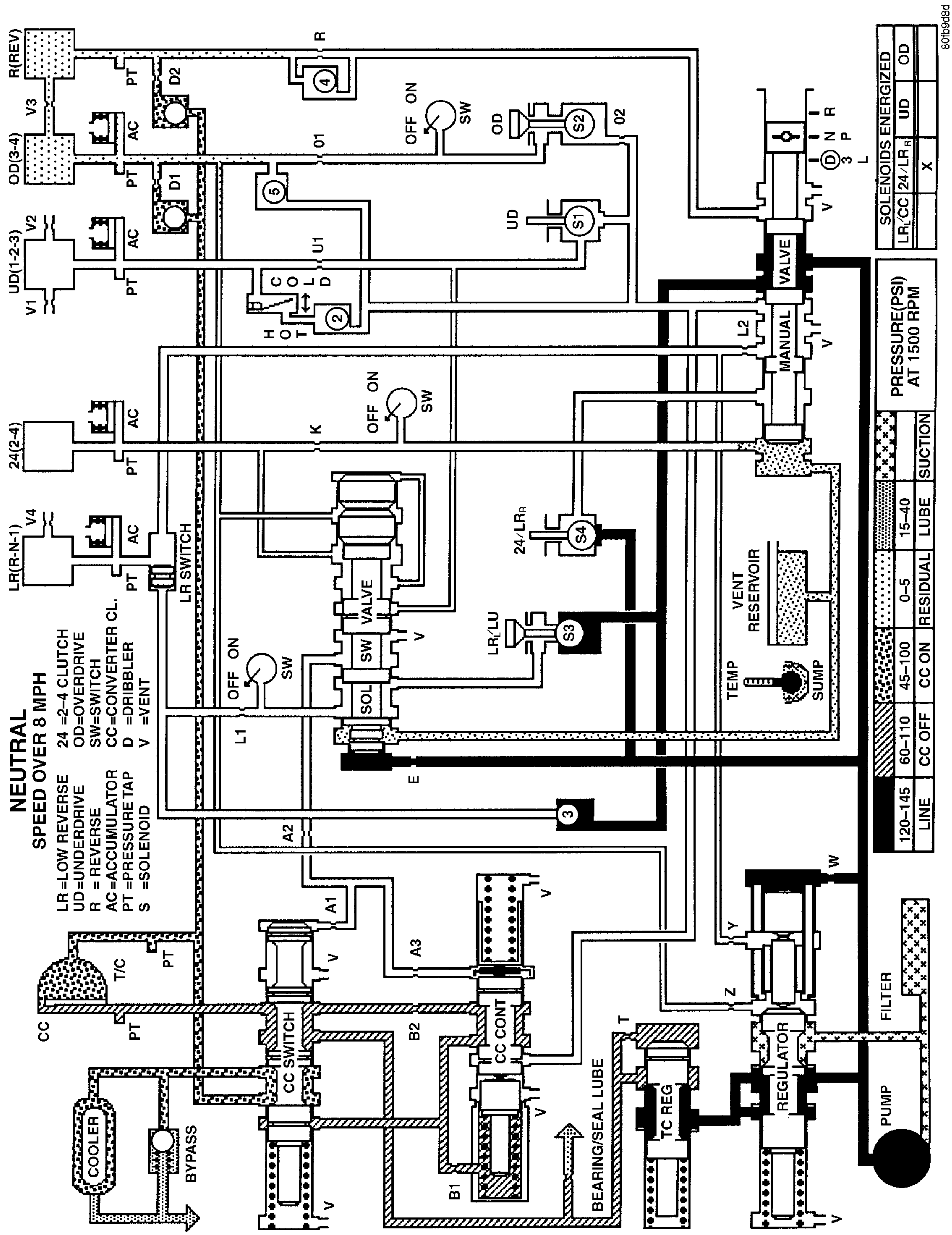
AUTOMATIC TRANSMISSION - 42RLE (Continued)

SCHEMATICS AND DIAGRAMS - 42RLE TRANSMISSION



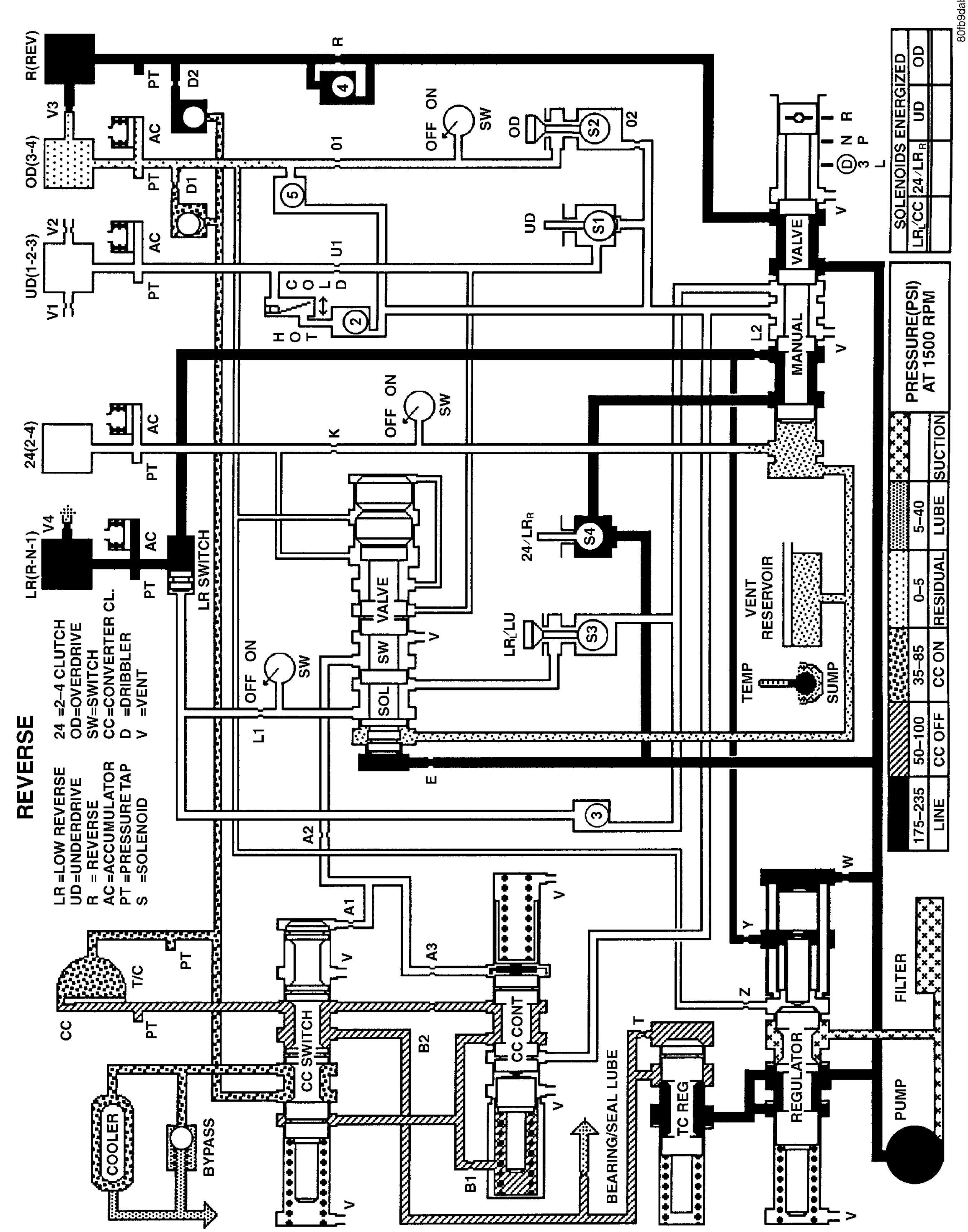
Park/Neutral (Speed Under 8 mph)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



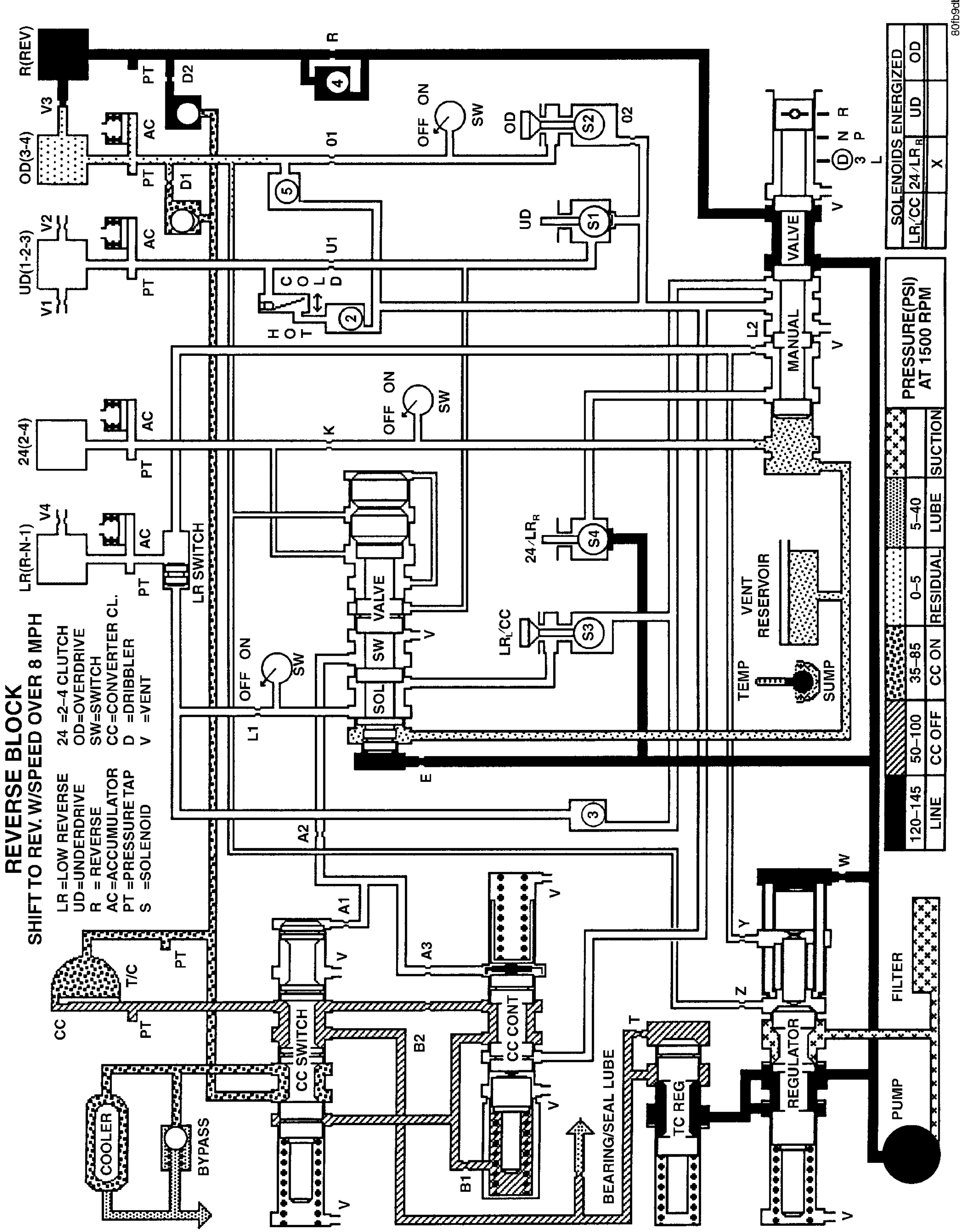
Neutral (Speed Over 8 mph)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



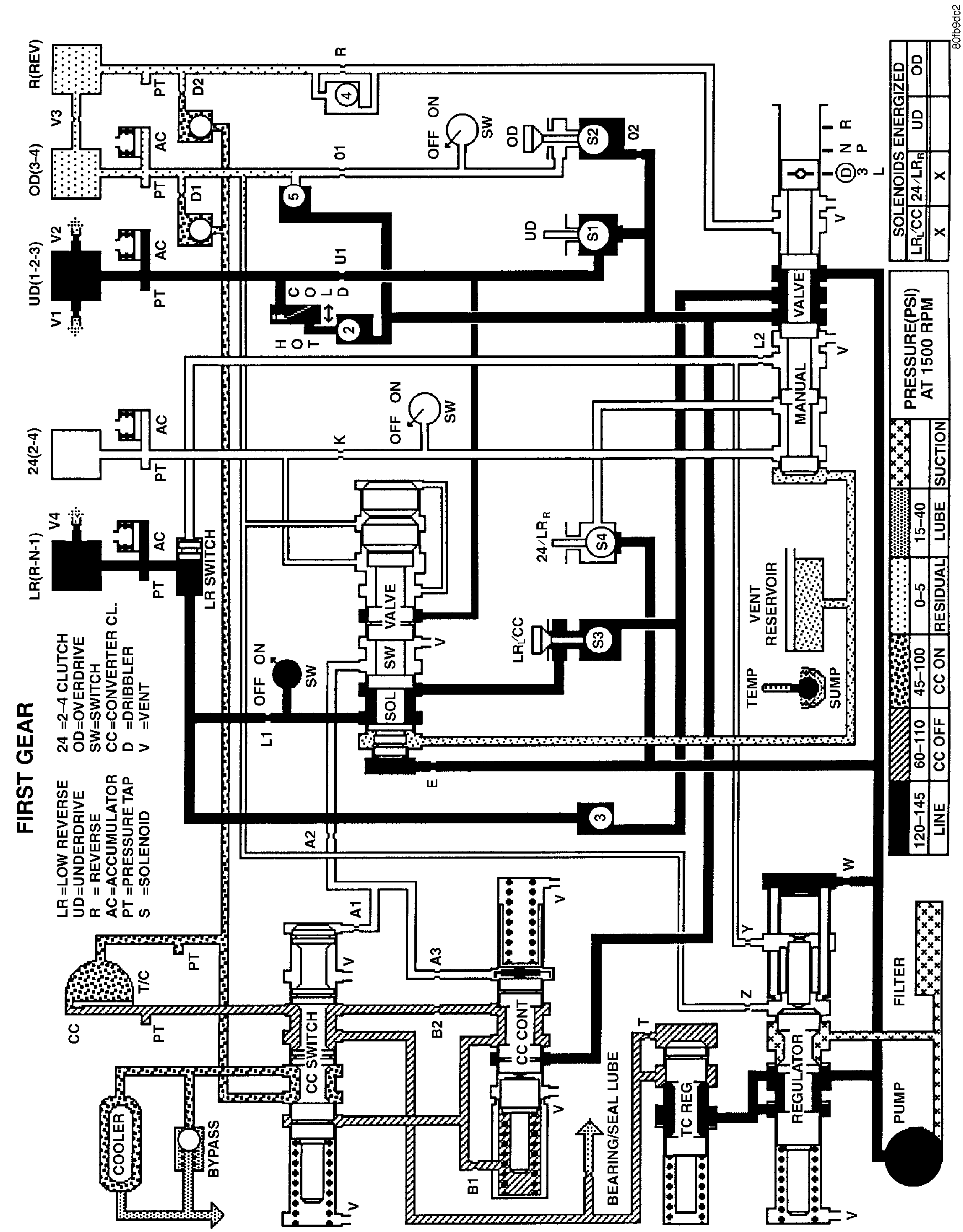
Reverse

AUTOMATIC TRANSMISSION - 42RLE (Continued)



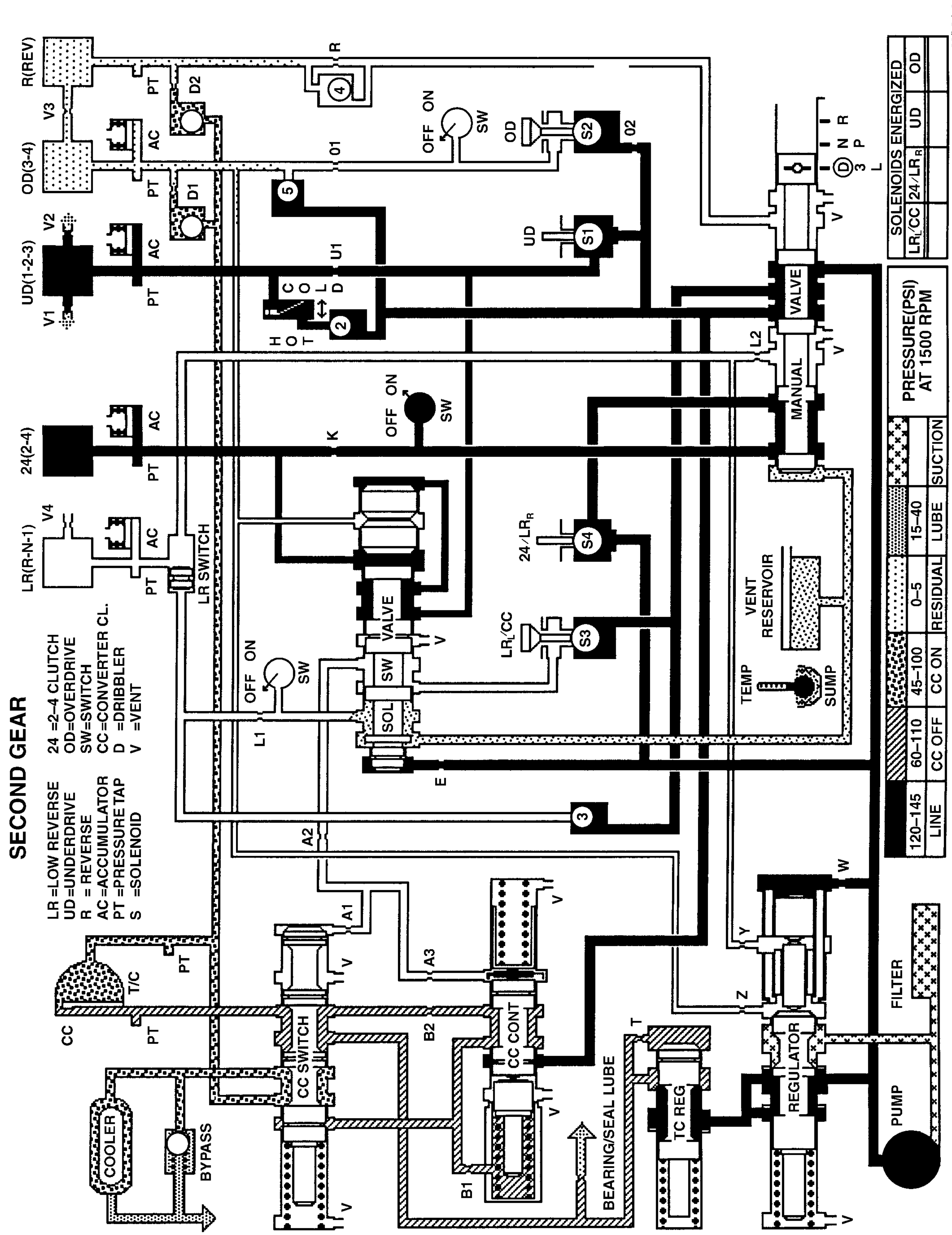
Reverse Block (Shift to Reverse w/Speed Over 8 mph)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



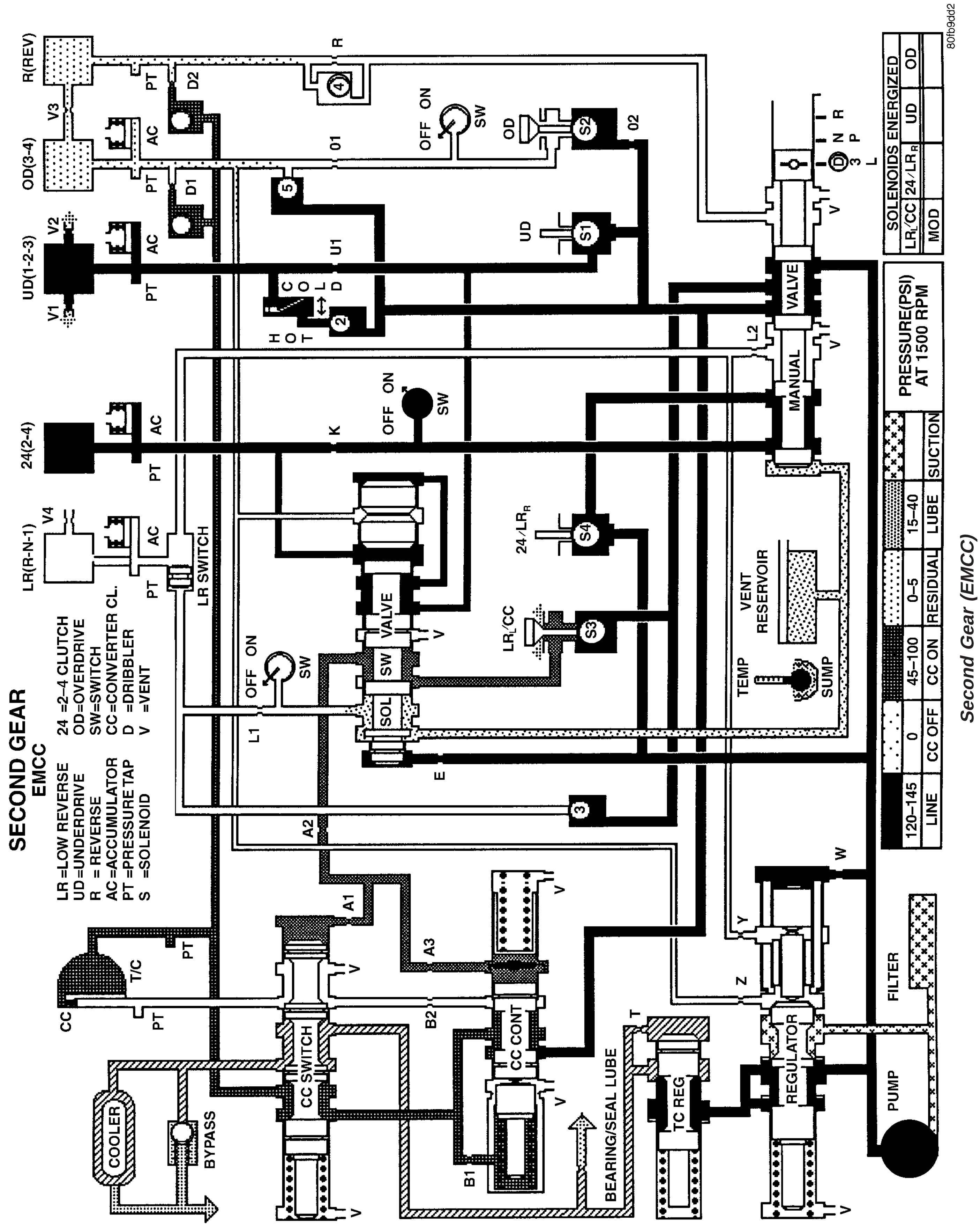
First Gear

AUTOMATIC TRANSMISSION - 42RLE (Continued)



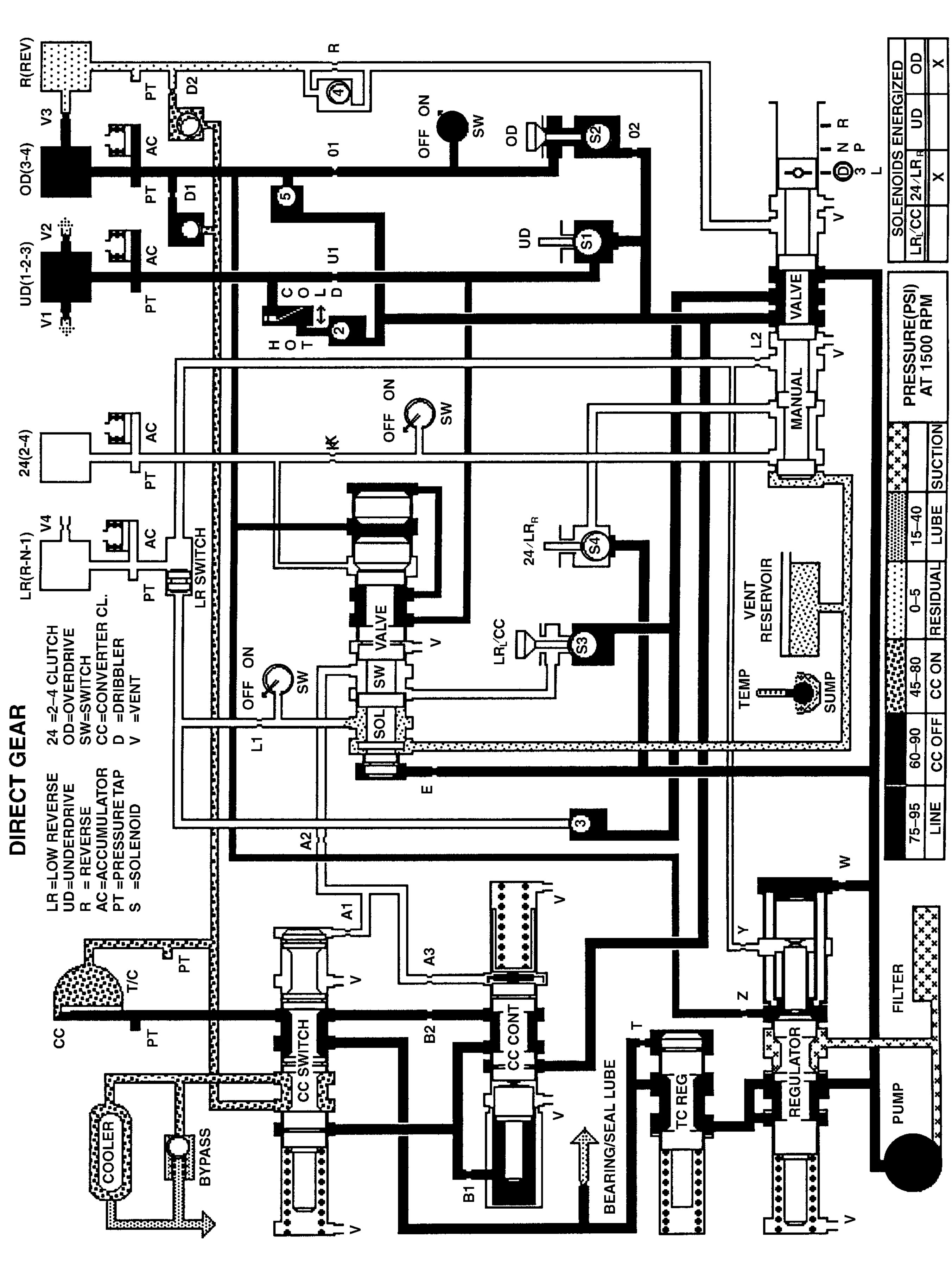
Second Gear

AUTOMATIC TRANSMISSION - 42RLE (Continued)



Second Gear (EMCC)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



Direct Gear

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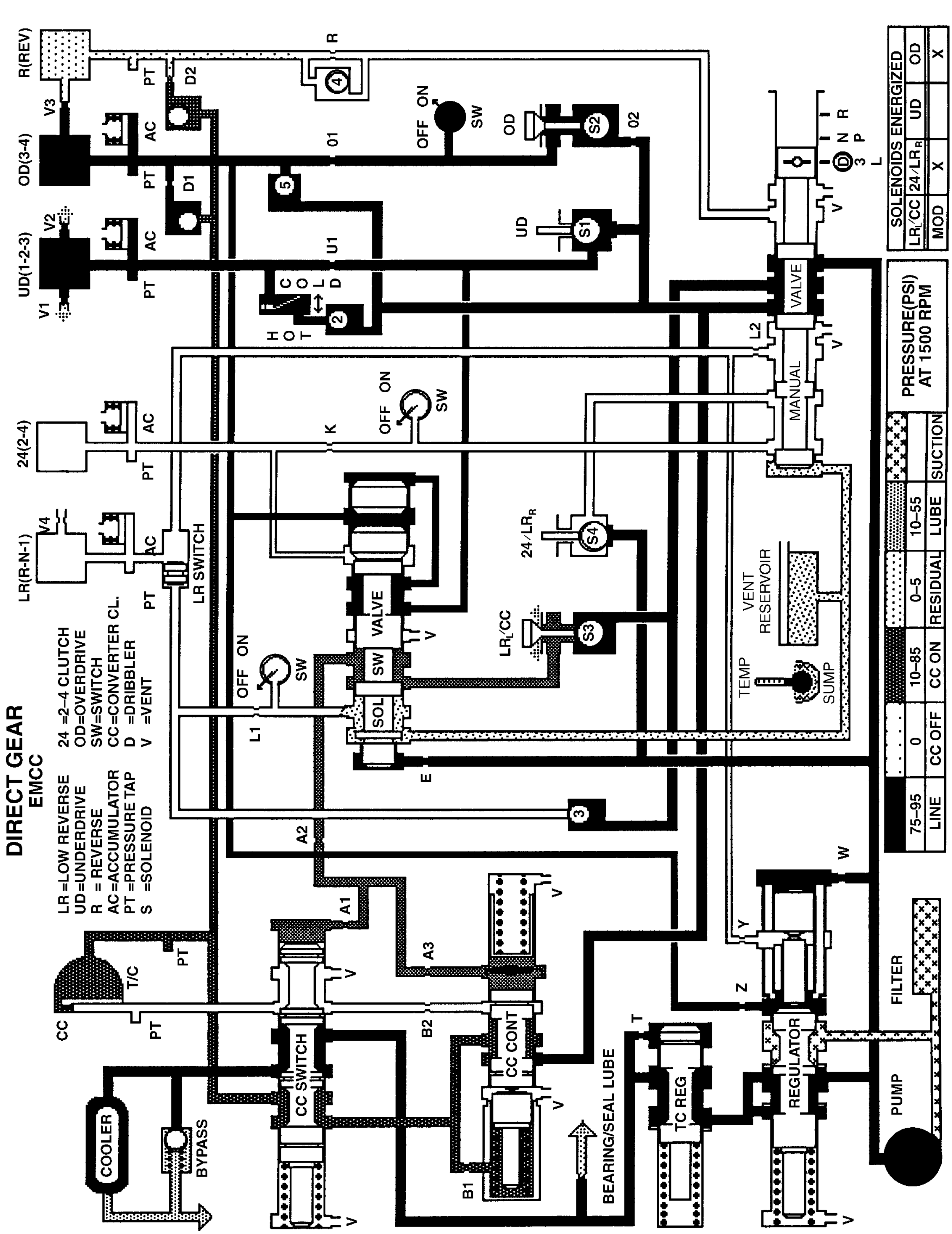

Direct Gear (EMCC)

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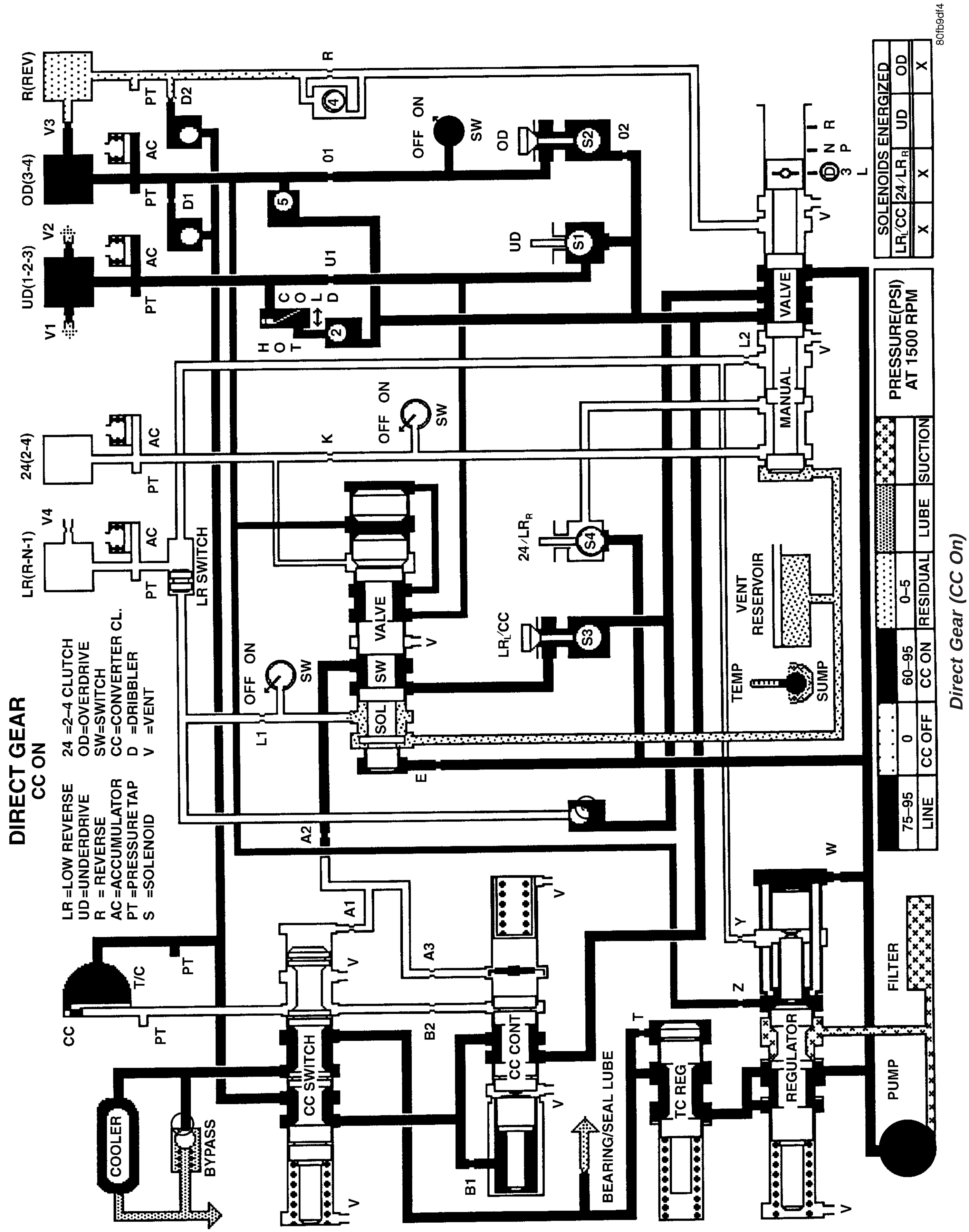
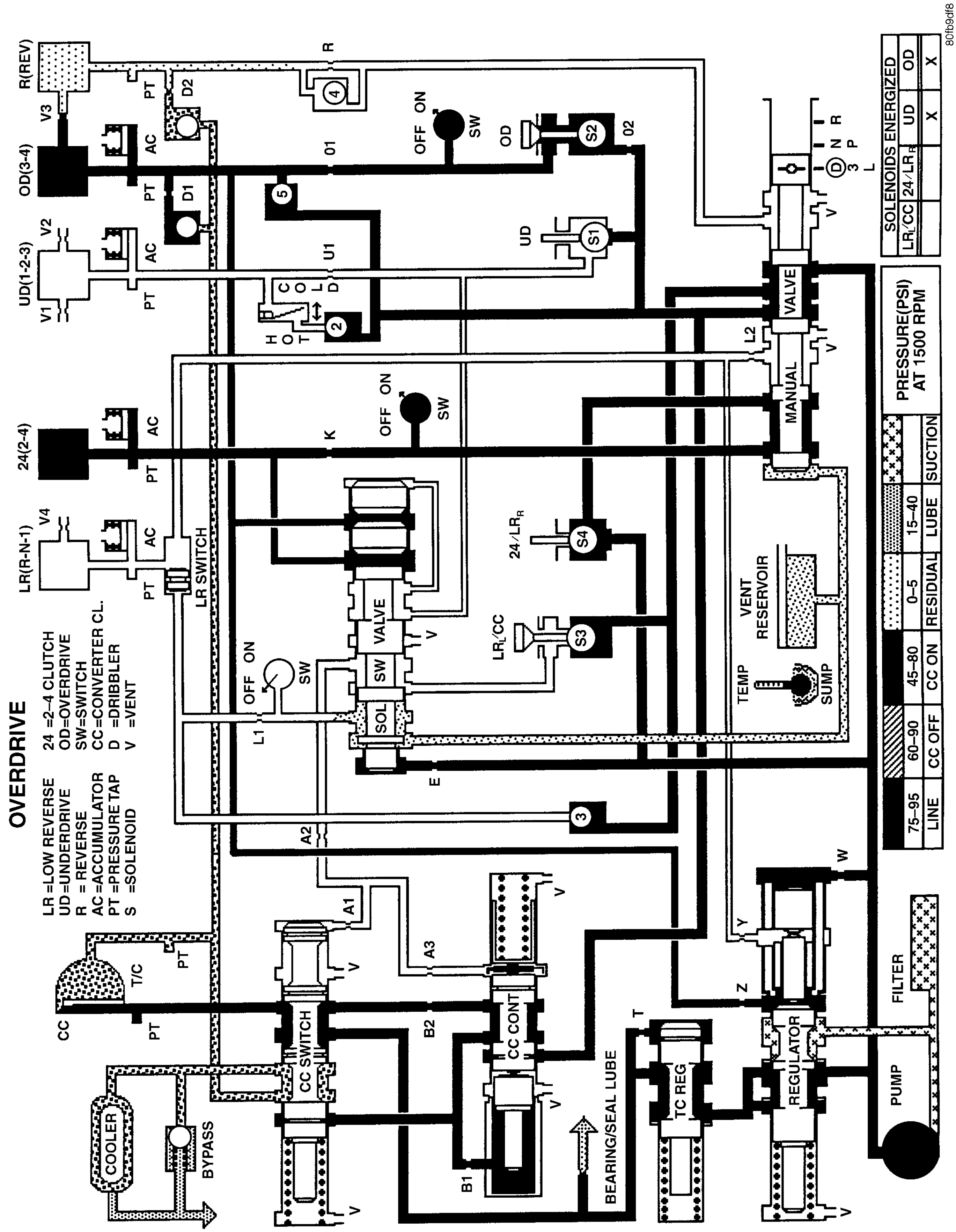


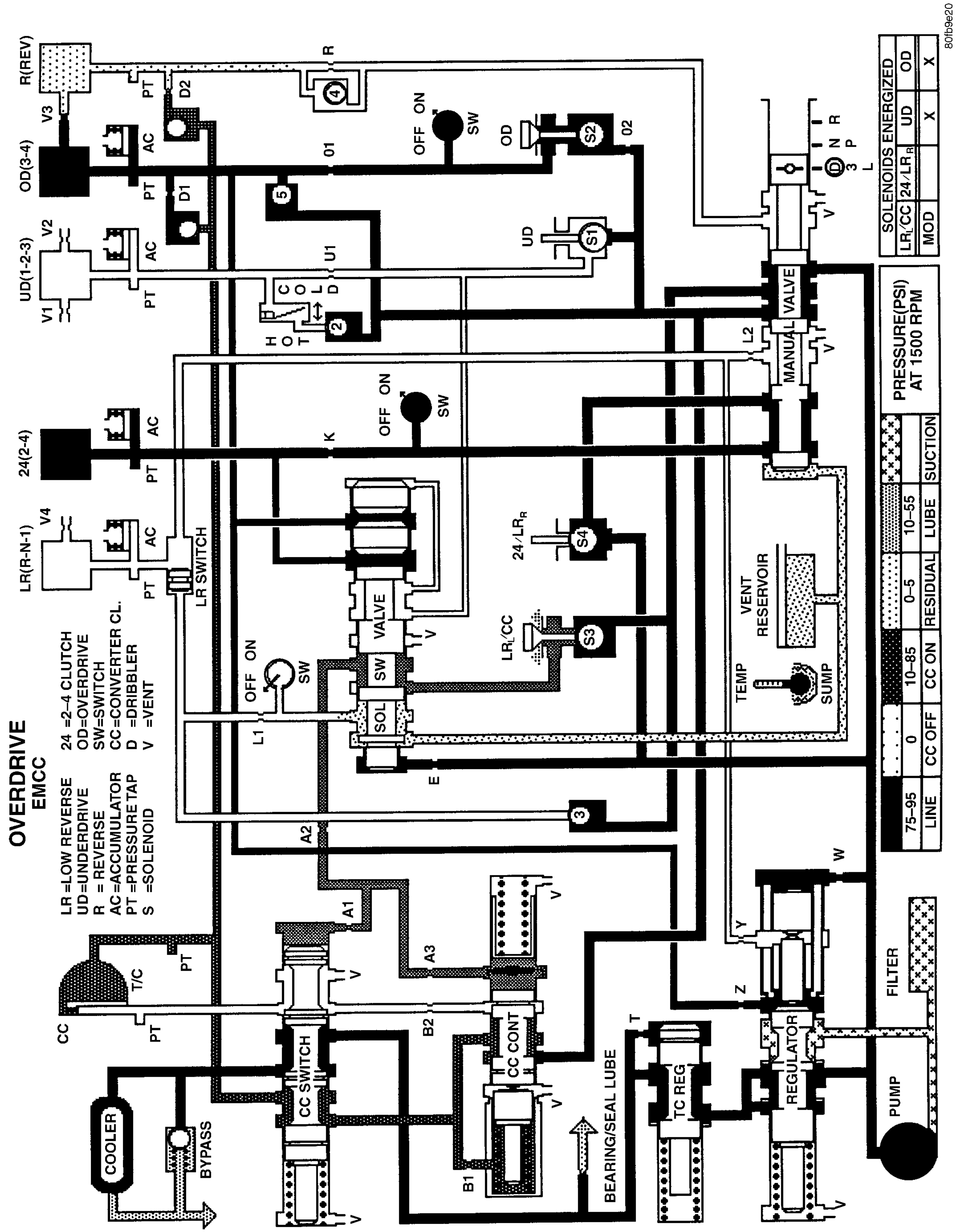
Direct Gear (CC On)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



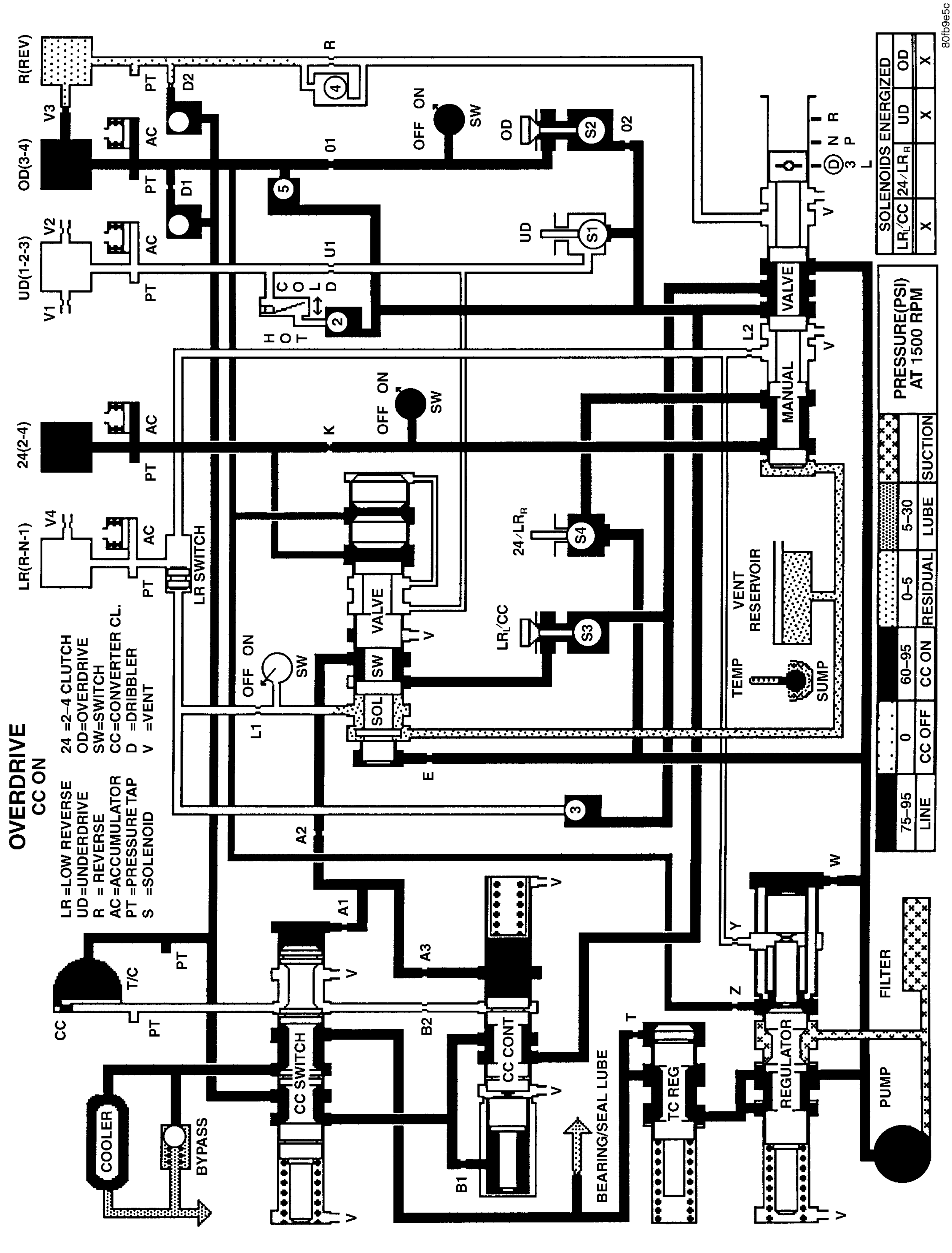
Overdrive

AUTOMATIC TRANSMISSION - 42RLE (Continued)



Overdrive (EMCC)

AUTOMATIC TRANSMISSION - 42RLE (Continued)



Overdrive (CC On)

AUTOMATIC TRANSMISSION - 42RLE (Continued)

SPECIFICATIONS

42RLE AUTOMATIC TRANSMISSION

GENERAL SPECIFICATIONS

Transmission Type	Four-Speed Automatic, Electronically Controlled, Fully Adaptive, Electronically Modulated Torque Converter
Lubrication Method	Pump (internal - external gear-type)
Cooling Method	Water Heat Exchanger and/or Air-to-Oil Heat Exchanger

GEAR RATIOS

1st Gear	2.84:1
2nd Gear	1.57:1
3rd Gear (Direct)	1.00:1
4th Gear (Overdrive)	0.69:1
Reverse Gear	2.21:1

BEARING PRELOAD (DRAG TORQUE)

Description	Metric	Standard
Output Shaft	0.22-0.903 N·m	1-8 in. lbs.

CLUTCH PACK

Description	Metric	Standard
Low/Reverse Clutch (Select Reaction Plate)	0.84-1.60 mm	0.033-0.063 in.
Two/Four Clutch (No Select)	0.76-2.64 mm	0.030-0.104 in.
Reverse Clutch (Select Snap Ring)	0.89-1.37 mm	0.035-0.054 in.
Overdrive Clutch (No Select)	1.07-3.25 mm	0.042-0.128 in.
Underdrive Clutch (Select Reaction Plate)	0.94-1.50 mm	0.037-0.059 in.

INPUT SHAFT

Description	Metric	Standard
End Play	0.127-0.635 mm	0.005-0.025 in.

AUTOMATIC TRANSMISSION - 42RLE (Continued)

OIL PUMP CLEARANCES

DESCRIPTION	METRIC	STANDARD
Outer Gear-to-Crescent	0.060-0.298 mm	0.0023-0.0117 in.
Inner Gear-to-Crescent	0.093-0.385 mm	0.0036-0.0151 in.
Outer Gear-to-Pocket	0.089-0.202 mm	0.0035-0.0079 in.
Outer Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.
Inner Gear Side Clearance	0.020-0.046 mm	0.0008-0.0018 in.

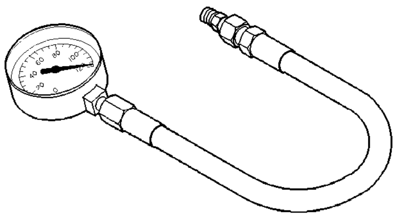
TORQUE SPECIFICATIONS

Description	N·m	Ft. Lbs.	In. Lbs.
Bolt, Converter-to-Driveplate	88	65	-
Bolt, Fluid Filter-to-Valve Body	5	-	45
Bolt, L/R Clutch Retainer-to-Case	5	-	45
Bolt, Adapter/Extension Housing	54	40	-
Bolt, Manual Valve Lever-to-Manual Valve	5	-	45
Bolt, Oil Pan-to-Case	20	14.5	-
Bolt, Oil Pump-to-Case	30	-	265
Bolt, Park Sprag Retainer	4.5	-	40
Bolt, Reaction Shaft Support Halves	28	-	250
Bolt, Solenoid/Pressure Switch Assy-to-Valve Body	5.5	-	50
Bolt, Valve Body-to-Case	12	-	105
Bolt, Valve Body-to-Transfer Plate	5	-	45
Fitting, Cooler Line	47.5	35	-
Nut, Output Shaft	271	200	-
Plug, Pressure Tap	5	-	45
Bolt, Input Speed-to-Case Sensor	9	-	80
Bolt, Output Speed-to-Case Sensor	9	-	80

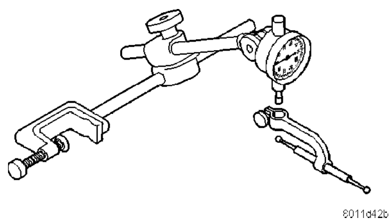
AUTOMATIC TRANSMISSION - 42RLE (Continued)

SPECIAL TOOLS

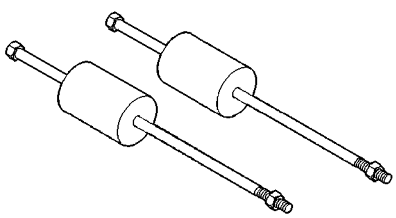
42RLE AUTOMATIC TRANSMISSION



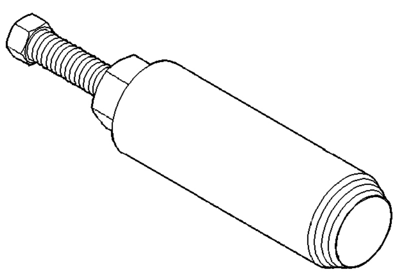
Pressure Gauge (High) C-3293SP



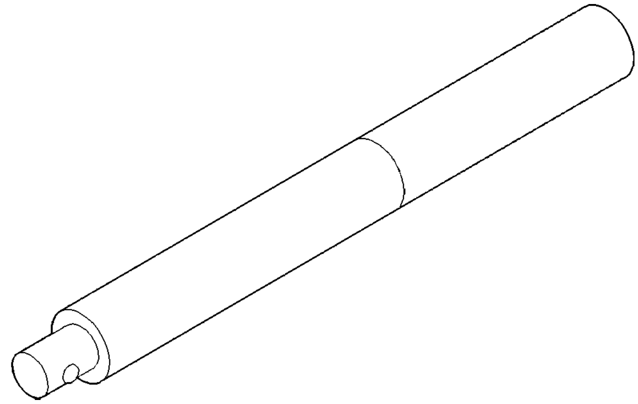
Dial Indicator C-3339



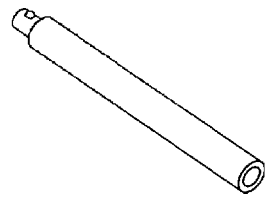
Slide Hammer C-3752



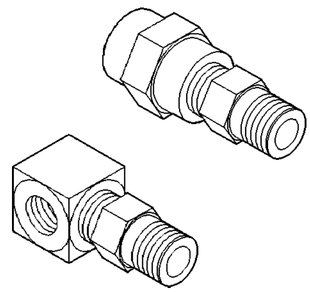
Seal Puller C-3981B



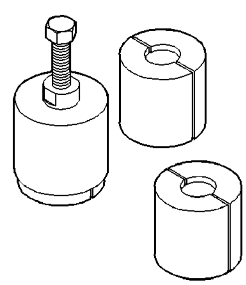
Universal Handle C-4171



Handle Extension C-4171-2

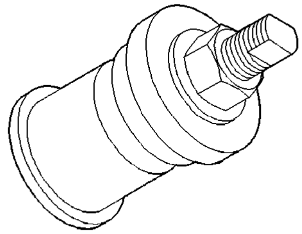


Adapter Set L-4559

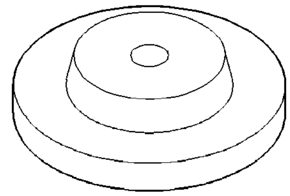


Puller Set 5048

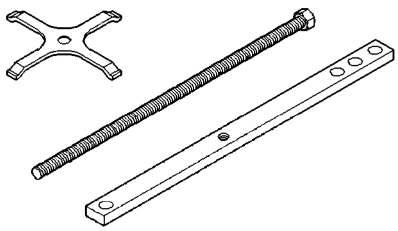
AUTOMATIC TRANSMISSION - 42RLE (Continued)



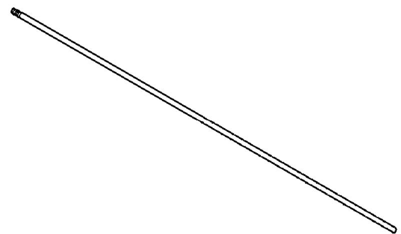
Installer 5050A



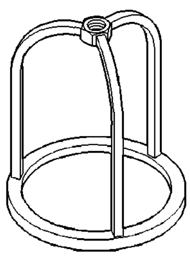
Disk 6057



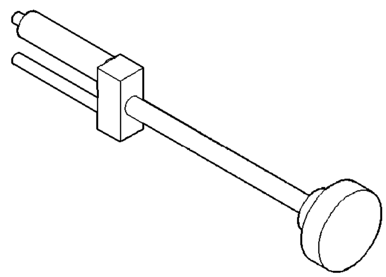
Compressor 5058A



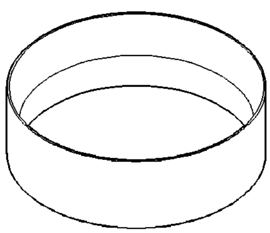
Tip 6268



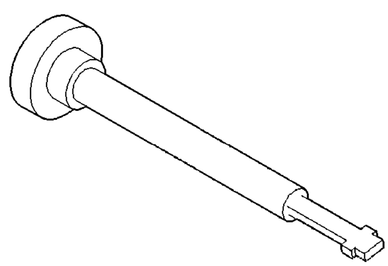
Compressor 5059-A



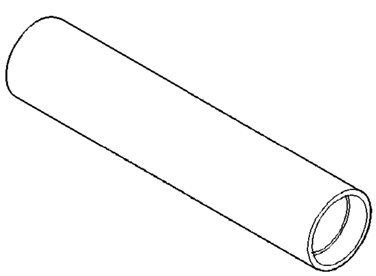
Remover/Installer 6301



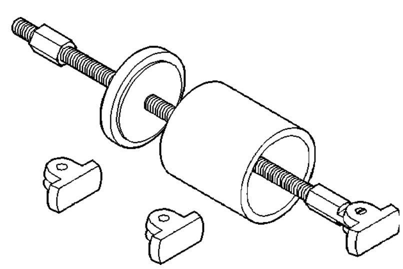
Installer 5067



Remover/Installer 6302

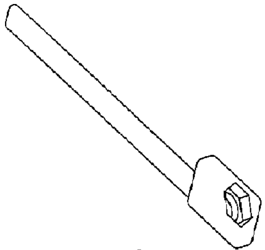


Installer 6052

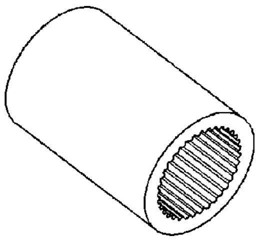


Remover 6310

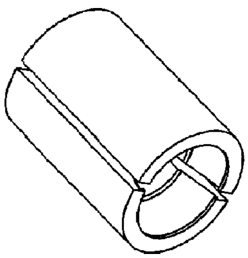
AUTOMATIC TRANSMISSION - 42RLE (Continued)



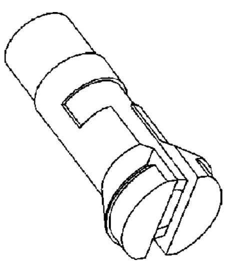
Wrench 6497



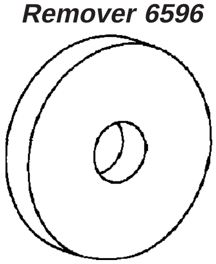
Wrench 6498-A



Puller Jaws 6545



Remover 6596



Remover 6597

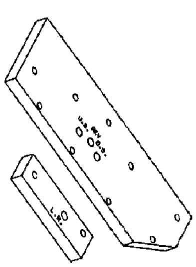
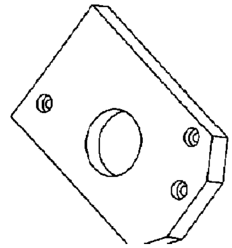
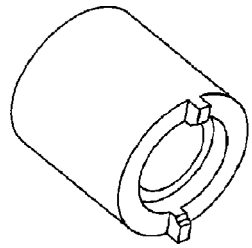


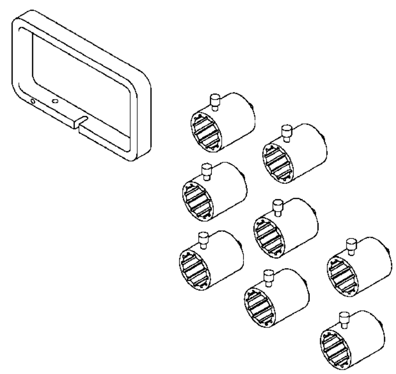
Plate Set 6599



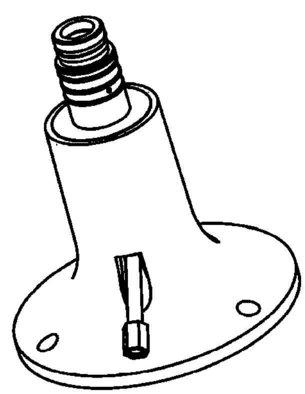
Support Plate 6618A



Staking Tool 6639



End Play Set 8266



Pressure Fixture 8391

AUTOMATIC TRANSMISSION - 42RLE (Continued)

ACCUMULATOR

DESCRIPTION

The 42RLE underdrive, overdrive, low/reverse, and 2/4 clutch hydraulic circuits each contain an accumulator. An accumulator typically consists of a piston, return spring(s), and a cover or plug. The overdrive and underdrive accumulators are located within the transmission case, and are retained by the valve body (Fig. 144).

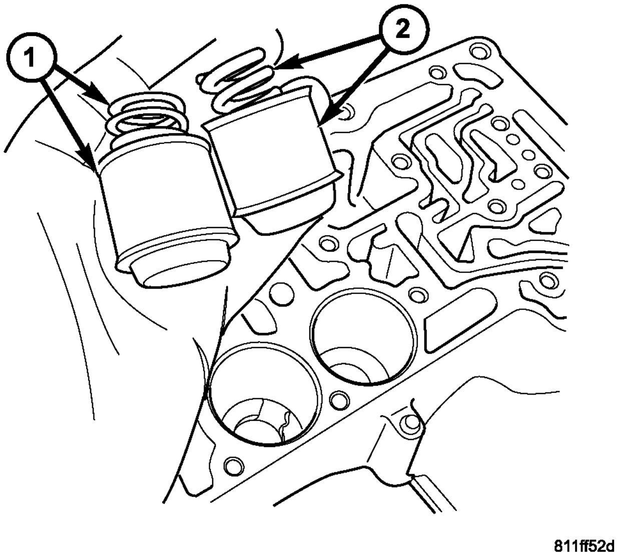


Fig. 144 Underdrive and Overdrive Accumulators

1 - OVERDRIVE PISTON AND SPRING
2 - UNDERDRIVE PISTON AND SPRING

The low reverse accumulator (Fig. 145) is also located within the transmission case, but the assembly is retained by a cover and a snap-ring.

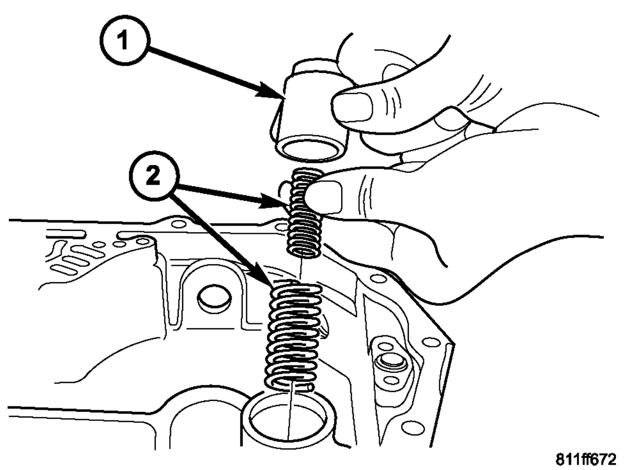


Fig. 145 Low/Reverse Accumulator

1 - PISTON
2 - RETURN SPRINGS

The 2/4 accumulator is located in the valve body. It is retained by a cover and retaining screws (Fig. 146).

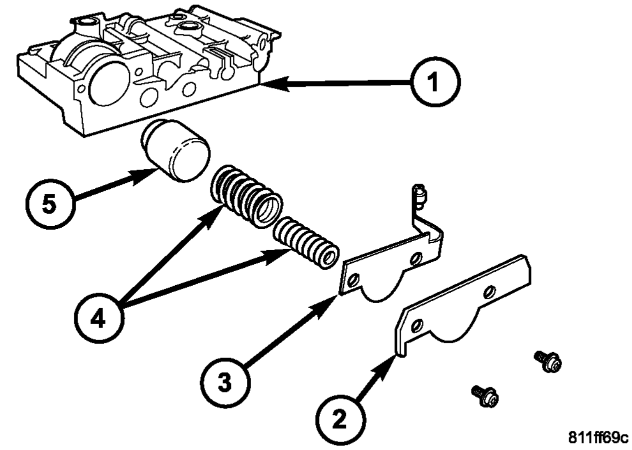


Fig. 146 2/4 Accumulator Assembly

1 - VALVE BODY
2 - RETAINER PLATE
3 - DETENT SPRING
4 - RETURN SPRINGS
5 - PISTON

OPERATION

The function of an accumulator is to cushion the application of a frictional clutch element. When pressurized fluid is applied to a clutch circuit, the application force is dampened by fluid collecting in the respective accumulator chamber against the piston and springs. The intended result is a smooth, firm clutch application.

ADAPTER HOUSING SEAL

REMOVAL

(1) Remove the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - REMOVAL).

(2) Using a screw mounted in a slide hammer, remove the adapter housing seal.

INSTALLATION

(1) Install a new adapter housing seal with Tool Handle C-4171 and Installer C-3860-A.

(2) Install the transfer case (Refer to 21 - TRANSMISSION/TRANSFER CASE - INSTALLATION).

BEARINGS

ADJUSTMENTS

BEARING ADJUSTMENT PROCEDURES

Take extreme care when removing and installing bearing cups and cones. **Use only an arbor press for installation,** as a hammer may not properly align the bearing cup or cone. Burrs or nicks on the bearing seat will give a false end play reading, while gauging for proper shims. Improperly seated bearing cup and cones are subject to low-mileage failure.

Bearing cups and cones should be replaced if they show signs of pitting or heat distress.

If distress is seen on either the cup or bearing rollers, both cup and cone must be replaced.

NOTE: Bearing drag torque specifications must be maintained to avoid premature bearing failures.

Used (original) bearing may lose up to 50 percent of the original drag torque after break-in.

NOTE: All bearing adjustments must be made with no other component interference or gear intermesh.

Oil all bearings before checking turning torque.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

DESCRIPTION

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 147).

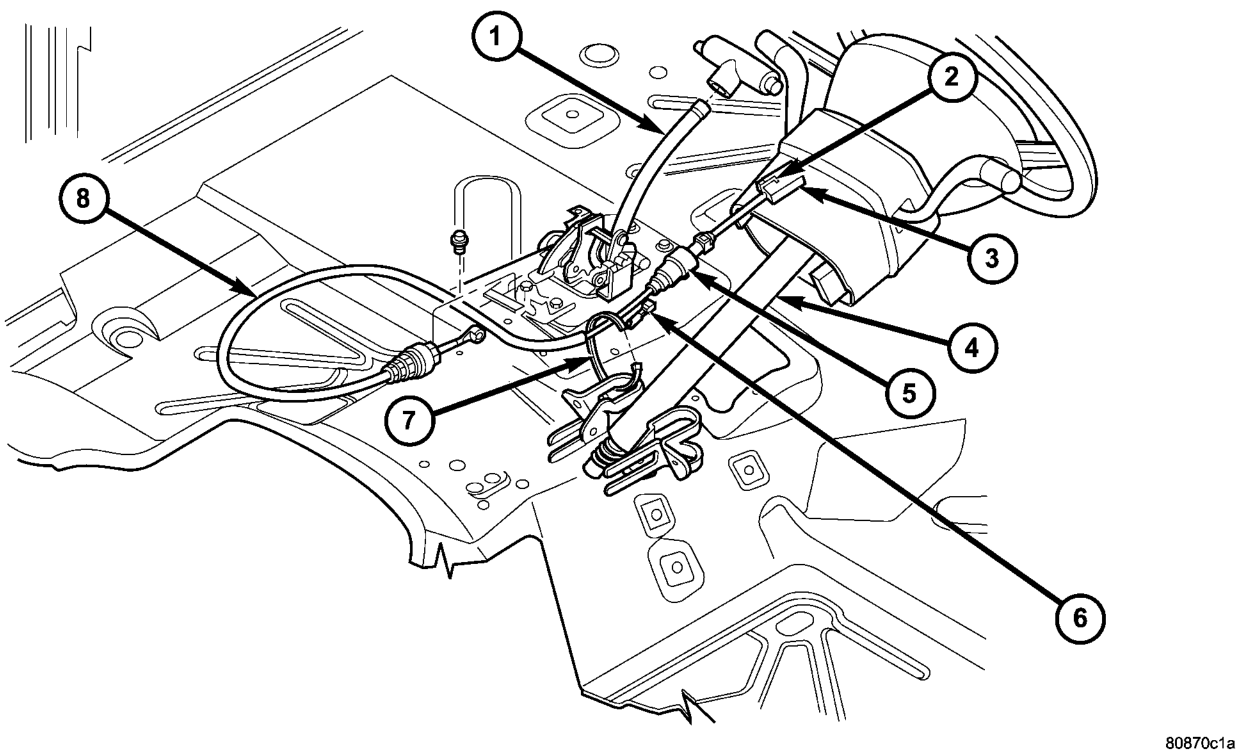


Fig. 147 Ignition Interlock Cable Routing

1 - SHIFT MECHANISM
2 - LOCK-TAB
3 - IGNITION LOCK INTERLOCK
4 - STEERING COLUMN
5 - SOLENOID
6 - WIRE CONNECTOR
7 - TIE STRAP
8 - PARK/BRAKE INTERLOCK CABLE

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

OPERATION

The system locks the shifter into the PARK position. The Interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A magnetic holding device in line with the park/brake interlock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position (Fig. 148) unless the shifter is fully locked into the PARK position.

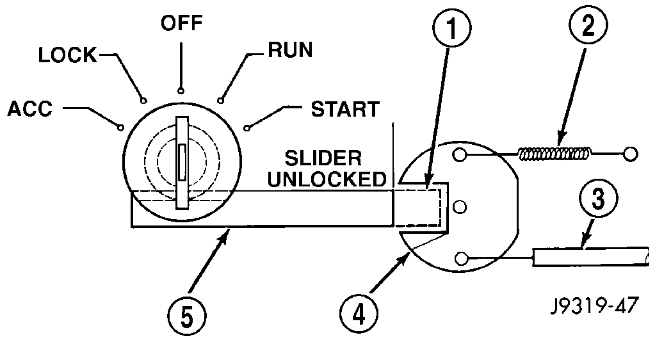


Fig. 148 Ignition Key Cylinder Actuation

1 - SLIDER LOCKED
2 - CAM RETURN SPRING
3 - INTERLOCK CABLE
4 - CAM
5 - SLIDER

REMOVAL

(1) Remove lower steering column cover. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL)

(2) Remove lower steering column shroud.

(3) Remove tie strap near the solenoid retaining the brake transmission interlock cable to the steering column.

(4) Disengage wire connector from solenoid.

(5) With the ignition removed or in the unlocked position, disengage lock tab holding cable end to steering column (Fig. 149).

(6) Pull cable end from steering column.

(7) Remove the floor console and related trim. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(8) Disconnect the cable from the bellcrank (Fig. 150).

(9) Disconnect and remove the cable from the shift bracket.

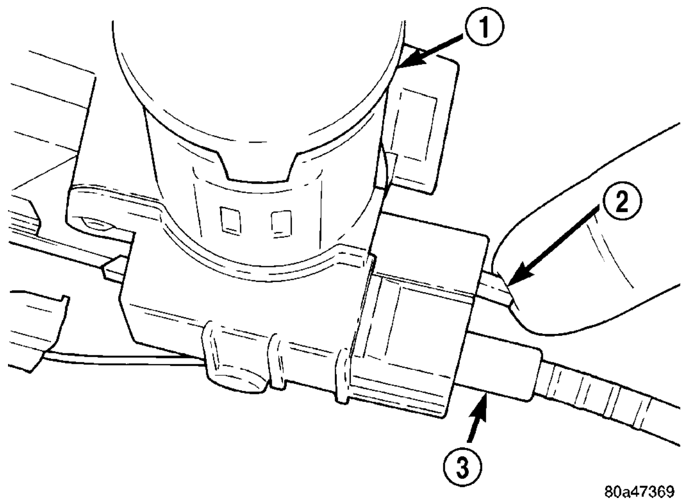


Fig. 149 Brake/Park Interlock Cable

1 - IGNITION LOCK
2 - LOCK TAB
3 - CABLE END

INSTALLATION

(1) Route replacement cable behind instrument panel and under floor console area to shift mechanism.

(2) Insert cable end into opening in steering column hub under ignition lock. Push cable inward until lock tab engages.

(3) Insert the cable end into the shifter bellcrank.

(4) Place gear selector in PARK.

(5) Push the spring-loaded cable adjuster forward and snap cable into bracket.

(6) Adjust the brake transmission shifter interlock cable.

(7) Verify that the cable adjuster lock clamp is pushed downward to the locked position.

(8) Test the park-lock cable operation.

(9) Install the floor console and related trim.

(10) Install tie strap to hold cable to base of steering column.

(11) Install lower steering column shroud and ignition lock.

(12) Install lower steering column cover.

ADJUSTMENTS

ADJUSTMENT - BRAKE TRANSMISSION SHIFT INTERLOCK CABLE

(1) Shift transmission into PARK.

(2) Remove shift lever bezel and console screws. Raise bezel and console for access to cable.

(3) Pull cable lock button up to release cable.

(4) Turn ignition switch to LOCK position.

(5) Use a spacer to create a one millimeter gap between the shifter pawl and top of the shift gate.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM (Continued)

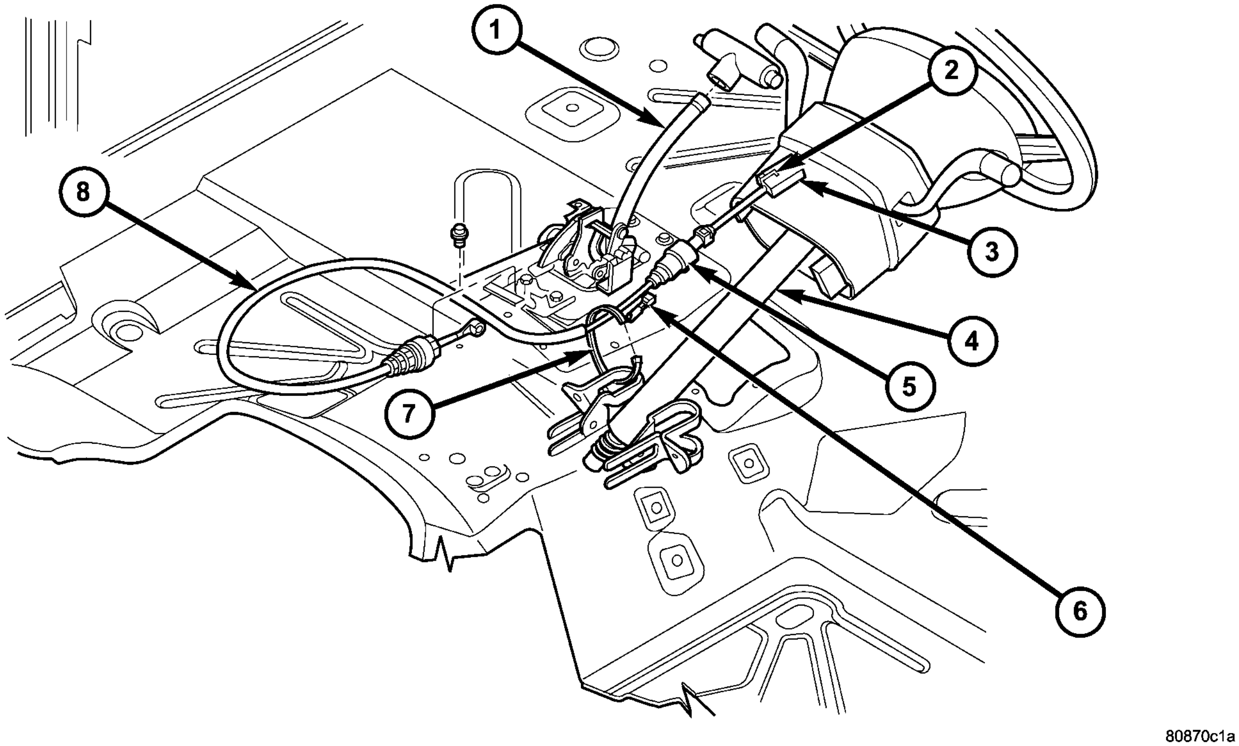


Fig. 150 Cable and Shifter

1 - SHIFT MECHANISM
2 - LOCK-TAB
3 - IGNITION LOCK INTERLOCK
4 - STEERING COLUMN
5 - SOLENOID
6 - WIRE CONNECTOR
7 - TIE STRAP
8 - PARK/BRAKE INTERLOCK CABLE

(6) Pull the cable forward and release.Ensure the cable end is seated in the bellcrank and press cable lock button down until it snaps in place.

(7) Check adjustment as follows:

(a) Check movement of release shift handle button (floor shift) or release lever (column shift). You should not be able to press button inward or move column lever.

(b) Turn ignition switch to RUN position.

(c) Shifting out of park should not be possible.

(d) Apply the brake and attempt to shift out of PARK. Shifting should be possible.

(e) While the transmission is shifted out of PARK, release the brake and attempt to shift through all gears. Release the shift button at least once during this procedure. The ignition key should not go to the LOCK position.

(f) Return transmission to the PARK position without applying the brake.

(8) Move shift lever back to PARK and check ignition switch operation. You should be able to turn switch to LOCK position and shift lever release button/lever should not move.

DRIVING CLUTCHES

DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly (Fig. 151). The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

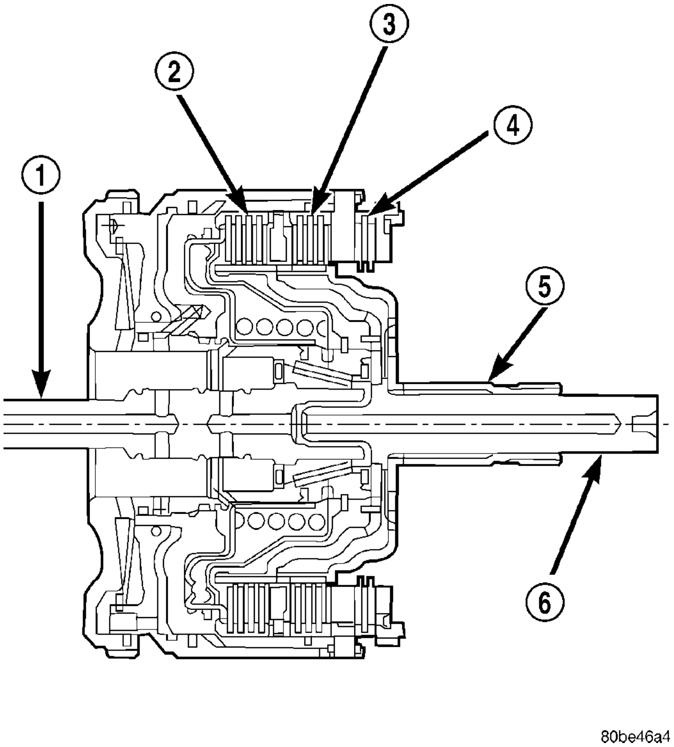


Fig. 151 Input Clutch Assembly

1 - INPUT SHAFT
2 - UNDERDRIVE CLUTCH
3 - OVERDRIVE CLUTCH
4 - REVERSE CLUTCH
5 - OVERDRIVE SHAFT
6 - UNDERDRIVE SHAFT

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the rear sun gear.

OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the front planet carrier.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear only by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the front sun gear assembly is driven.

FLUID AND FILTER

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

FLUID AND FILTER (Continued)

DIAGNOSIS AND TESTING - FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL CHECK

FLUID LEVEL CHECK

The transmission sump has a dipstick to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the PARK and NEUTRAL positions. Place the selector lever in PARK to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level should be in COLD region at 70° F fluid temperature. Adjust fluid level as necessary. Use only Mopar® ATF+4, Automatic Transmission Fluid.

FLUID LEVEL CHECK USING DRB

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

(1) Start engine and apply parking brake.

(2) Connect DRBIII® scan tool and select transmission.

(3) Select sensors.

(4) Read the transmission temperature value.

(5) Compare the fluid temperature value with the chart.

(6) Adjust transmission fluid level shown on the dipstick according to the chart (Fig. 152). Use only Mopar® ATF+4, Automatic Transmission Fluid.

(7) Check transmission for leaks.

STANDARD PROCEDURE - FLUID/FILTER SERVICE

NOTE: Only fluids of the type labeled Mopar® ATF+4, Automatic Transmission Fluid, should be used in the transmission sump. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

NOTE: If the transmission is disassembled for any reason, the fluid and filter should be changed.

(1) Raise vehicle on a hoist. Place a drain container with a large opening, under transmission oil pan.

NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Seperate this bolt for reuse.

(2) Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.

(3) Install a new filter and o-ring on bottom of the valve body and tighten retaining screws to 5 N·m (40 in. lbs.).

NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits (Fig. 153), it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

FLUID AND FILTER (Continued)

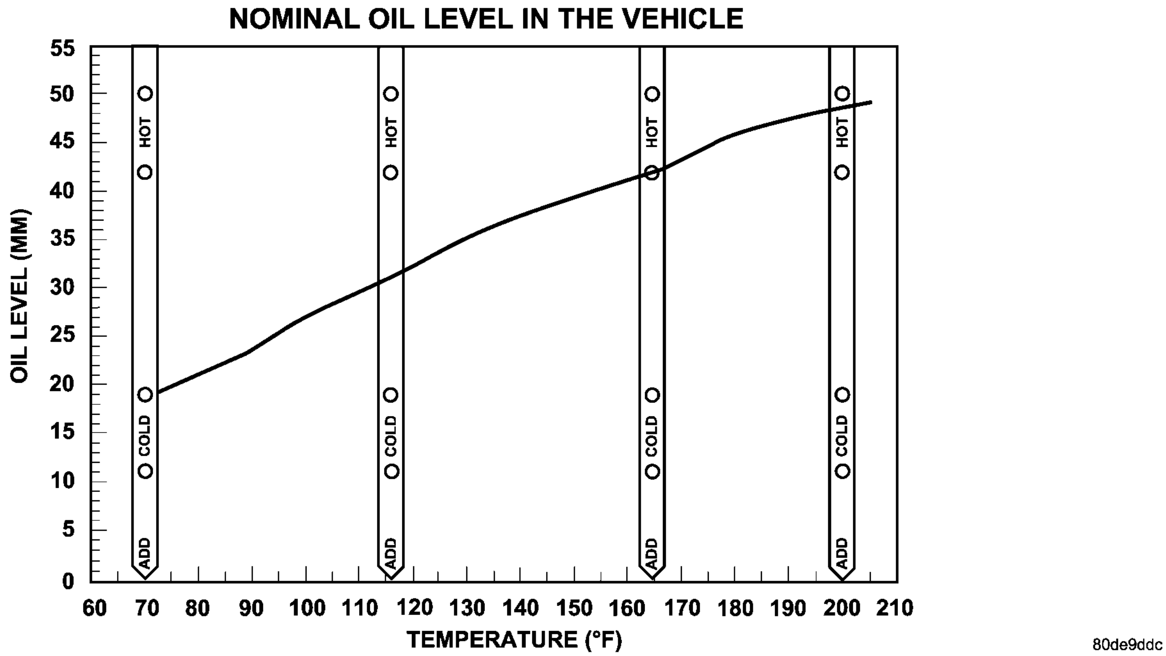


Fig. 152 42RLE Fluid Temperature Chart

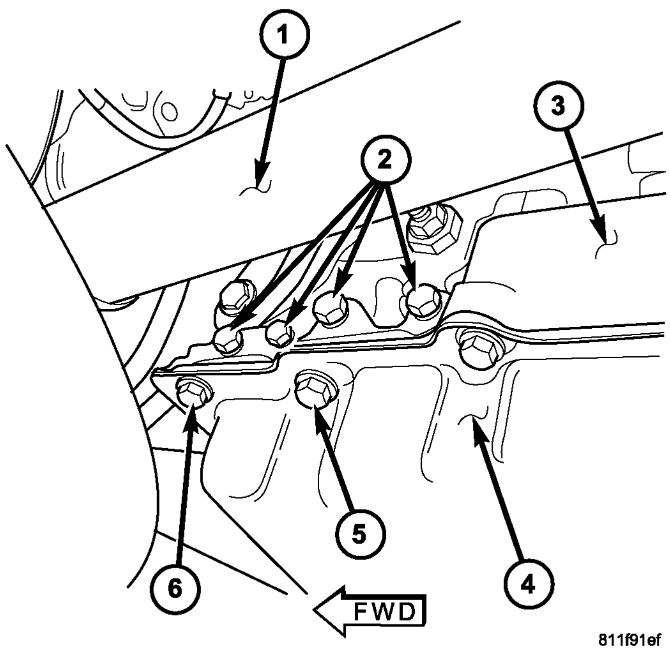


Fig. 153 Pan Fastener

1 - FRONT DRIVESHAFT
2 - PRESSURE PORTS
3 - TRANSMISSION CASE
4 - TRANSMISSION OIL PAN
5 - SECOND TRANSMISSION OIL PAN BOLT ON LEFT SIDE
6 - FIRST TRANSMISSION OIL PAN BOLT

(4) Clean the oil pan and magnet. Reinstall pan using new Mopar® Silicone Adhesive sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of Mopar® ATF+4, Automatic Transmission Fluid, through the dipstick opening.

(6) Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.

(7) Check the transmission fluid level and add an appropriate amount to bring the transmission fluid level to 3mm (1/8 in.) below the lowest mark on the dipstick.

(8) Recheck the fluid level after the transmission has reached normal operating temperature (180°F.).

(9) To prevent dirt from entering transmission, make certain that dipstick is fully seated into the dipstick opening.

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF +4, Automatic Transmission Fluid, to transmission:

(a) If only fluid and filter were changed, add **6 pints (3 quarts)** of ATF +4 to transmission.

(b) If transmission was completely overhauled, or torque converter was replaced or drained, add **10 pints (5 quarts)** of ATF +4 to transmission.

(3) Apply parking brakes.

(4) Start and run engine at normal curb idle speed.

FLUID AND FILTER (Continued)

(5) Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into PARK.

(2) Remove shift lever bezel and necessary console parts for access to shift lever assembly. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(3) Disconnect cable at shift lever (Fig. 154) and feed cable through dash panel opening to underside of vehicle.

(4) Raise vehicle.

(5) Disengage cable eyelet at transmission shift lever and removel cable from the mounting bracket. Then remove old cable from vehicle.

INSTALLATION

(1) Route cable through hole in dash panel. Fully seat cable grommet into dash panel.

(2) Place the auto transmission manual shift control lever in “PARK” detent (rearmost) position and rotate prop shaft to ensure transmission is in PARK.

(3) Snap the cable into the transmission bracket so the retaining clip is engaged and connect cable end fitting onto the manual control lever ball stud.

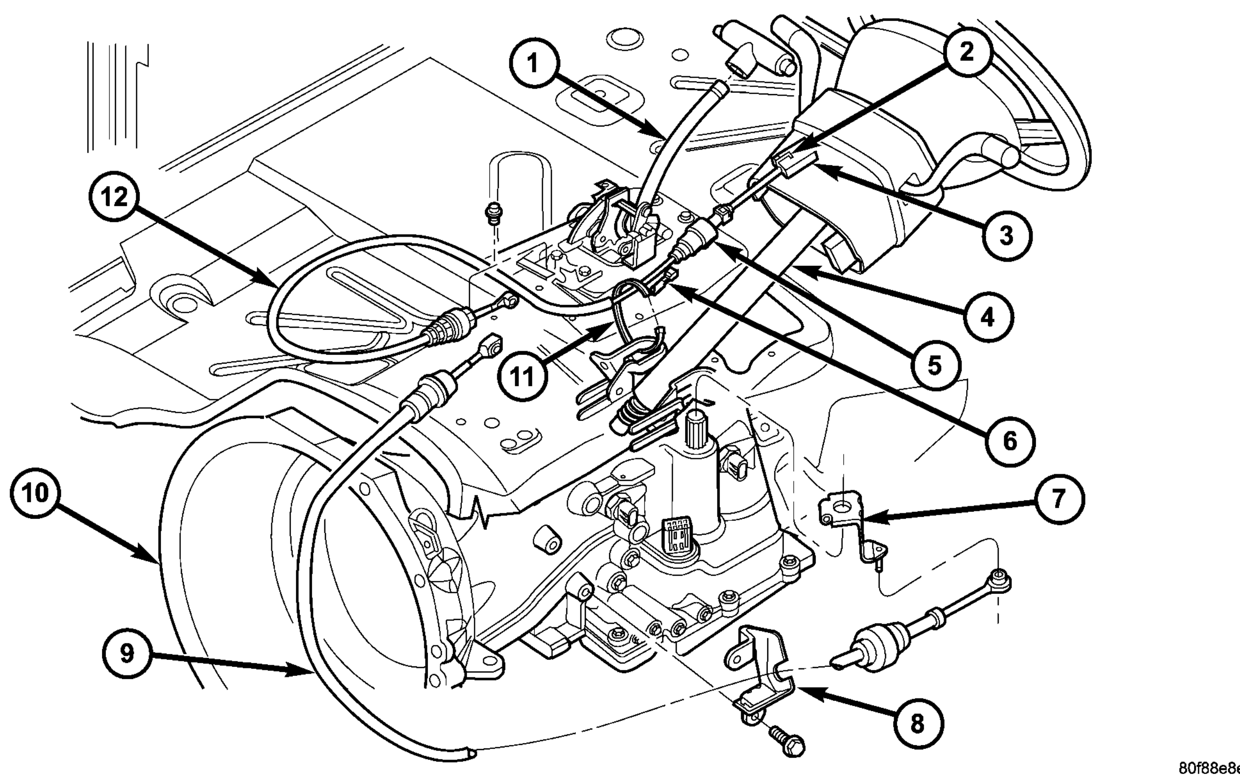


Fig. 154 Shifter Cable Routing

1 - SHIFT MECHANISM
2 - LOCK-TAB
3 - IGNITION LOCK INTERLOCK
4 - STEERING COLUMN
5 - SOLENOID
6 - WIRE CONNECTOR
7 - MANUAL LEVER
8 - CABLE BRACKET
9 - SHIFTER CABLE
10 - BELLHOUSING
11 - TIE STRAP
12 - PARK/BRAKE INTERLOCK CABLE

GEARSHIFT CABLE (Continued)

(4) Place the floor shifter lever in PARK position.

(5) Connect shift cable to shifter mechanism by snapping cable retaining ears into shifter bracket and press cable end fitting onto lever ball stud.

(6) Snap the cable into the transmission bracket so the retaining ears are engaged and connect cable end fitting onto the manual control lever ball stud.

(7) Adjust the shift mechanism.

(8) Install any floor console components removed previously. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

HOLDING CLUTCHES

DESCRIPTION

Two hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2/4 and Low/Reverse clutches are considered holding clutches and are contained at the rear of the transmission case (Fig. 155).

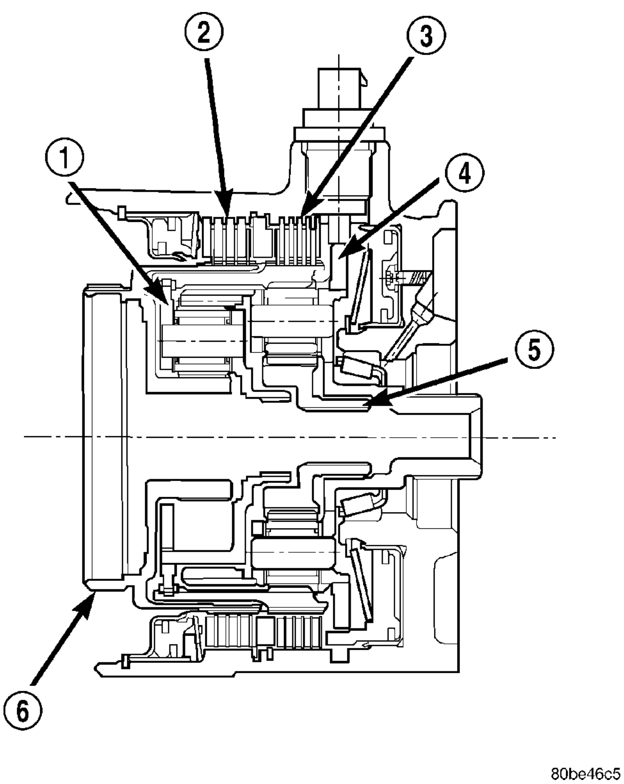


Fig. 155 2/4 and Low/Reverse Clutches

1 - FRONT PLANET CARRIER/REAR ANNULUS
2 - 2/4 CLUTCH
3 - L/R CLUTCH
4 - REAR PLANET CARRIER/FRONT ANNULUS
5 - REAR SUN GEAR
6 - FRONT SUN GEAR ASSEMBLY

OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - DIAGNOSIS AND TESTING) for a collective view of which clutch elements are applied at each position of the selector lever.

2/4 CLUTCH

The 2/4 clutch is hydraulically applied in second and fourth gears by pressurized fluid against the 2/4 clutch piston. When the 2/4 clutch is applied, the front sun gear assembly is held or grounded to the transmission case.

LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the front planet carrier/rear annulus assembly is held or grounded to the transmission case.

INPUT CLUTCH ASSEMBLY

DISASSEMBLY

(1) Mount input clutch assembly to Input Clutch Pressure Fixture (Tool 8391).

(2) Tap down reverse clutch reaction plate to release pressure from snap ring (Fig. 156).

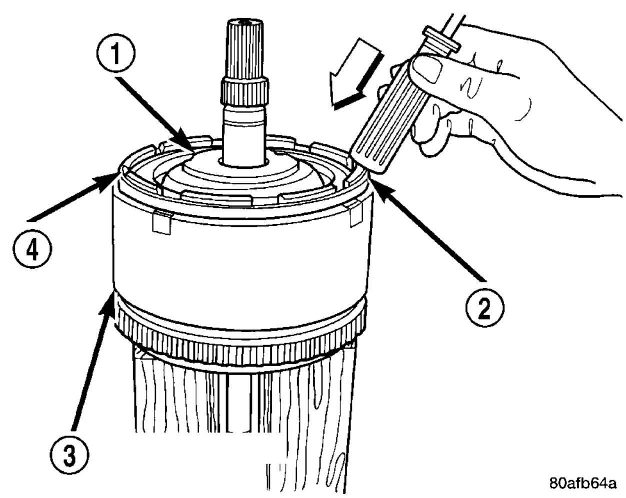


Fig. 156 Tapping Reaction Plate

1 - #4 THRUST PLATE (SELECT)
2 - TAP DOWN REVERSE CLUTCH REACTION PLATE TO REMOVE OR INSTALL SNAP RING
3 - INPUT CLUTCH RETAINER
4 - REVERSE CLUTCH REACTION PLATE

INPUT CLUTCH ASSEMBLY (Continued)

(3) Remove reverse clutch snap ring (Fig. 157).

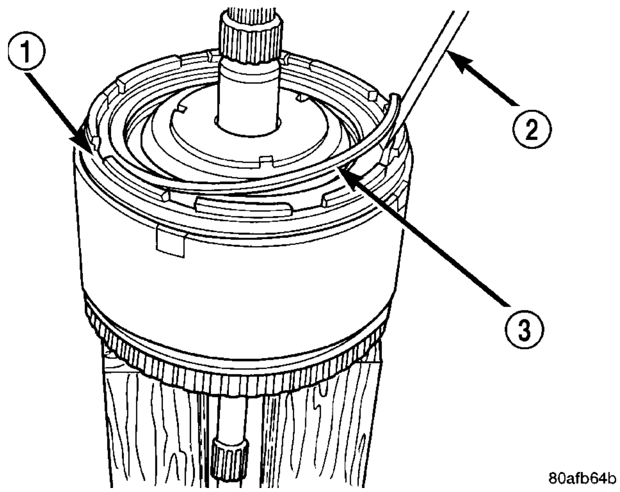


Fig. 157 Reverse Clutch Snap Ring

1 - REACTION PLATE
2 - SCREWDRIVER
3 - REVERSE CLUTCH SNAP RING (SELECT)

(4) Pry up and remove reverse clutch reaction plate (Fig. 158) (Fig. 159).

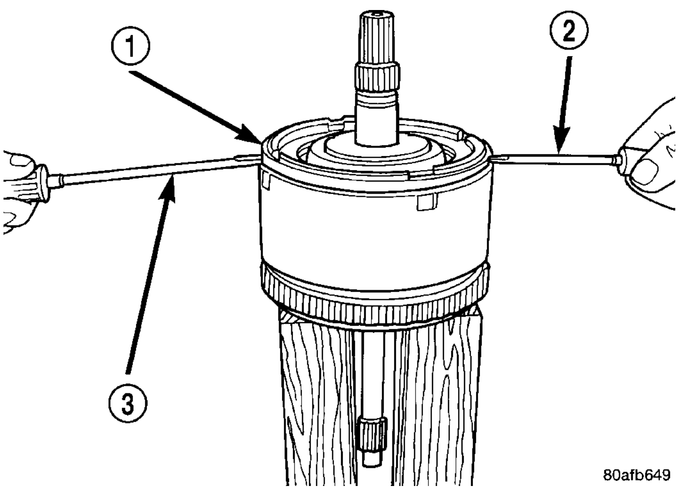


Fig. 158 Pry Reverse Clutch Reaction Plate

1 - REVERSE CLUTCH REACTION PLATE
2 - SCREWDRIVER
3 - SCREWDRIVER

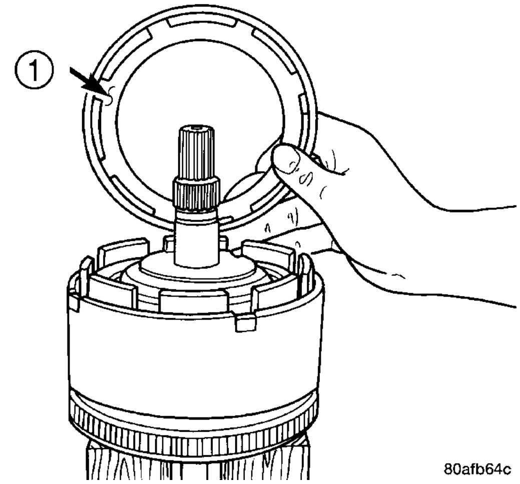


Fig. 159 Reverse Clutch Reaction Plate

1 - REVERSE CLUTCH REACTION PLATE (INSTALL FLAT SIDE DOWN)

(5) Remove the reverse clutch pack (two fibers/one steel) (Fig. 160).

NOTE: Tag reverse clutch pack for reassembly identification.

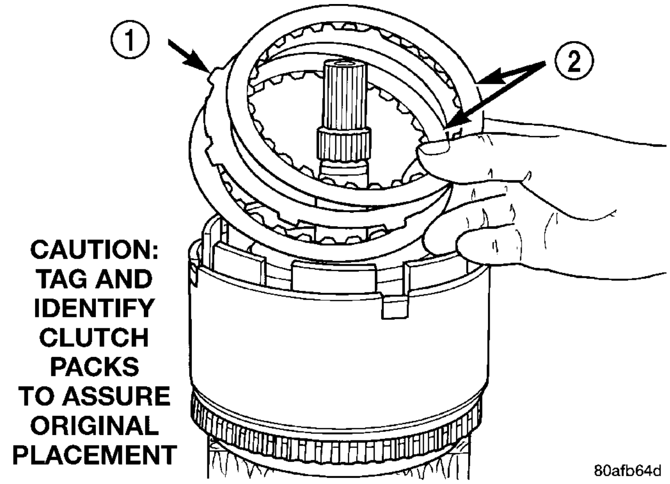


Fig. 160 Reverse Clutch Pack

1 - REVERSE CLUTCH PLATE
2 - REVERSE CLUTCH DISC

INPUT CLUTCH ASSEMBLY (Continued)

(6) Remove the OD/Reverse reaction plate snap ring (Fig. 161).

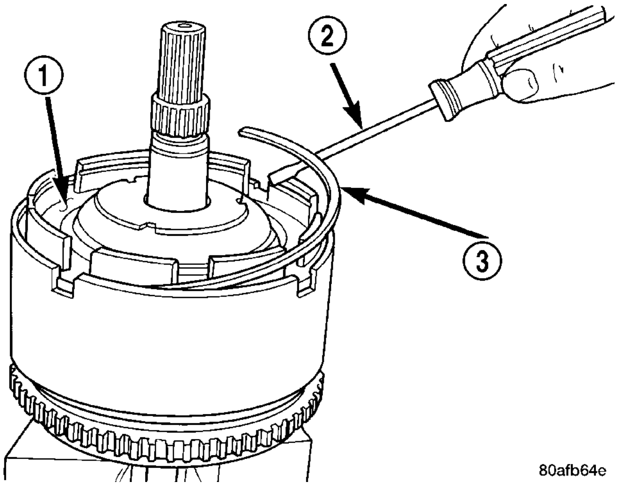


Fig. 161 OD/Reverse Pressure Plate Snap Ring

1 - OD/REVERSE PRESSURE PLATE
2 - SCREWDRIVER
3 - OD/REVERSE PRESSURE PLATE SNAP RING

(7) Remove OD/Reverse pressure plate (Fig. 162).

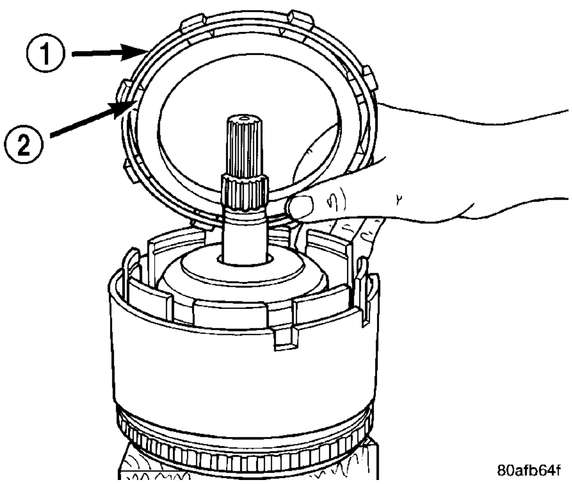


Fig. 162 OD/Reverse Reaction Plate

1 - OD/REVERSE PRESSURE PLATE (STEP SIDE DOWN)
2 - (STEP SIDE DOWN)

(8) Remove OD/Reverse reaction plate wave snap ring (Fig. 163).

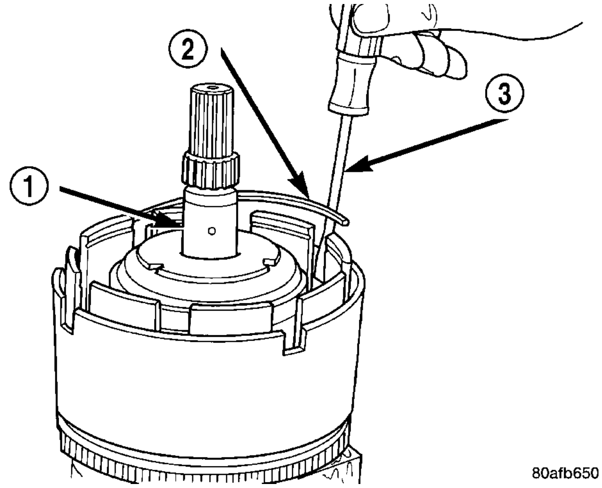


Fig. 163 Waved Snap Ring

1 - OVERDRIVE SHAFT ASSEMBLY
2 - OD/REVERSE CLUTCH WAVED SNAP RING
3 - SCREWDRIVER

(9) Remove OD shaft/hub and OD clutch pack (Fig. 164), (Fig. 165).

NOTE: Tag overdrive clutch pack for reassembly identification.

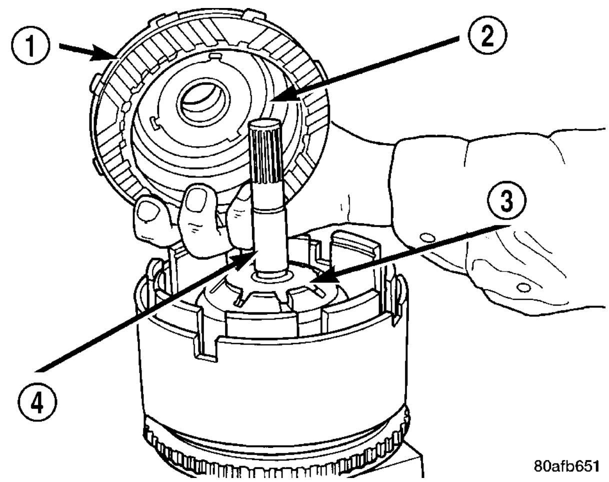


Fig. 164 Remove OD Clutch Pack

1 - OVERDRIVE SHAFT ASSEMBLY AND OD CLUTCH PACK
2 - #3 THRUST PLATE
3 - #3 THRUST WASHER
4 - UNDERDRIVE SHAFT ASSEMBLY

INPUT CLUTCH ASSEMBLY (Continued)

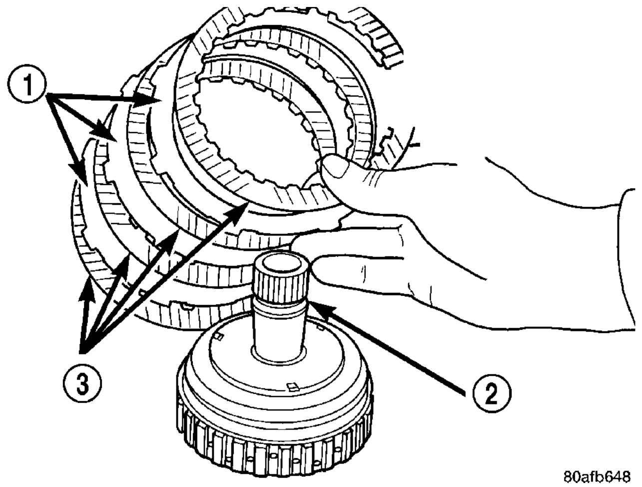


Fig. 165 Overdrive Clutch Pack

1 - OVERDRIVE CLUTCH PLATE
2 - OVERDRIVE SHAFT ASSEMBLY
3 - OVERDRIVE CLUTCH DISC

(10) Remove and inspect #3 & #4 thrust washers (Fig. 166).

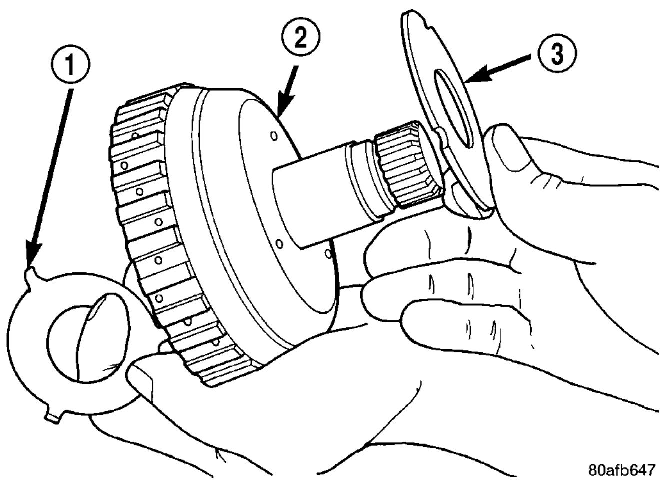


Fig. 166 #3 and #4 Thrust Washers

1 - #3 THRUST PLATE (3 TABS)
2 - OD SHAFT ASSEMBLY
3 - #4 THRUST PLATE (3 SLOTS)

(11) Remove the underdrive shaft assembly (Fig. 167).

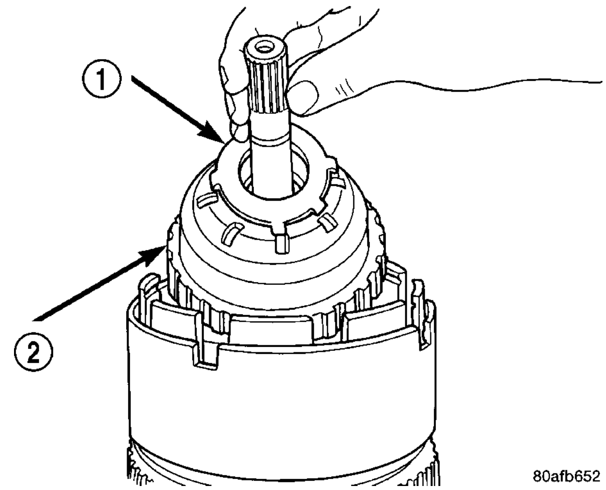


Fig. 167 Underdrive Shaft Assembly

1 - #3 THRUST WASHER (5 TABS)
2 - UNDERDRIVE SHAFT ASSEMBLY

(12) Remove the #2 needle bearing (Fig. 168).

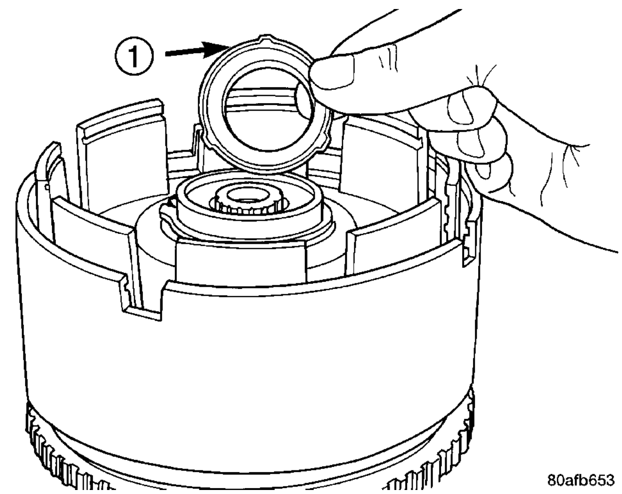


Fig. 168 No 2 Needle Bearing

1 - #2 NEEDLE BEARING (NOTE 3 TABS)

INPUT CLUTCH ASSEMBLY (Continued)

(13) Remove the OD/UD reaction plate tapered snap ring (Fig. 169).

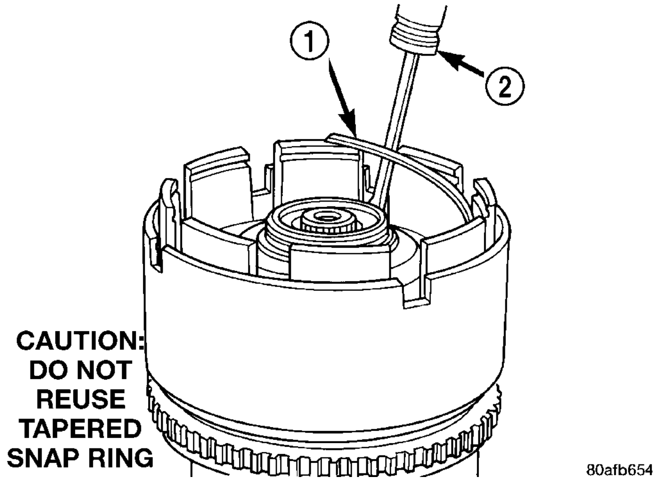


Fig. 169 Tapered Snap Ring

1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING
2 - SCREWDRIVER (DO NOT SCRATCH REACTION PLATE)

NOTE: The OD/UD clutch reaction plate has a step on both sides. The OD/UD clutches reaction plate goes tapered step side up.

(14) Remove the OD/UD reaction plate (Fig. 170).

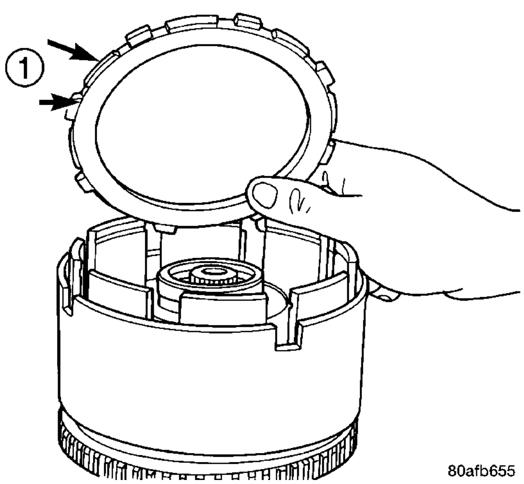


Fig. 170 OD/UD Reaction Plate

1 - OD/UD CLUTCH REACTION PLATE (STEP SIDE DOWN)

(15) Remove the first UD clutch disc (Fig. 171).

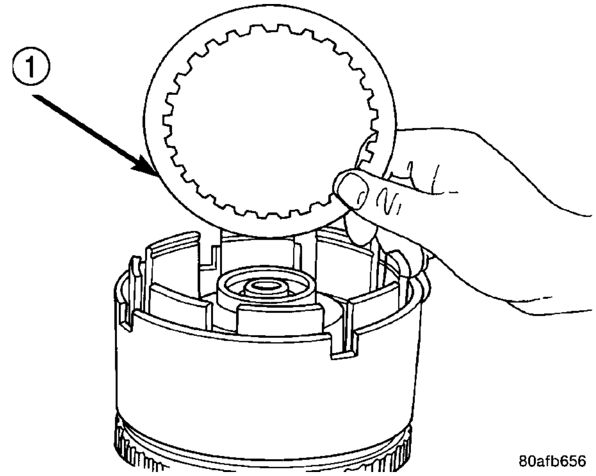


Fig. 171 Remove Last UD Clutch Disc

1 - ONE UNDERDRIVE CLUTCH DISC

(16) Remove the UD clutch flat snap ring (Fig. 172).

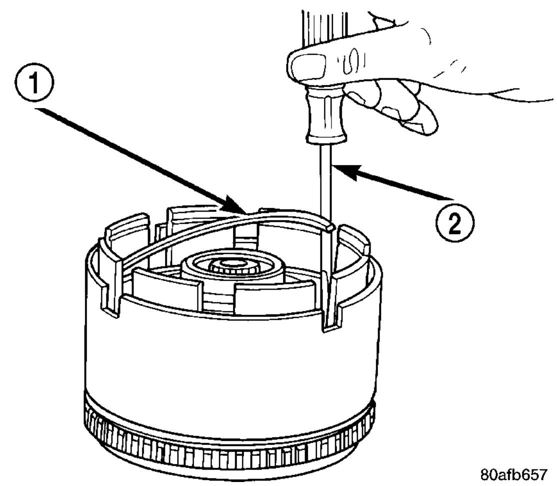


Fig. 172 UD Clutch Flat Snap Ring

1 - UNDERDRIVE CLUTCH REACTION PLATE FLAT SNAP RING
2 - SCREWDRIVER

NOTE: Tag underdrive clutch pack for reassembly identification.

INPUT CLUTCH ASSEMBLY (Continued)

(17) Remove the UD clutch pack (Fig. 173).

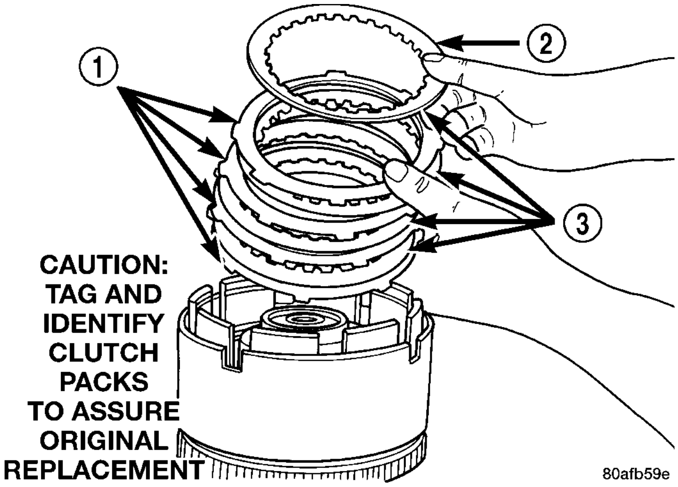


Fig. 173 Underdrive Clutch Pack

1 - CLUTCH PLATE
2 - ONE UD CLUTCH DISC
3 - CLUTCH DISC

CAUTION: Compress return spring just enough to remove or install snap ring.

(18) Using Tool 5059A and an arbor press, compress UD clutch piston enough to remove snap ring (Fig. 174), (Fig. 175).

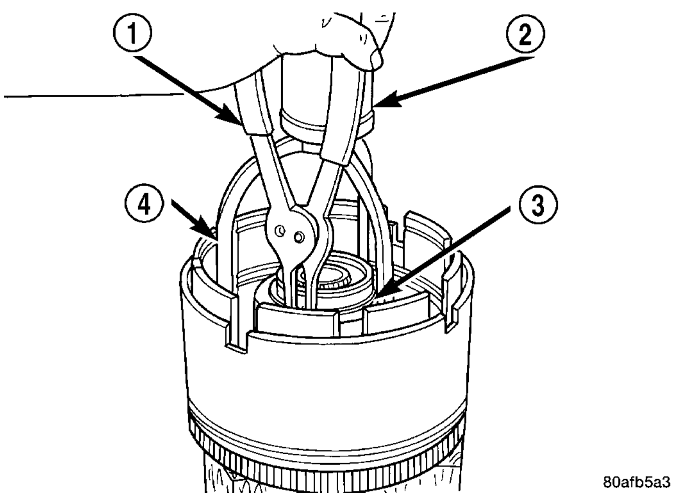


Fig. 174 UD Spring Retainer Snap Ring

1 - SNAP RING PLIERS
2 - ARBOR PRESS RAM
3 - SNAP RING
4 - SPECIAL TOOL 5059A

(19) Remove spring retainer (Fig. 175).

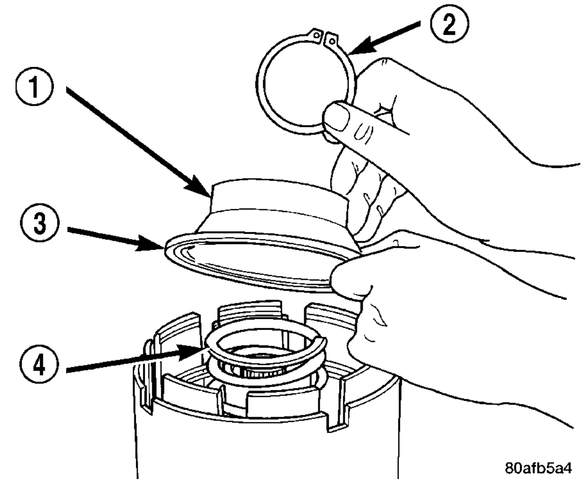


Fig. 175 UD Return Spring and Retainer

1 - UNDERDRIVE SPRING RETAINER
2 - SNAP RING
3 - SEAL
4 - PISTON RETURN SPRING

(20) Remove UD clutch piston (Fig. 176).

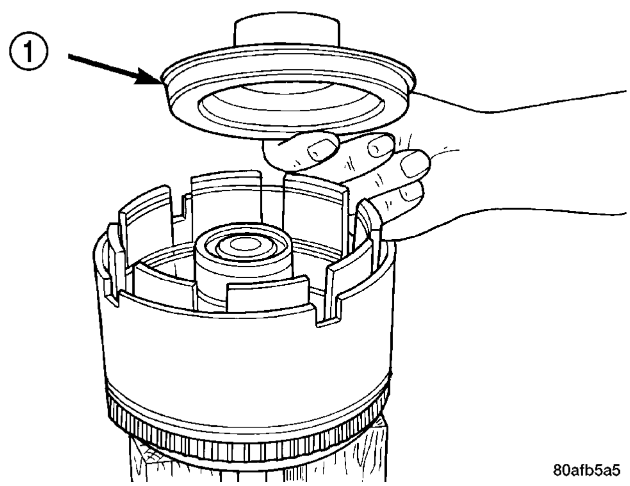


Fig. 176 Underdrive Clutch Piston

1 - PISTON

INPUT CLUTCH ASSEMBLY (Continued)

(21) Remove input hub tapered snap ring (Fig. 177).

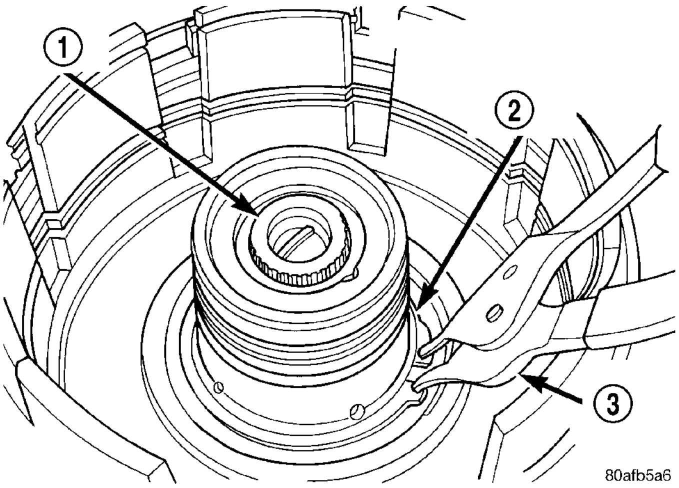


Fig. 177 Input Hub Tapered Snap Ring

1 - INPUT SHAFT
2 - INPUT HUB SNAP RING (TAPERED SIDE UP WITH TABS IN CAVITY)
3 - SNAP RING PLIERS

(22) Tap on input hub with soft faced hammer and separate input hub from OD/Reverse piston and clutch retainer (Fig. 178), (Fig. 179).

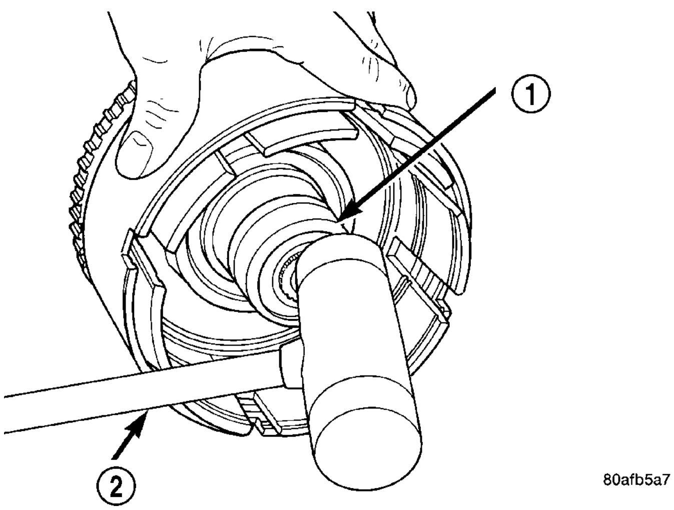


Fig. 178 Tap on Input Hub

1 - INPUT SHAFT AND HUB ASSEMBLY
2 - PLASTIC HAMMER

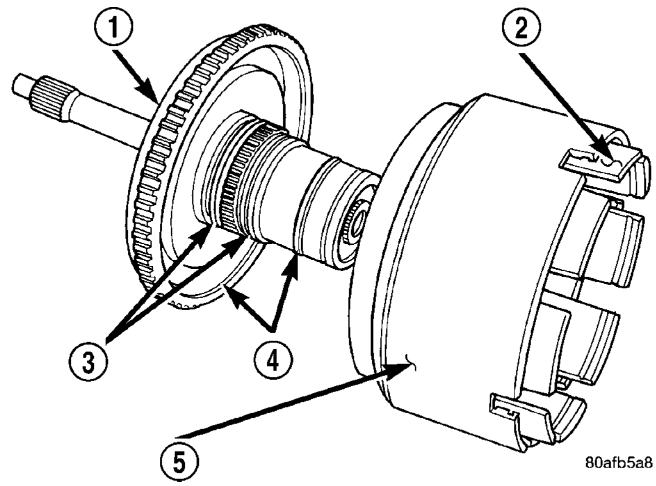


Fig. 179 Input Hub Removed

1 - INPUT SHAFT AND HUB ASSEMBLY
2 - INPUT CLUTCH RETAINER
3 - O-RING
4 - SEAL
5 - OVERDRIVE/REVERSE PISTON

(23) Separate clutch retainer from OD/Reverse piston (Fig. 180).

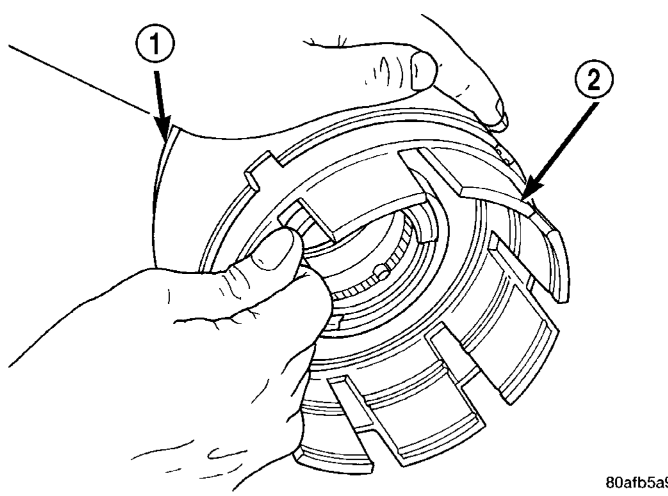


Fig. 180 Pull Retainer from Piston

1 - OVERDRIVE/REVERSE PISTON
2 - INPUT CLUTCH RETAINER

INPUT CLUTCH ASSEMBLY (Continued)

(24) Using Tool 6057 and an arbor press, compress return OD/Reverse piston return spring just enough to remove snap ring (Fig. 181), (Fig. 182).

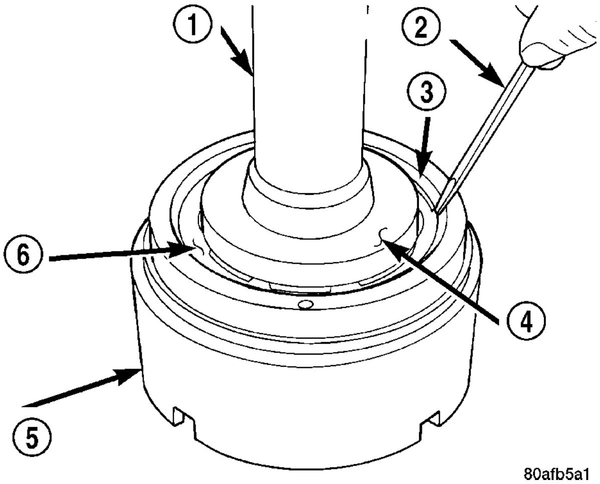


Fig. 181 Remove Snap Ring

1 - ARBOR PRESS RAM (COMPRESS RETURN SPRING JUST ENOUGH TO REMOVE OR INSTALL SNAP RING)
2 - SCREWDRIVER
3 - SNAP RING
4 - SPECIAL TOOL 6057
5 - OD/REVERSE PISTON
6 - RETURN SPRING

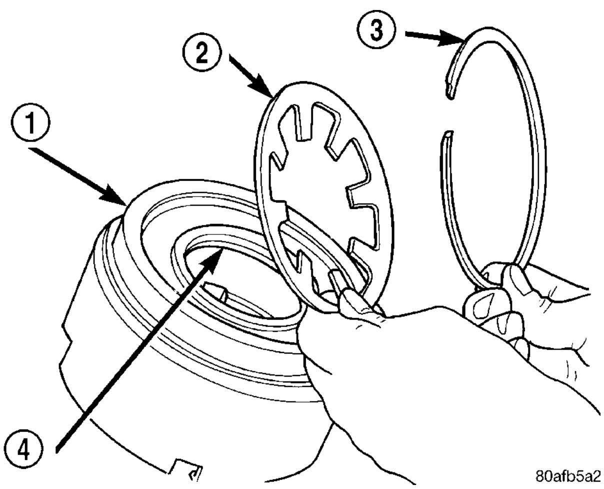


Fig. 182 Return Spring and Snap Ring

1 - OD/REVERSE PISTON
2 - RETURN SPRING
3 - SNAP RING
4 - O-RING

(25) Remove input shaft to input clutch hub snap ring (Fig. 183).

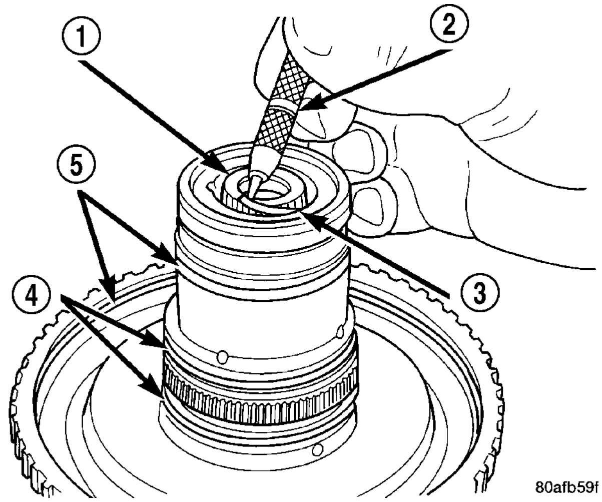


Fig. 183 Remove Input Shaft Snap Ring

1 - INPUT SHAFT
2 - SHARP-POINTED TOOL
3 - SNAP RING
4 - O-RINGS
5 - SEALS

(26) Using a suitably sized socket and an arbor press, remove input shaft from input shaft hub (Fig. 184).

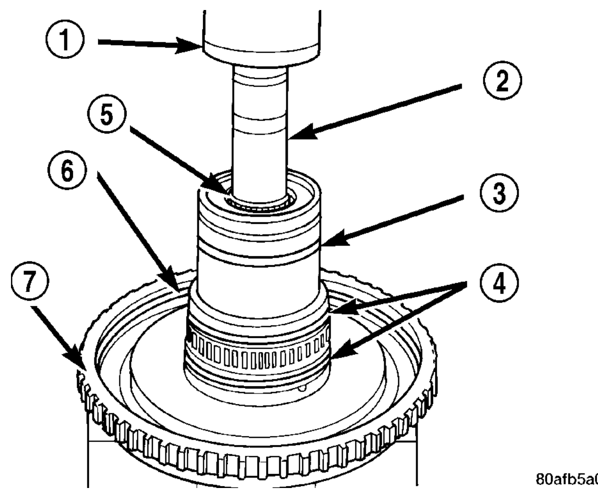


Fig. 184 Remove Input Shaft

1 - ARBOR PRESS RAM
2 - SOCKET
3 - SEAL
4 - O-RINGS
5 - INPUT SHAFT
6 - SEAL
7 - INPUT CLUTCH HUB

INPUT CLUTCH ASSEMBLY (Continued)

ASSEMBLY

Use petrolatum on all seals to ease assembly of components.

(1) Using an arbor press, install input shaft to input shaft hub (Fig. 185).

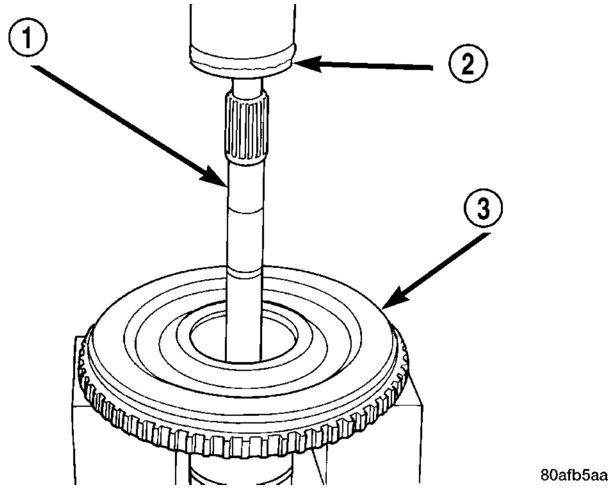


Fig. 185 Install Input Shaft

1 - INPUT SHAFT
2 - ARBOR PRESS RAM
3 - INPUT CLUTCH HUB

(2) Install input shaft snap ring (Fig. 186).

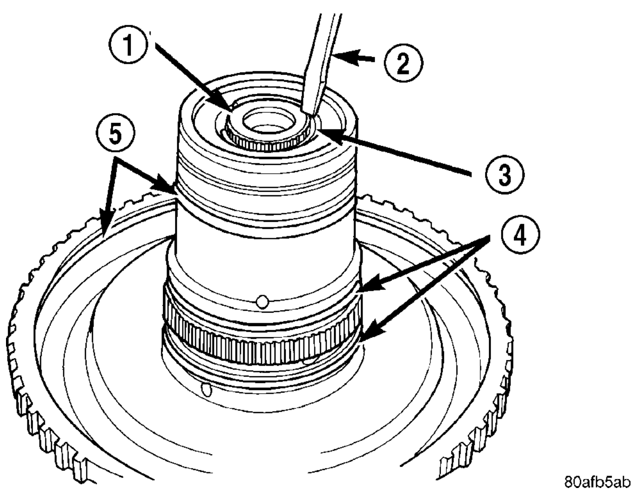


Fig. 186 Install Input Shaft Snap Ring

1 - INPUT SHAFT
2 - SCREWDRIVER (DO NOT SCRATCH BEARING SURFACE)
3 - SNAP RING
4 - O-RINGS
5 - SEALS

(3) Using an arbor press and Tool 6057, Install OD/Reverse piston return spring and snap ring (Fig. 187), (Fig. 188).

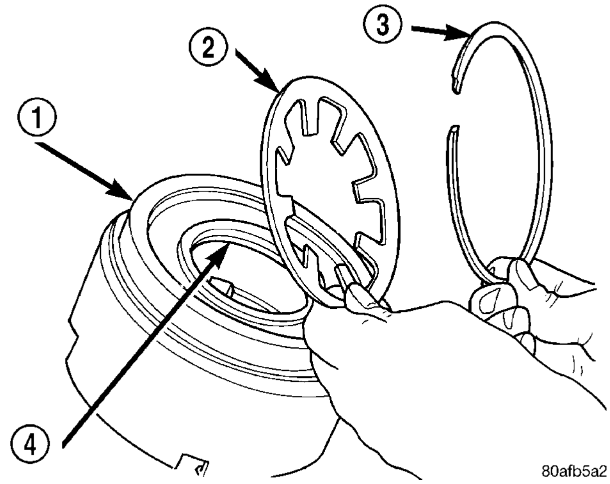


Fig. 187 Return Spring and Snap Ring

1 - OD/REVERSE PISTON
2 - RETURN SPRING
3 - SNAP RING
4 - O-RING

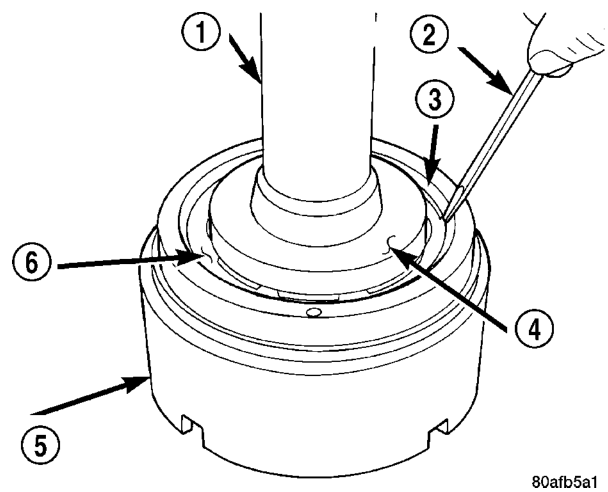


Fig. 188 Install Snap Ring

1 - ARBOR PRESS RAM (COMPRESS RETURN SPRING JUST ENOUGH TO REMOVE OR INSTALL SNAP RING)
2 - SCREWDRIVER
3 - SNAP RING
4 - SPECIAL TOOL 6057
5 - OD/REVERSE PISTON
6 - RETURN SPRING

INPUT CLUTCH ASSEMBLY (Continued)

(4) Install the OD/Reverse piston assembly to the input clutch retainer as shown in (Fig. 189).

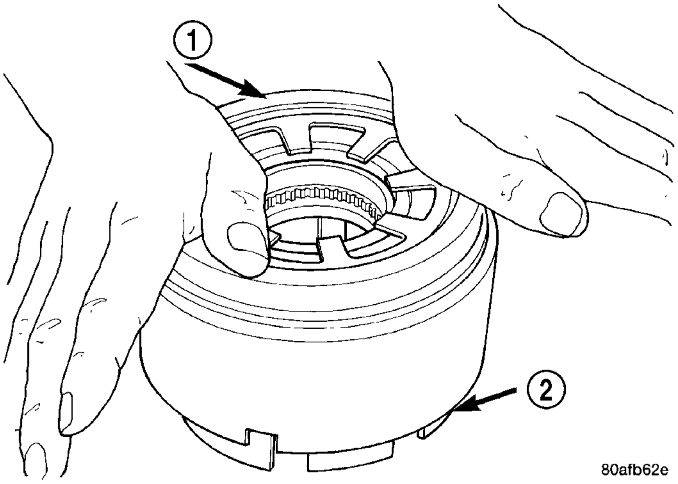


Fig. 189 Install OD/Reverse Piston

1 - PUSH DOWN TO INSTALL OVERDRIVE/REVERSE PISTON
2 - INPUT CLUTCHES RETAINER

(5) Install the input hub/shaft assembly to the OD/Reverse piston/clutch retainer assembly (Fig. 190).

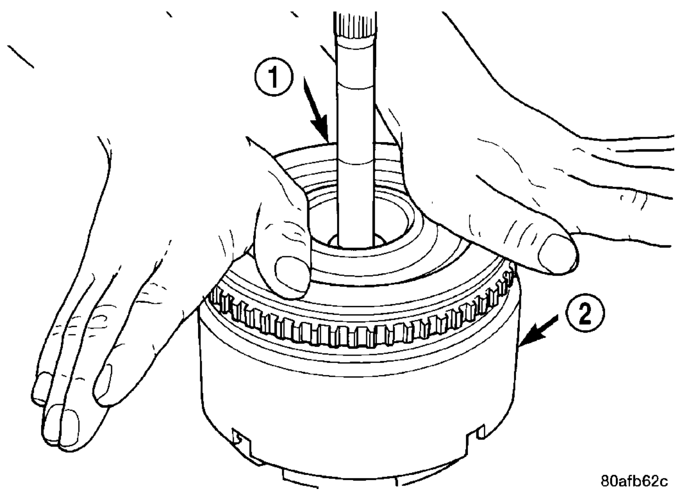


Fig. 190 Install Input Shaft Hub Assembly

1 - PUSH DOWN TO INSTALL INPUT SHAFT HUB ASSEMBLY (ROTATE TO ALIGN SPLINES)
2 - OD/REV. PISTON

(6) Install input hub tapered snap ring (Fig. 191). **Make sure snap ring is fully seated.**

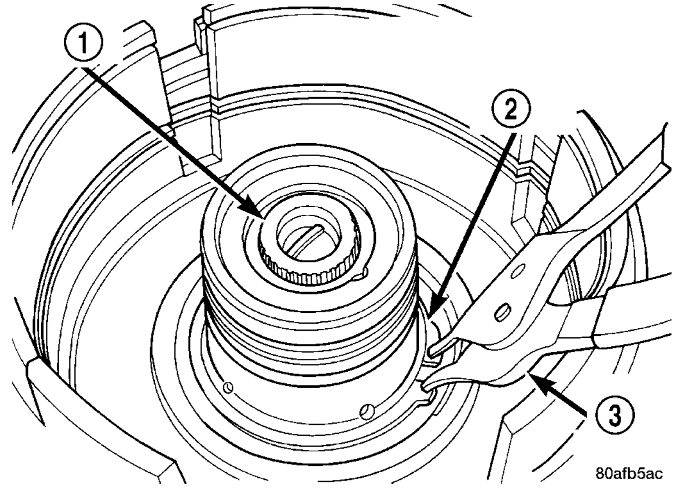


Fig. 191 Install Input Hub Tapered Snap Ring

1 - INPUT SHAFT
2 - INPUT HUB SNAP RING (TAPERED SIDE UP WITH TABS IN CAVITY)
3 - SNAP RING PLIERS

(7) Install UD clutch piston (Fig. 192).

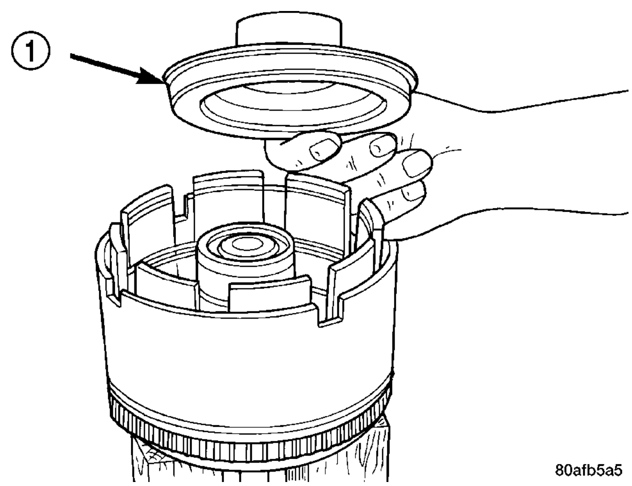


Fig. 192 Underdrive Clutch Piston

1 - PISTON

INPUT CLUTCH ASSEMBLY (Continued)

(8) Install UD piston return spring and Tool 5067 as shown in (Fig. 193).

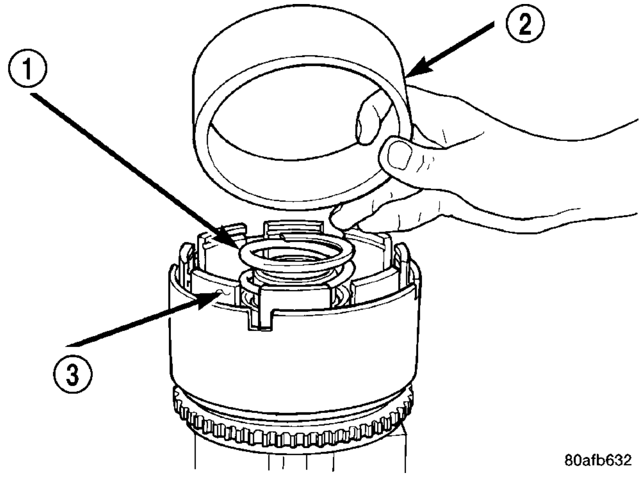


Fig. 193 Seal Compressor Special Tool 5067

1 - PISTON RETURN SPRING
2 - SPECIAL TOOL 5067
3 - INPUT CLUTCH RETAINER

(9) Using Tool 5059A and an arbor press, install the UD spring retainer and snap ring. (Fig. 194), (Fig. 195) Compress just enough to install snap ring.

CAUTION: Compress return spring just enough to install snap ring.

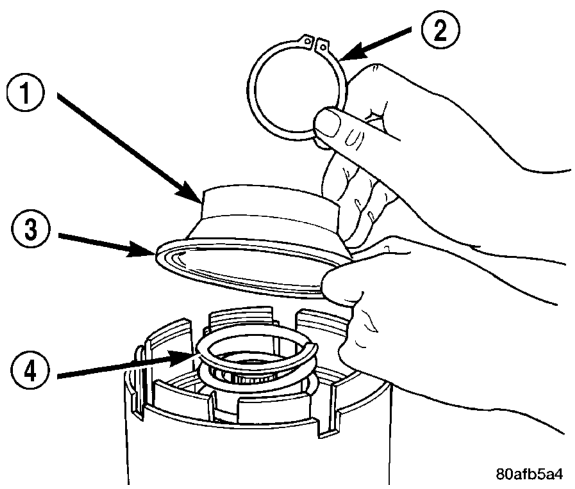


Fig. 194 UD Return Spring and Retainer

1 - UNDERDRIVE SPRING RETAINER
2 - SNAP RING
3 - SEAL
4 - PISTON RETURN SPRING

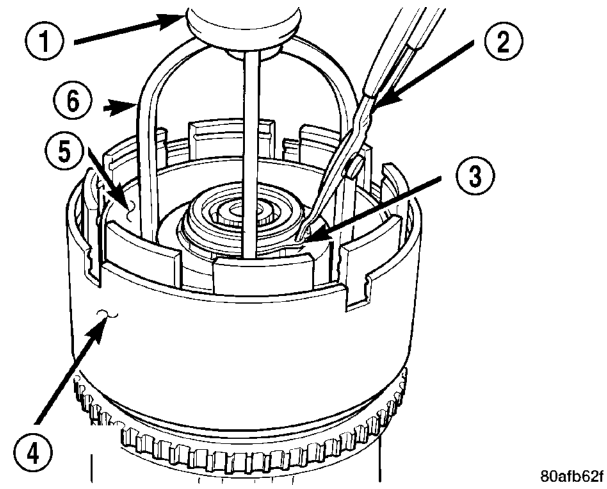


Fig. 195 Install UD Spring Retainer and Snap Ring

1 - ARBOR PRESS RAM
2 - SNAP RING PLIERS
3 - SNAP RING
4 - OD/REVERSE PISTON
5 - TOOL 5067
6 - TOOL 5059A

(10) Install the UD clutch pack (four fibers/four steels) (Fig. 196). Leave the top disc out until after the snap ring is installed.

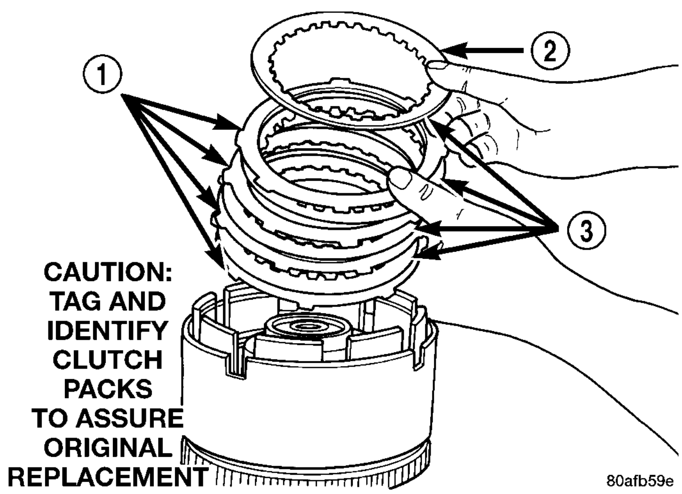


Fig. 196 Underdrive Clutch Pack

1 - CLUTCH PLATE
2 - ONE UD CLUTCH DISC
3 - CLUTCH DISC

INPUT CLUTCH ASSEMBLY (Continued)

(11) Install the UD clutch flat snap ring (Fig. 197).

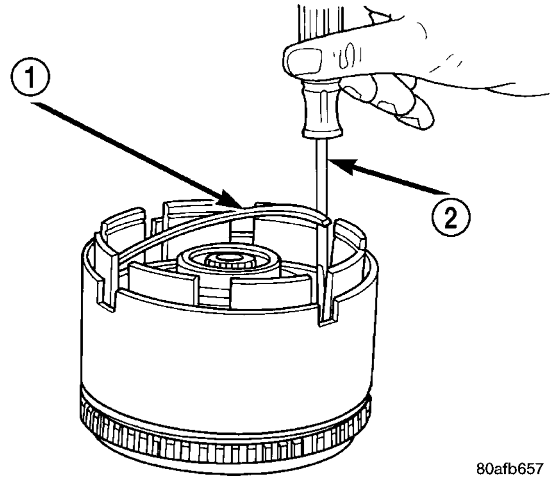


Fig. 197 UD Clutch Flat Snap Ring

1 - UNDERDRIVE CLUTCH REACTION PLATE FLAT SNAP RING
2 - SCREWDRIVER

(12) Install the last UD clutch disc (Fig. 198).

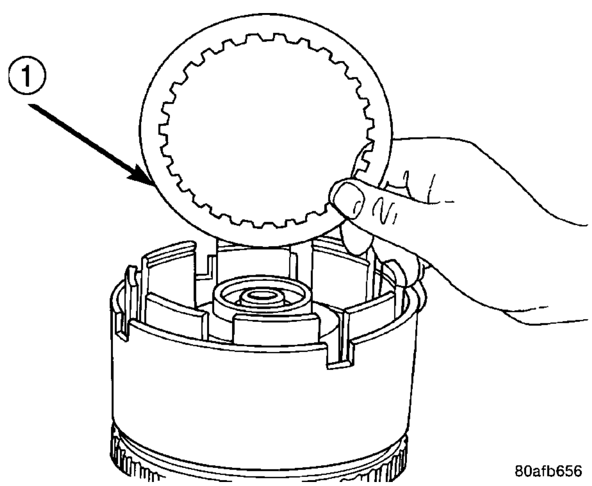


Fig. 198 Install Last UD Clutch Disc

1 - ONE UNDERDRIVE CLUTCH DISC

(13) Install the OD/UD clutch reaction plate and snap ring (Fig. 199), (Fig. 200). The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

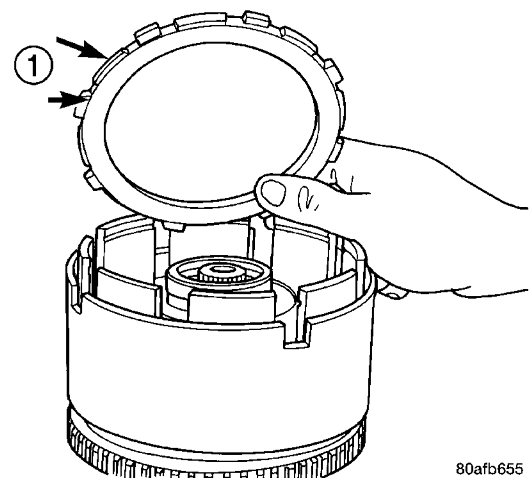


Fig. 199 OD/UD Reaction Plate

1 - OD/UD CLUTCH REACTION PLATE (STEP SIDE DOWN)

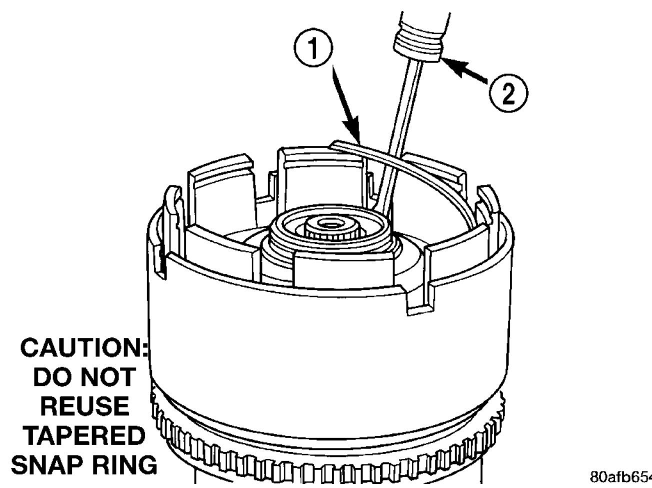


Fig. 200 Tapered Snap Ring

1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING
2 - SCREWDRIVER (DO NOT SCRATCH REACTION PLATE)

NOTE: Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.

INPUT CLUTCH ASSEMBLY (Continued)

(14) Seat tapered snap ring to ensure proper installation (Fig. 201).

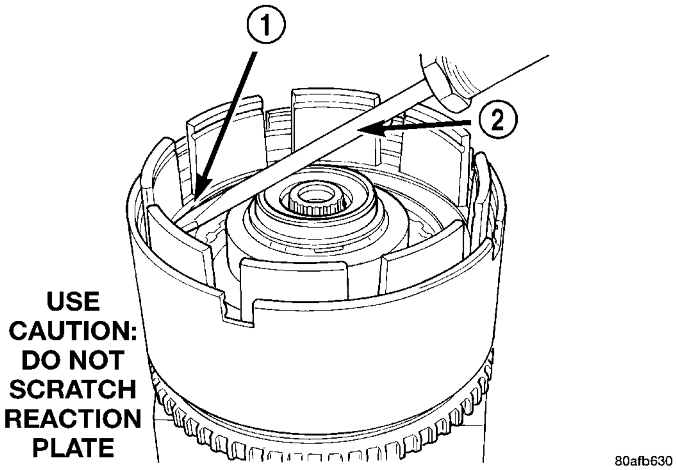


Fig. 201 Seating Tapered Snap Ring

1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING
2 - SCREWDRIVER

(15) Install input clutch assembly to the Input Clutch Pressure Fixture - Tool 8391 (Fig. 202).

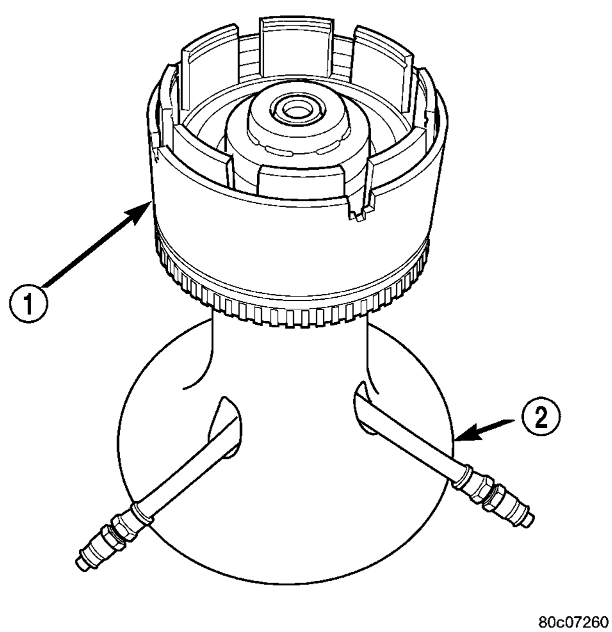


Fig. 202 Input Clutch Assembly on Pressure Fixture Tool - 8391

1 - INPUT CLUTCH ASSEMBLY
2 - INPUT CLUTCH PRESSURE FIXTURE - 8391

(16) Set up dial indicator on the UD clutch pack as shown in (Fig. 203).

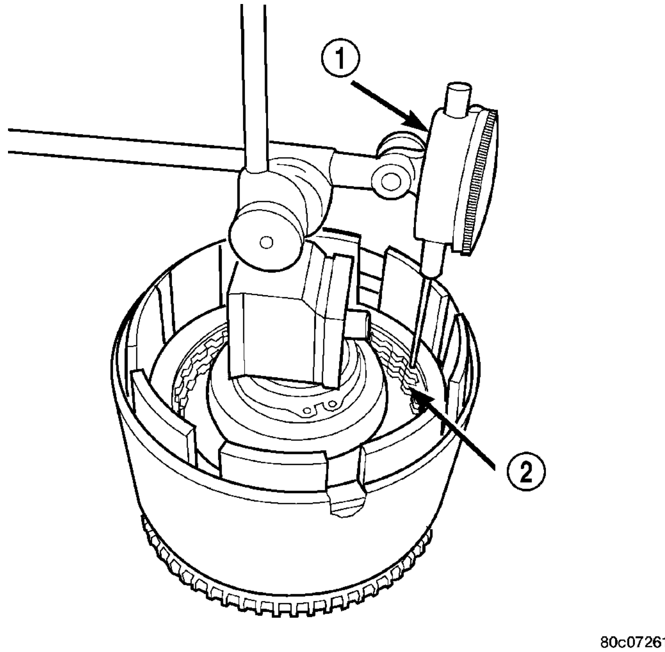


Fig. 203 Set Up Dial Indicator to Measure UD Clutch Clearance

1 - DIAL INDICATOR
2 - UNDERDRIVE CLUTCH

(17) Using moderate pressure, press down and hold (near indicator) the UD clutch pack with screwdriver or suitable tool and zero dial indicator (Fig. 204). When releasing pressure on clutch pack, indicator reading should advance 0.005–0.010.

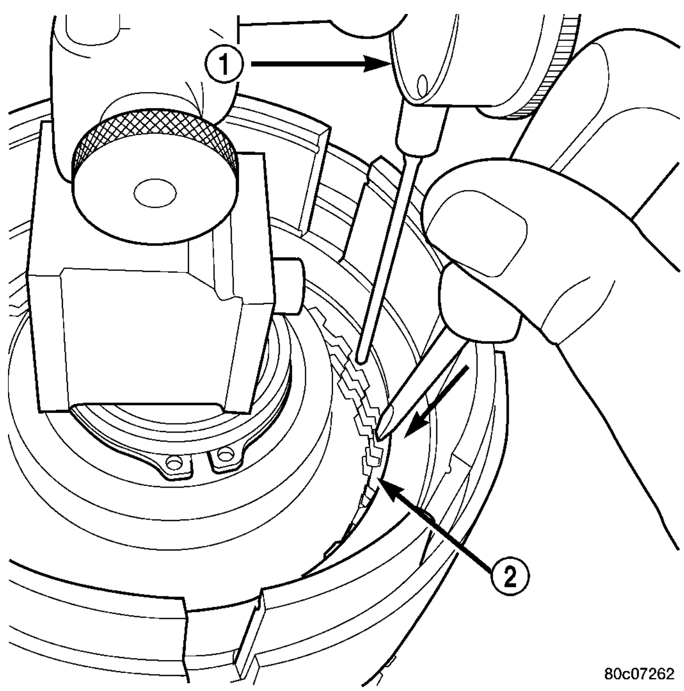


Fig. 204 Press Down on UD Clutch Pack and Zero Dial Indicator

1 - DIAL INDICATOR
2 - UNDERDRIVE CLUTCH

INPUT CLUTCH ASSEMBLY (Continued)

CAUTION: Do not apply more than 30 psi (206 kPa) to the underdrive clutch pack.

(18) Apply 30 psi (206 kPa) to the underdrive hose on Tool 8391 and measure UD clutch clearance. Measure and record UD clutch pack measurement in four (4) places, 90° apart.

(19) Take average of four measurements and compare with UD clutch pack clearance specification. **Underdrive clutch pack clearance must be 0.94-1.50 mm (0.037-0.059 in.).**

(20) If necessary, select the proper reaction plate to achieve specifications:

(21) Install the OD clutch pack (four fibers/three steels) (Fig. 205).

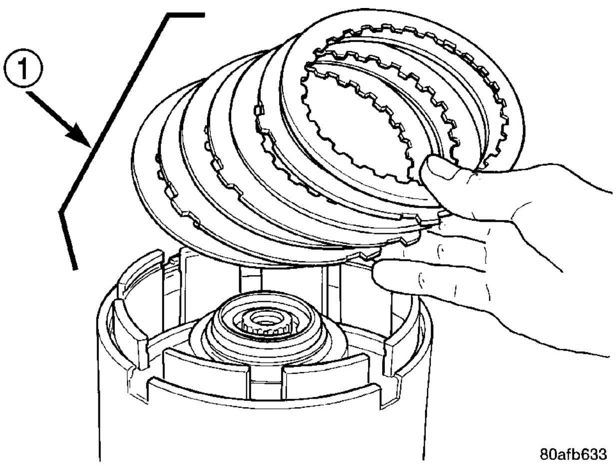


Fig. 205 Install OD Clutch Pack

1 - OVERDRIVE CLUTCH PACK

(22) Install OD reaction plate waved snap ring (Fig. 206).

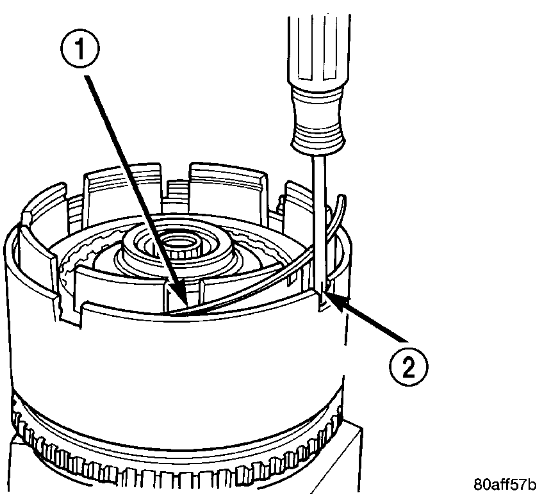


Fig. 206 Install Waved Snap Ring

1 - OVERDRIVE REACTION PLATE WAVED SNAP RING
2 - SCREWDRIVER

(23) Install the OD/Reverse reaction plate with large step down (towards OD clutch pack) (Fig. 207).

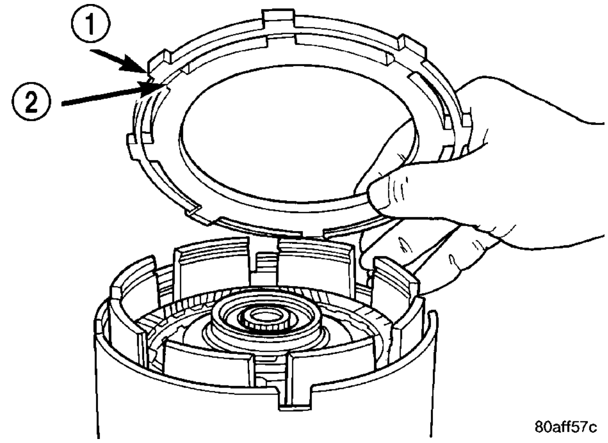


Fig. 207 OD/Reverse Reaction Plate

1 - OVERDRIVE/REVERSE PRESSURE PLATE
2 - (STEP SIDE DOWN)

(24) Install OD reaction plate flat snap ring (Fig. 208).

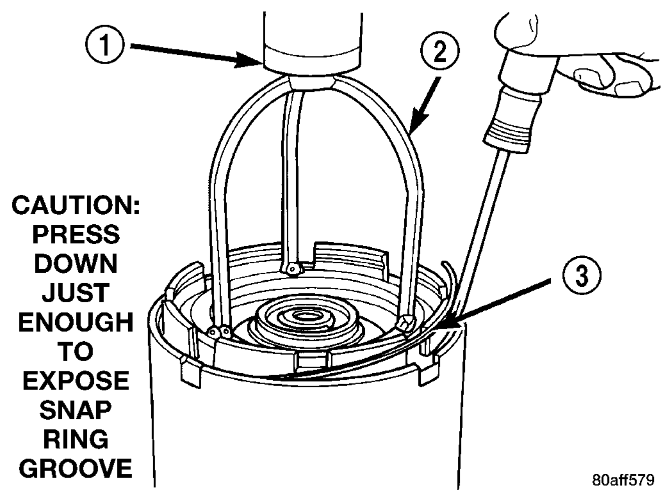


Fig. 208 Install Flat Snap Ring

1 - ARBOR PRESS RAM
2 - TOOL 5059A
3 - FLAT SNAP RING

INPUT CLUTCH ASSEMBLY (Continued)

(25) Measure OD clutch pack clearance. Set up dial indicator on top of the OD/Reverse reaction plate as shown in (Fig. 209).

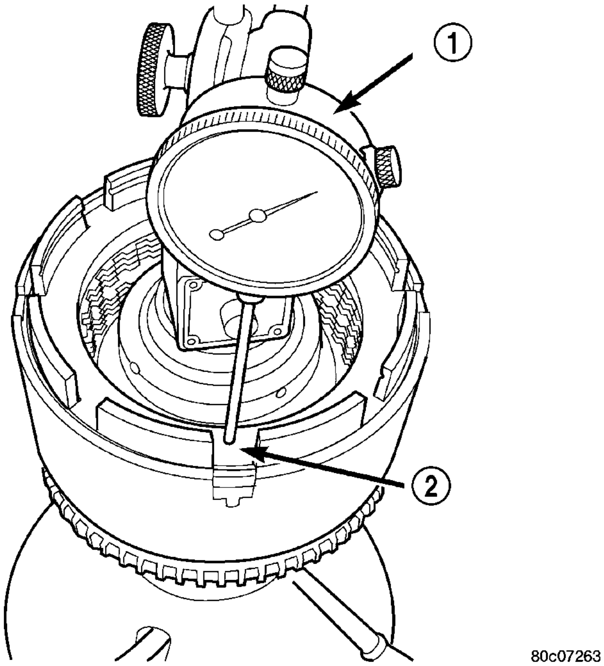


Fig. 209 Measure OD Clutch Pack Clearance

1 - DIAL INDICATOR
2 - OD/REVERSE PRESSURE PLATE

(26) Zero dial indicator and apply 30 psi (206 kPa) air pressure to the overdrive clutch hose on Tool 8391. Measure and record OD clutch pack measurement in four (4) places, 90° apart.

(27) Take average of four measurements and compare with OD clutch pack clearance specification. **The overdrive (OD) clutch pack clearance is 1.07-3.25 mm (0.042-0.128 in.).**

If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.

(28) Install reverse clutch pack (two fibers/one steel) (Fig. 210).

(29) Install reverse clutch reaction plate with the flat side down towards reverse clutch (Fig. 211).

(30) Tap reaction plate down to allow installation of the reverse clutch snap ring. Install reverse clutch snap ring (Fig. 212).

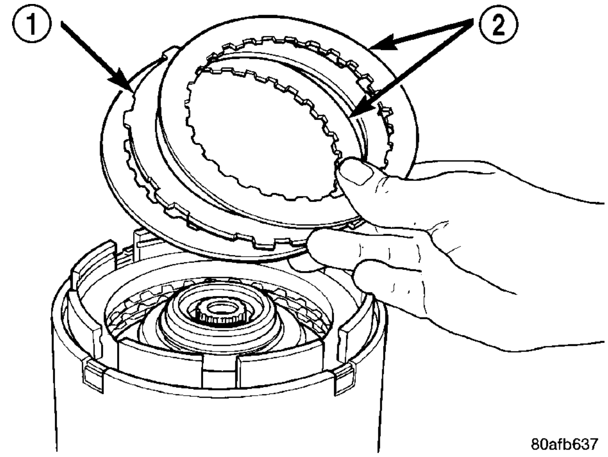


Fig. 210 Install Reverse Clutch Pack

1 - REVERSE CLUTCH PLATE
2 - REVERSE CLUTCH DISCS

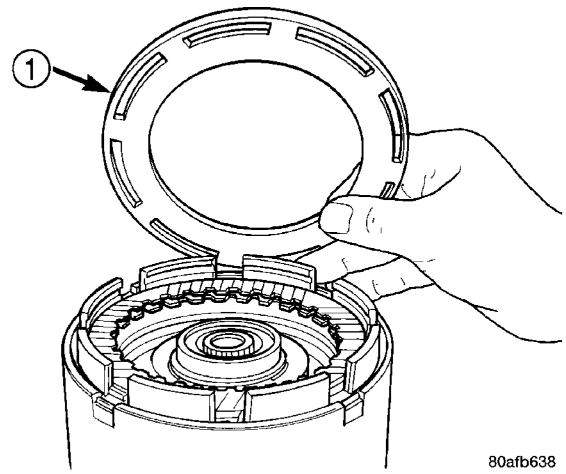


Fig. 211 Install Reaction Plate

1 - REVERSE CLUTCH REACTION PLATE (FLAT SIDE DOWN)

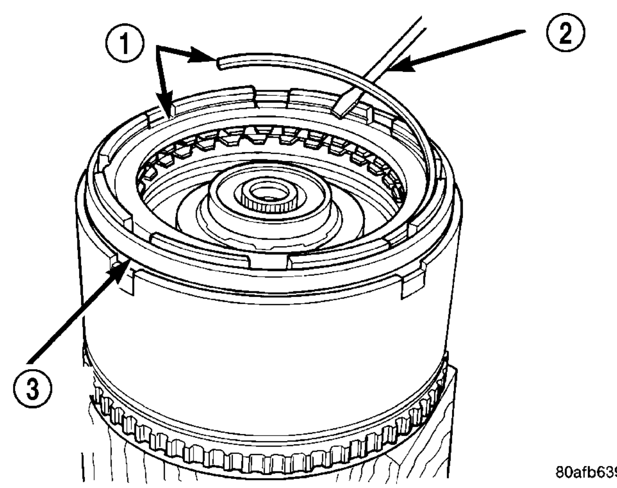


Fig. 212 Install Reverse Clutch Snap Ring

1 - REVERSE CLUTCH SNAP RING (SELECT)
2 - SCREWDRIVER
3 - REVERSE CLUTCH REACTION PLATE

INPUT CLUTCH ASSEMBLY (Continued)

(31) Pry up reverse reaction plate to seat against snap ring (Fig. 213).

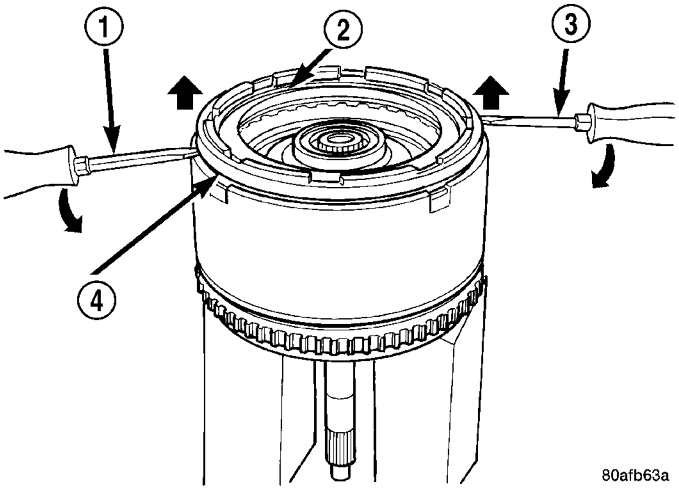


Fig. 213 Pry Up Reaction Plate

1 - SCREWDRIVER
2 - SNAP RING
3 - SCREWDRIVER
4 - MUST RAISE REVERSE REACTION PLATE TO RAISE SNAP RING

(32) Set up a dial indicator on the reverse clutch pack as shown in (Fig. 214).

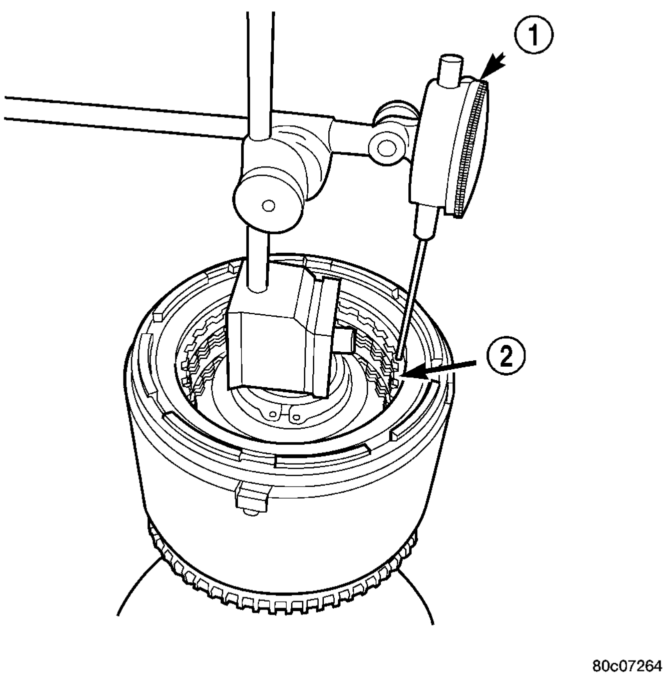


Fig. 214 Measure Reverse Clutch Pack Clearance

1 - DIAL INDICATOR
2 - REVERSE CLUTCH

(33) Using moderate pressure, press down and hold (near indicator) reverse clutch disc with screwdriver or suitable tool and zero dial indicator (Fig. 215). When releasing pressure, indicator should advance 0.005-0.010. as clutch pack relaxes.

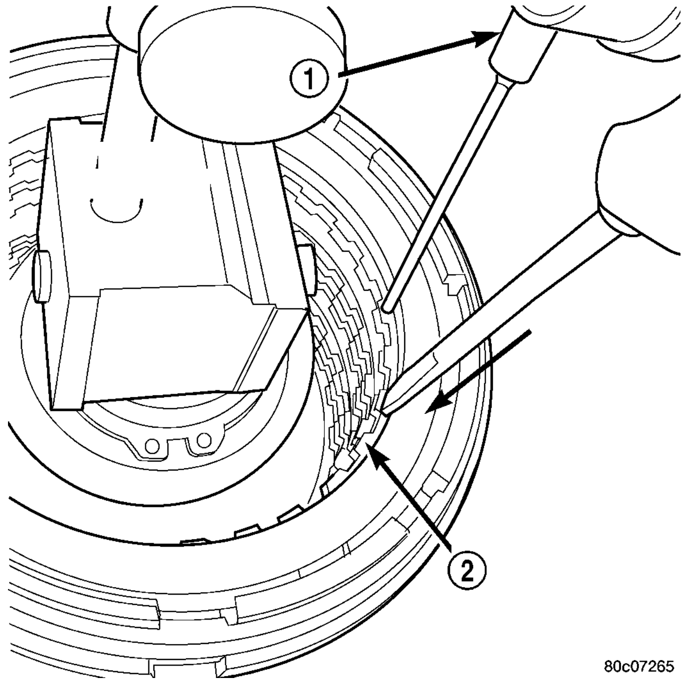


Fig. 215 Press Down on Reverse Clutch and Zero Indicator

1 - DIAL INDICATOR
2 - REVERSE CLUTCH

(34) Apply 30 psi (206 kPa) air pressure to the reverse clutch hose on Tool 8391. Measure and record reverse clutch pack measurement in four (4) places, 90° apart.

(35) Take average of four measurements and compare with reverse clutch pack clearance specification. **The reverse clutch pack clearance is 0.89-1.37 mm (0.035-0.054 in.).** Select the proper reverse clutch snap ring to achieve specifications:

(36) To complete the assembly, reverse clutch and overdrive clutch must be removed.

INPUT CLUTCH ASSEMBLY (Continued)

(37) Install the #2 needle bearing (Fig. 216).

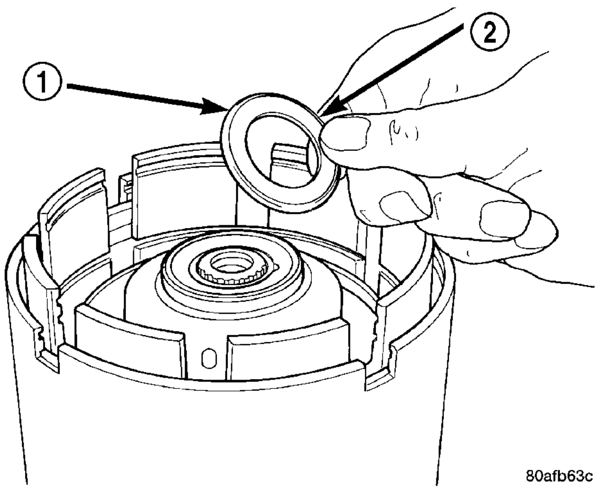


Fig. 216 Install No. 2 Needle Bearing

1 - #2 NEEDLE BEARING (NOTE 3 SMALL TABS)
2 - TABS UP

(38) Install the underdrive shaft assembly (Fig. 217).

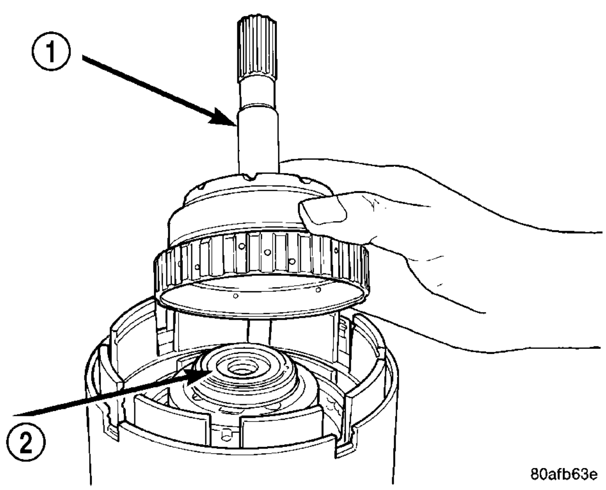


Fig. 217 Install Underdrive Shaft Assembly

1 - UNDERDRIVE SHAFT ASSEMBLY
2 - #2 NEEDLE BEARING

(39) Install the #3 thrust washer to the underdrive shaft assembly. Be sure five tabs are seated properly (Fig. 218).

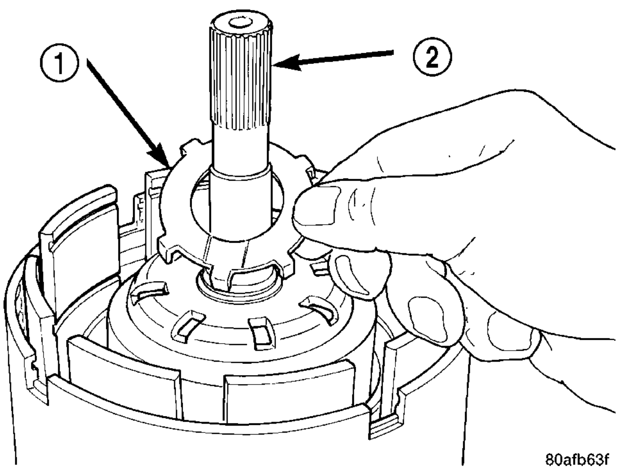


Fig. 218 Install No. 3 Thrust Washer

1 - #3 THRUST WASHER (NOTE 5 TABS)
2 - UNDERDRIVE SHAFT ASSEMBLY

(40) Install the #3 thrust plate to the bottom of the overdrive shaft assembly. Retain with petrolatum or transmission assembly gel (Fig. 219).

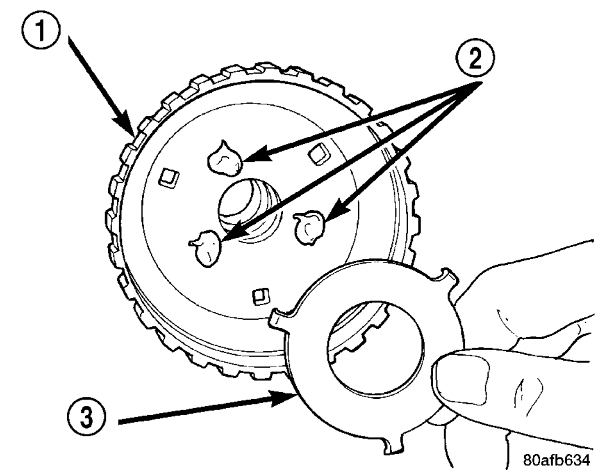


Fig. 219 Install No. 3 Thrust Plate

1 - OVERDRIVE SHAFT ASSEMBLY
2 - DABS OF PETROLATUM (FOR RETENTION)
3 - #3 THRUST PLATE (NOTE 3 TABS)

INPUT CLUTCH ASSEMBLY (Continued)

(41) Install the overdrive shaft assembly (Fig. 220).

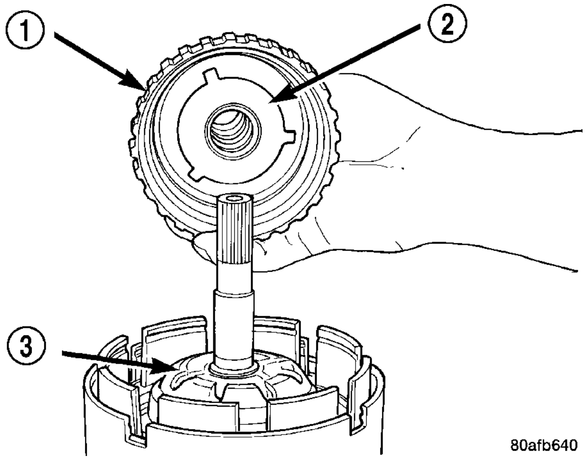


Fig. 220 Install Overdrive Shaft Assembly

1 - OVERDRIVE SHAFT ASSEMBLY
2 - #3 THRUST PLATE
3 - #3 THRUST WASHER

(42) Reinstall overdrive and reverse clutch as shown (Fig. 221). **Rechecking these clutch clearances is not necessary.**

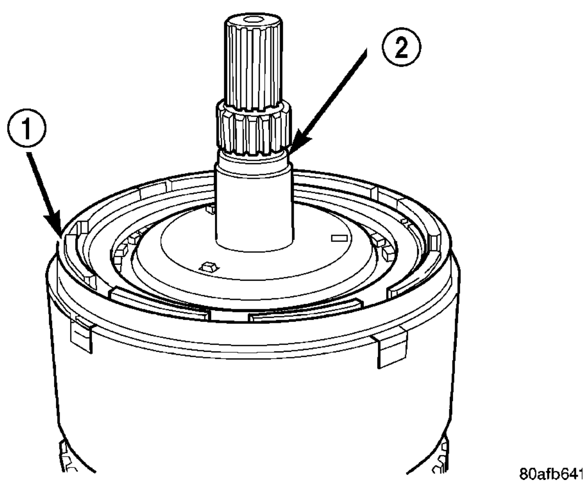


Fig. 221 Input Clutch Assembly

1 - INPUT CLUTCH ASSEMBLY
2 - OVERDRIVE SHAFT ASSEMBLY

INPUT SPEED SENSOR

DESCRIPTION

The Input and Output Speed Sensors (Fig. 222) are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

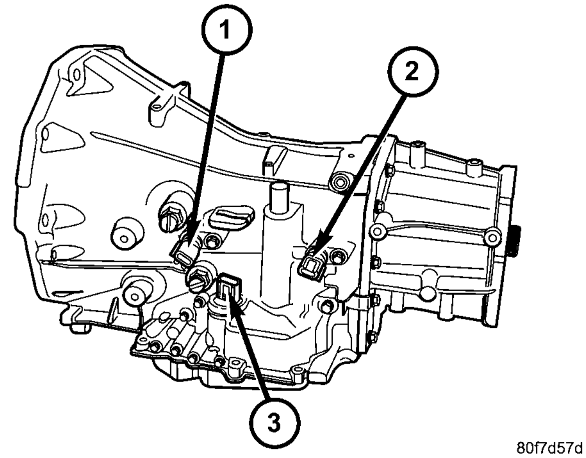


Fig. 222 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the input speed sensor (Fig. 223).

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

(4) Remove the bolt holding the input speed sensor to the transmission case.

(5) Remove the input speed sensor from the transmission case.

INPUT SPEED SENSOR (Continued)

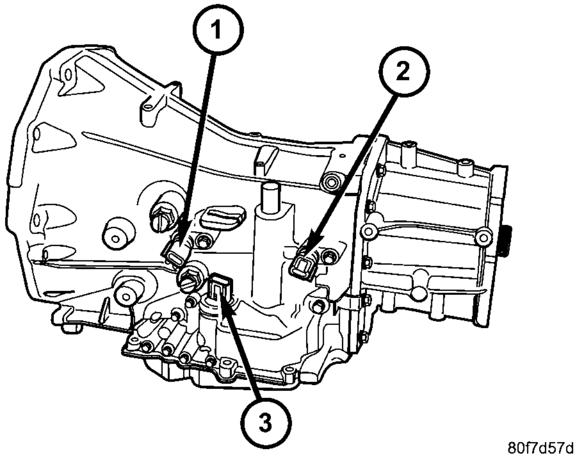


Fig. 223 Input Speed Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

INSTALLATION

(1) Install the input speed sensor into the transmission case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

(2) Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).

(3) Install the wiring connector onto the input speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

OIL PUMP

DESCRIPTION

The oil pump is located in the pump housing inside the bell housing of the transmission case. The oil pump assembly (Fig. 224) consists of an inner and outer gear, a housing, and a cover that also serves as the reaction shaft support.

OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area

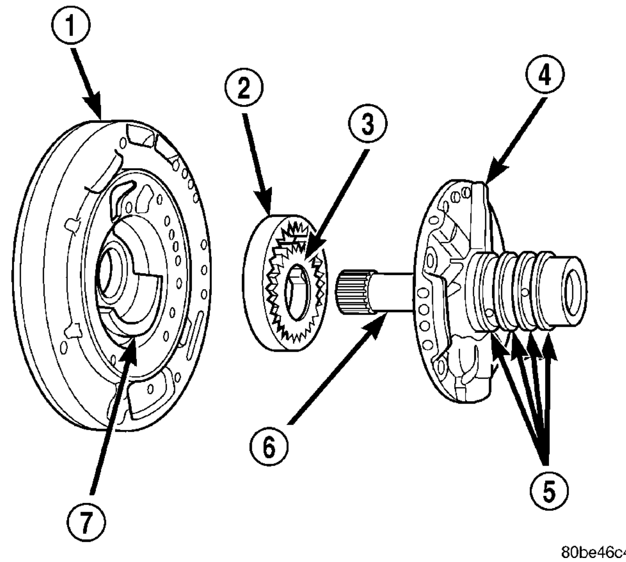


Fig. 224 Oil Pump Assembly

1 - PUMP HOUSING
2 - OUTER PUMP GEAR
3 - INNER PUMP GEAR
4 - REACTION SHAFT SUPPORT
5 - SEAL RINGS (4)
6 - REACTION SHAFT
7 - CRESCENT

decreases, it forces pressurized fluid into the pump outlet and to the valve body.

DISASSEMBLY

(1) Remove the reaction shaft support bolts.

(2) Remove reaction shaft support from pump housing (Fig. 225).

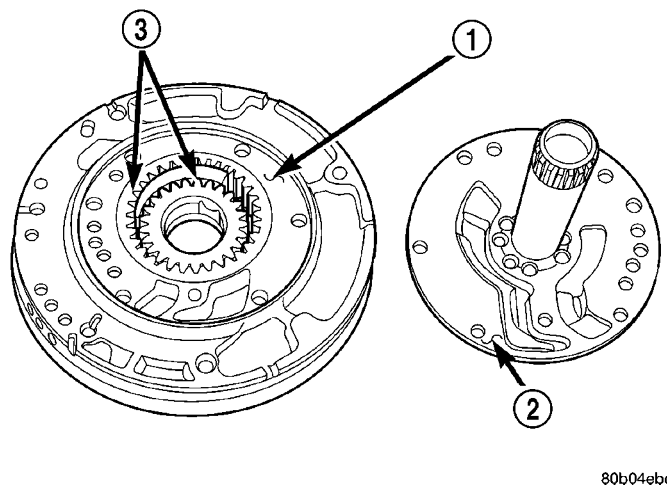


Fig. 225 Reaction Shaft Support

1 - PUMP HOUSING
2 - REACTION SHAFT SUPPORT
3 - PUMP GEARS

OIL PUMP (Continued)

(3) Remove the pump gears (Fig. 226) and check for wear and damage on pump housing and gears.

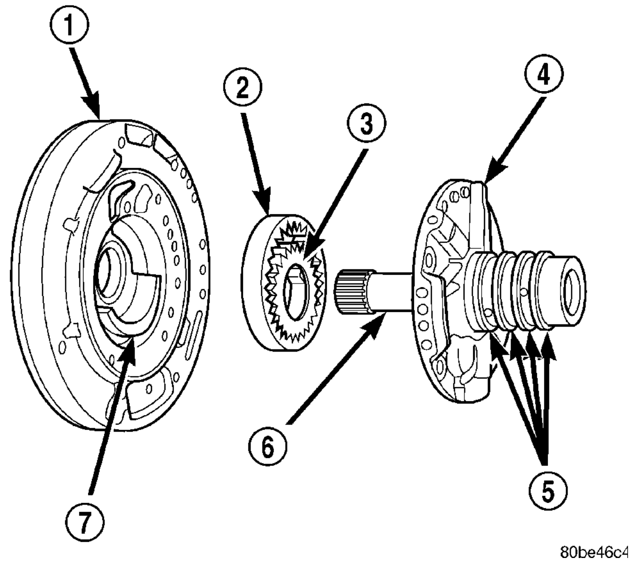


Fig. 226 Oil Pump Assembly

1 - PUMP HOUSING
2 - OUTER PUMP GEAR
3 - INNER PUMP GEAR
4 - REACTION SHAFT SUPPORT
5 - SEAL RINGS (4)
6 - REACTION SHAFT
7 - CRESCENT

(4) Re-install the gears and check clearances.

(5) Measure the clearance between the outer gear and the pump pocket (Fig. 227). Clearance should be 0.089-0.202 mm (0.0035-0.0079 in.).

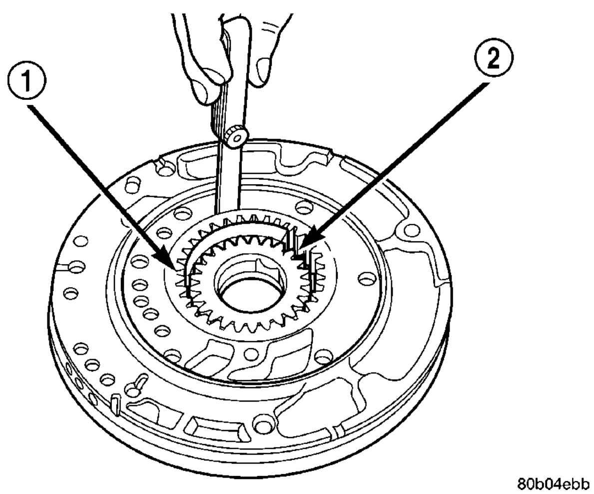


Fig. 227 Measure Outer Gear to Pocket

1 - OUTER GEAR
2 - POCKET

(6) Measure clearance between outer gear and crescent. Clearance should be 0.060-0.298 mm (0.0023-0.0117 in.).

(7) Measure clearance between inner gear and crescent. Clearance should be 0.093-0.385 mm (0.0036-0.0151 in.).

(8) Position an appropriate piece of Plastigage across both pump gears.

(9) Align the Plastigage to a flat area on the reaction shaft support housing.

(10) Install the reaction shaft to the pump housing. Tighten the bolts to 27 N·m (20 ft. lbs.).

(11) Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.

(12) Clearance between outer gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046 mm (0.0008-0.0018 in.).

ASSEMBLY

(1) Assemble oil pump as shown in (Fig. 228)

(2) Install and torque reaction shaft support-to-oil pump housing bolts to 28 N·m (20 ft. lbs.) torque.

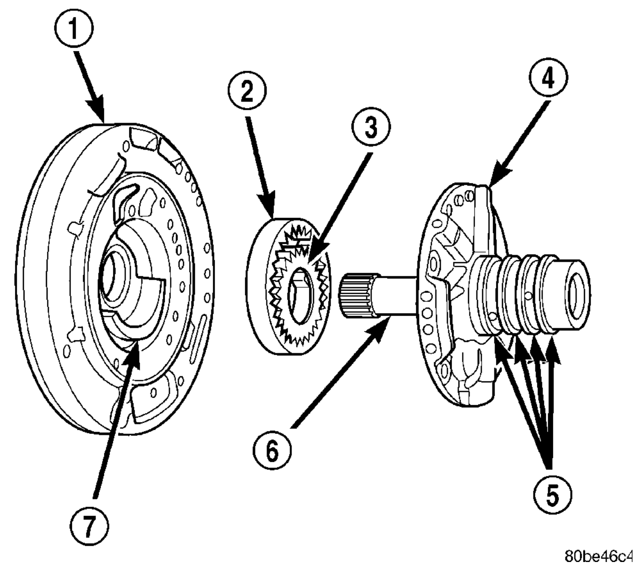


Fig. 228 Oil Pump Assembly

1 - PUMP HOUSING
2 - OUTER PUMP GEAR
3 - INNER PUMP GEAR
4 - REACTION SHAFT SUPPORT
5 - SEAL RINGS (4)
6 - REACTION SHAFT
7 - CRESCENT

OUTPUT SPEED SENSOR

DESCRIPTION

The Input and Output Speed Sensors (Fig. 229) are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

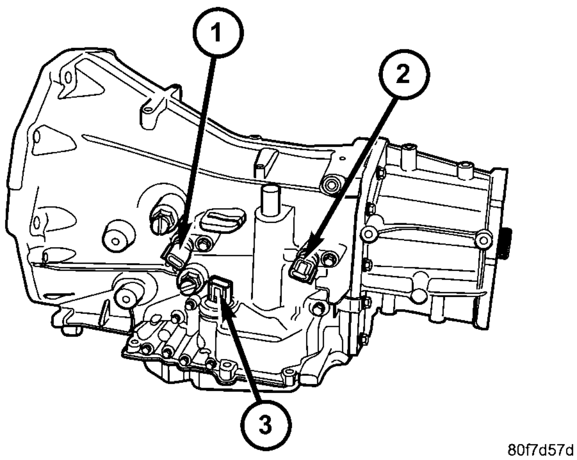


Fig. 229 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the output speed sensor (Fig. 230).

NOTE: The speed sensor bolt has a sealing patch applied from the factory. Be sure to reuse the same bolt.

(4) Remove the bolt holding the output speed sensor to the transmission case.

(5) Remove the output speed sensor from the transmission case.

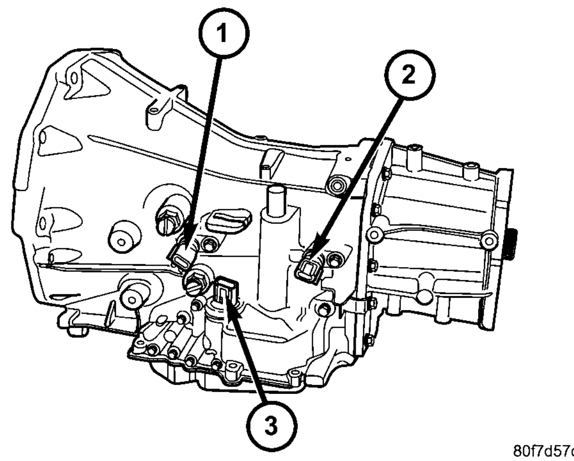


Fig. 230 Input and Output Speed Sensors and Transmission Range Sensor

1 - INPUT SPEED SENSOR
2 - OUTPUT SPEED SENSOR
3 - TRANSMISSION RANGE SENSOR

INSTALLATION

(1) Install the output speed sensor into the transmission case.

NOTE: Before installing the speed sensor bolt, it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

(2) Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 9 N·m (80 in.lbs.).

(3) Install the wiring connector onto the output speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

OVERDRIVE SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the center console (Fig. 231). The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.

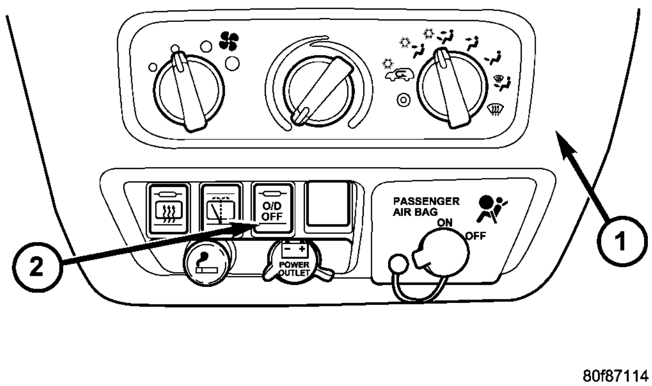


Fig. 231 Overdrive Off Switch

1 - ACCESSORY SWITCH BEZEL
2 - OVERDRIVE OFF SWITCH

OPERATION

At key-on, overdrive operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

REMOVAL

(1) Remove the accessory switch bezel (Fig. 232)(Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL).

(2) Remove the overdrive off switch from the accessory switch bezel.

INSTALLATION

(1) Install the overdrive off switch to the accessory switch bezel.

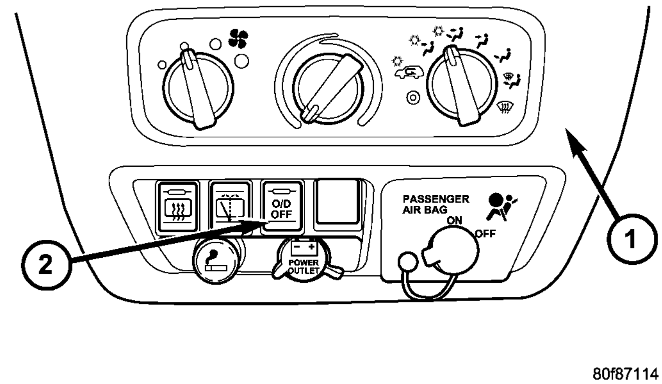


Fig. 232 Overdrive Off Switch

1 - ACCESSORY SWITCH BEZEL
2 - OVERDRIVE OFF SWITCH

(2) Install the accesory switch bezel (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION).

PLANETARY GEARTRAIN

DESCRIPTION

The planetary geartrain is located between the input clutch assembly and the rear of the transmission case. The planetary geartrain consists of two sun gears, two planetary carriers, two annulus (ring) gears, and one output shaft (Fig. 233).

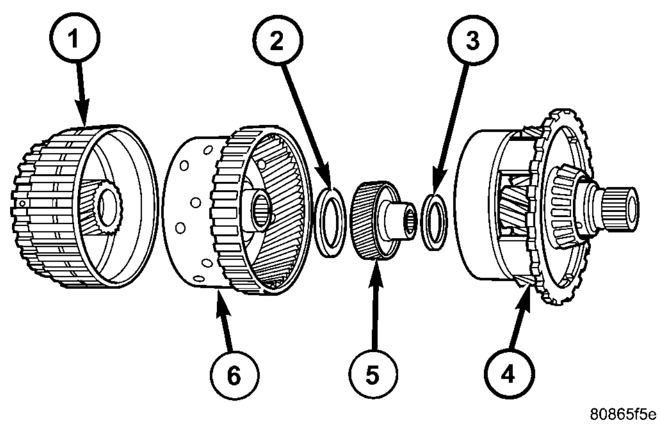


Fig. 233 Planetary Geartrain

1 - FRONT SUN GEAR ASSEMBLY
2 - #6 THRUST BEARING
3 - #7 THRUST BEARING
4 - REAR CARRIER FRONT ANNULUS ASSEMBLY
5 - REAR SUN GEAR
6 - FRONT CARRIER REAR ANNULUS ASSEMBLY

PLANETARY GEARTRAIN (Continued)

OPERATION

The planetary geartrain utilizes two planetary gear sets that connect the transmission input shaft to the output shaft. Input and holding clutches drive or lock different planetary members to change output ratio or direction.

SEAL - OIL PUMP

REMOVAL

(1) Remove the transmission from the vehicle (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - REMOVAL).

(2) Remove the torque converter from the transmission bellhousing.

(3) Use special tool C-3981B to remove oil pump seal.

INSTALLATION

(1) Clean and inspect oil pump seal seat. Then install seal using special tool C-4193-A.

(2) Clean and inspect torque converter hub. If nicks, scratches or hub wear are found, torque converter replacement will be required.

CAUTION: If the torque converter is being replaced, apply a light coating of grease to the crankshaft pilot hole. Also inspect the engine drive plate for cracks. If any cracks are found replace the drive plate. Do not attempt to repair a cracked drive plate. Always use new torque converter to drive plate bolts.

(3) Apply a light film of transmission oil to the torque converter hub and oil seal lips. Then install torque converter into transmission. Be sure that the hub lugs mesh with the front pump lugs when installing.

(4) Reinstall the transmission into the vehicle.

SHIFT MECHANISM

DESCRIPTION

The shift mechanism is cable operated and provides six shift positions. The shift indicator is located on the console next to the gear shift. The shift positions are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual Second (2)
- Manual Low (1)

OPERATION

Manual low (1) range provides first gear only. Over run braking is also provided in this range. Manual second (2) range provides first and second gear only. Drive range provides first, second, and third gear ranges.

DIAGNOSIS AND TESTING - SHIFT MECHANISM

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position - Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position - Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position - Normal position. Engine starts must be possible.

(d) NEUTRAL position - Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from NEUTRAL to REVERSE.

ADJUSTMENTS - SHIFT MECHANISM

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the TRS may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into PARK.

(2) Remove floor console as necessary for access to the shift cable adjustment. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(3) Loosen the shift cable adjustment nut.

(4) Raise vehicle.

(5) Unsnap cable eyelet from transmission shift lever.

(6) Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

SHIFT MECHANISM (Continued)

(9) Lower vehicle

(10) Tighten the shift cable adjustment screw to 12 N·m (105 in.lbs.).

(11) Verify correct operation.

(12) Install any floor console components removed for access. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open (Fig. 234)** or **normally closed (Fig. 235)**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or
2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

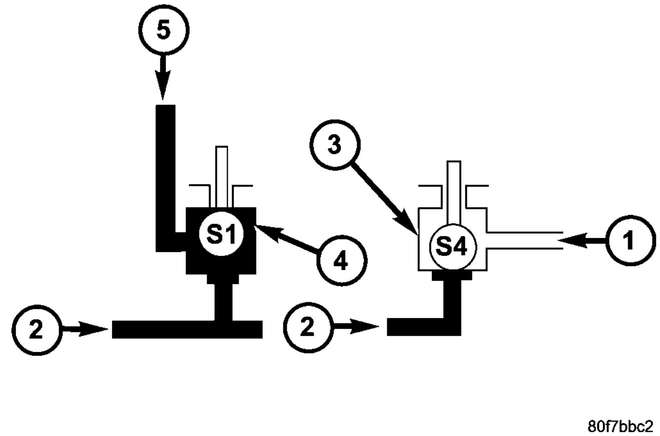


Fig. 234 2/4 - Low Reverse and Underdrive Solenoids

1 - MANUAL VALVE
2 - LINE PRESSURE
3 - 2/4 - LOW REVERSE SOLENOID ENERGIZED
4 - UNDERDRIVE SOLENOID DE-ENERGIZED
5 - UNDERDRIVE CLUTCH

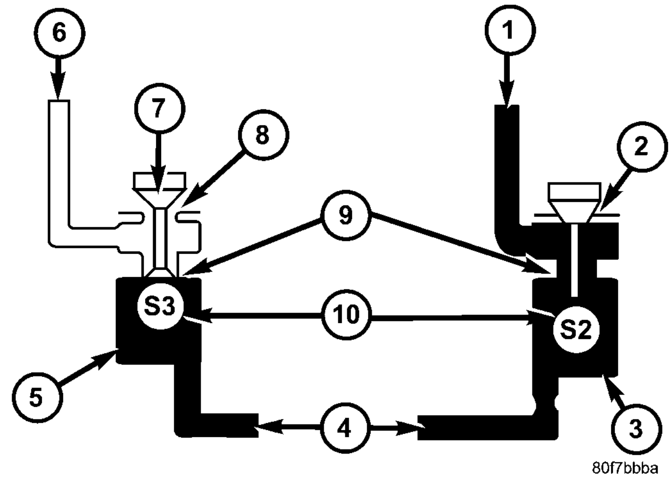


Fig. 235 Low Reverse/Converter Clutch and Overdrive Solenoids

1 - OVERDRIVE CLUTCH
2 - NO VENT
3 - OVERDRIVE SOLENOID ENERGIZED
4 - MANUAL VALVE
5 - LOW REVERSE/CONVERTER CLUTCH SOLENOID DE-ENERGIZED
6 - SOLENOID SWITCH VALVE
7 - TAPER
8 - VENT TO SUMP
9 - ORIFICE
10 - CHECK BALL

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to posi-

SOLENOID (Continued)

tion the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

SOLENOID/PRESSURE SWITCH ASSY

DESCRIPTION

The Solenoid/Pressure Switch Assembly (Fig. 236) is inside the transmission and mounted to the valve body assembly. The assembly consists of four solenoids that control hydraulic pressure to the L/R, 2/4, OD, and UD friction elements (transmission clutches), and the torque converter clutch. The reverse clutch is controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid/Pressure Switch Assembly, and can only be serviced by replacing the assembly.

The solenoid assembly also contains pressure switches that monitor and send hydraulic circuit information to the PCM. Likewise, the pressure switches can only be service by replacing the assembly.

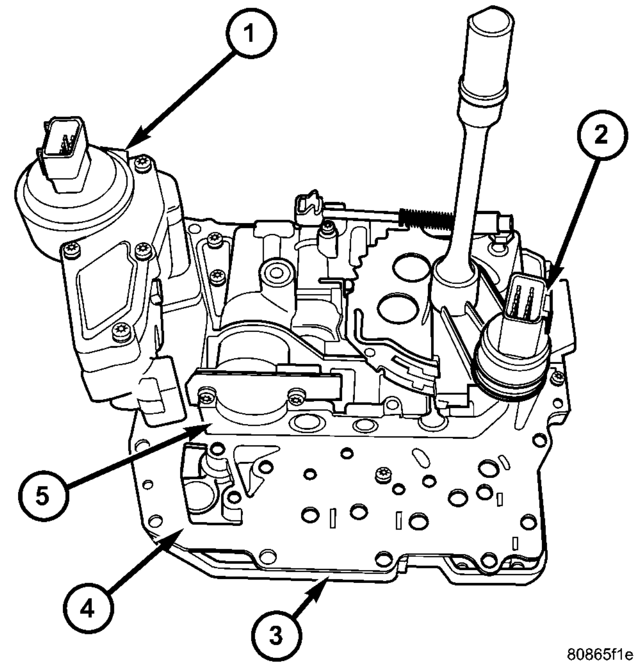


Fig. 236 Valve Body Assembly

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - TRS
3 - TRANSFER PLATE
4 - SEPARATOR PLATE
5 - VALVE BODY

OPERATION

SOLENOIDS

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The PCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The 2/4 and UD solenoids are normally applied, which allows fluid to pass through in their relaxed or “off” state. By design, this allows transmission limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the pcm during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

SOLENOID/PRESSURE SWITCH ASSY (Continued)

PRESSURE SWITCHES

The PCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the PCM detect when clutch circuit hydraulic failures occur. The range for the pressure switch closing and opening points is 11-23 psi. Typically the switch opening point will be approximately one psi lower than the closing point. For example, a switch may close at 18 psi and open at 17 psi. The switches are continuously monitored by the PCM for the correct states (open or closed) in each gear as shown in the following chart:

PRESSURE SWITCH STATES

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

CL = CLOSED

A Diagnostic Trouble Code (DTC) will set if the PCM senses any switch open or closed at the wrong time in a given gear.

The PCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 3rd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the PCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

REMOVAL

NOTE: If the Solenoid/Pressure Switch Assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

(1) Raise vehicle on hoist.

(2) Remove valve body assembly from transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - REMOVAL)

(3) Remove Solenoid/Pressure Switch Assembly retaining screws from solenoid (Fig. 237).

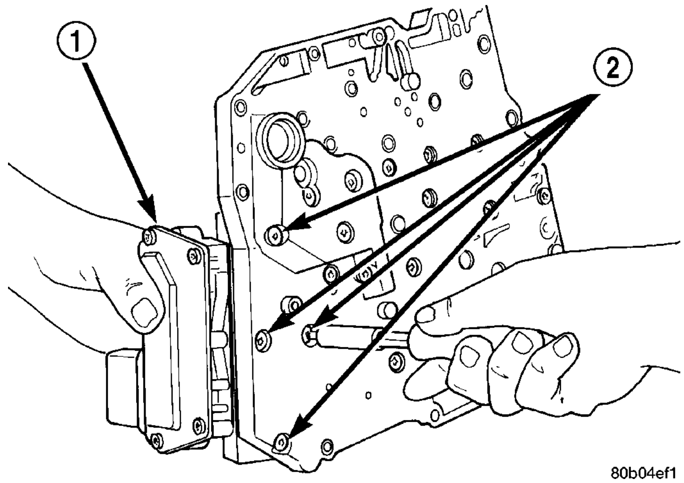


Fig. 237 Solenoid Retaining Screws

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - RETAINING SCREWS

(4) Remove Solenoid/Pressure Switch Assembly and screen from valve body (Fig. 238).

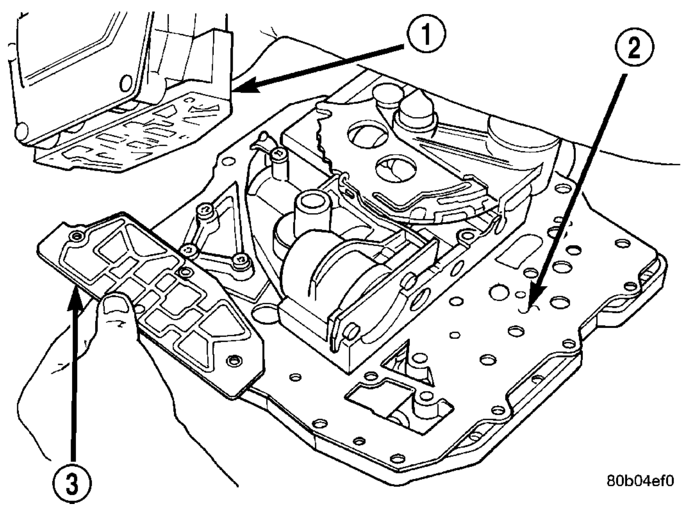


Fig. 238 Solenoid/Pressure Switch Assembly and Screen

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - VALVE BODY
3 - SCREEN

INSTALLATION

NOTE: If the Solenoid/Pressure Switch assembly is being replaced, the Quick Learn Procedure must be performed. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

SOLENOID/PRESSURE SWITCH ASSY (Continued)

(1) Install Solenoid/Pressure Switch Assembly and screen to the separator and transfer plates.

(2) Install and tighten retaining screws to 5.5 N·m (50 in. lbs.) torque.

(3) Install valve body. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/VALVE BODY - INSTALLATION)

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 239) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid.

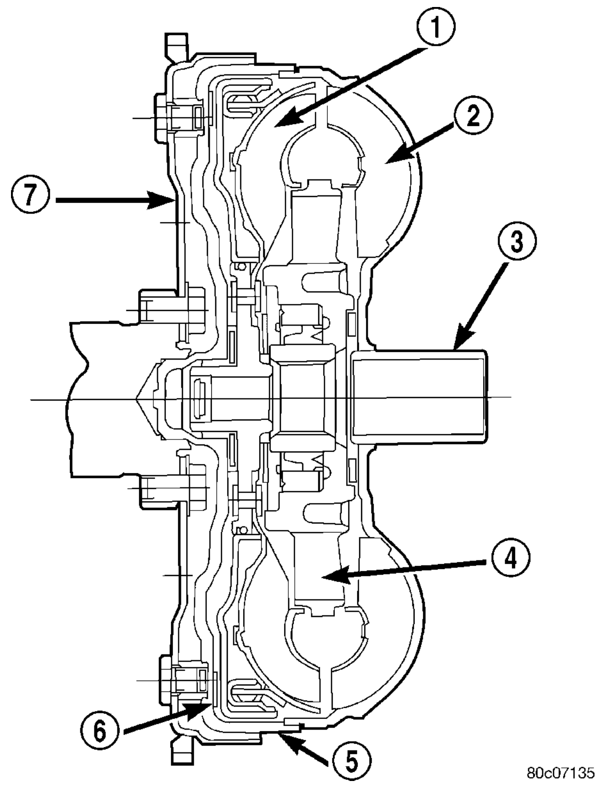


Fig. 239 Torque Converter Assembly

1 - TURBINE
2 - IMPELLER
3 - HUB
4 - STATOR
5 - FRONT COVER
6 - CONVERTER CLUTCH DISC
7 - DRIVE PLATE

TORQUE CONVERTER (Continued)

IMPELLER

The impeller (Fig. 240) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

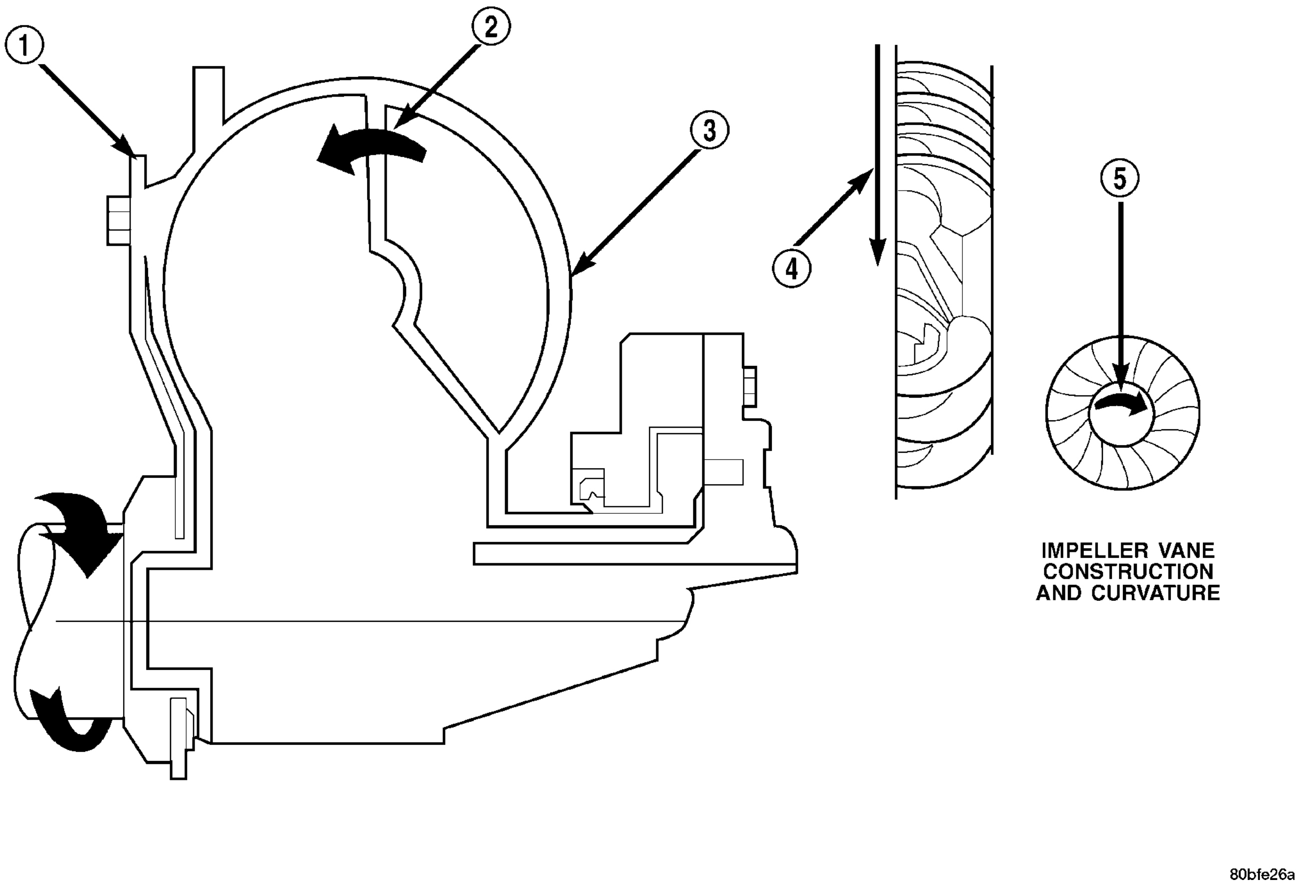


Fig. 240 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

TORQUE CONVERTER (Continued)

TURBINE

The turbine (Fig. 241) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

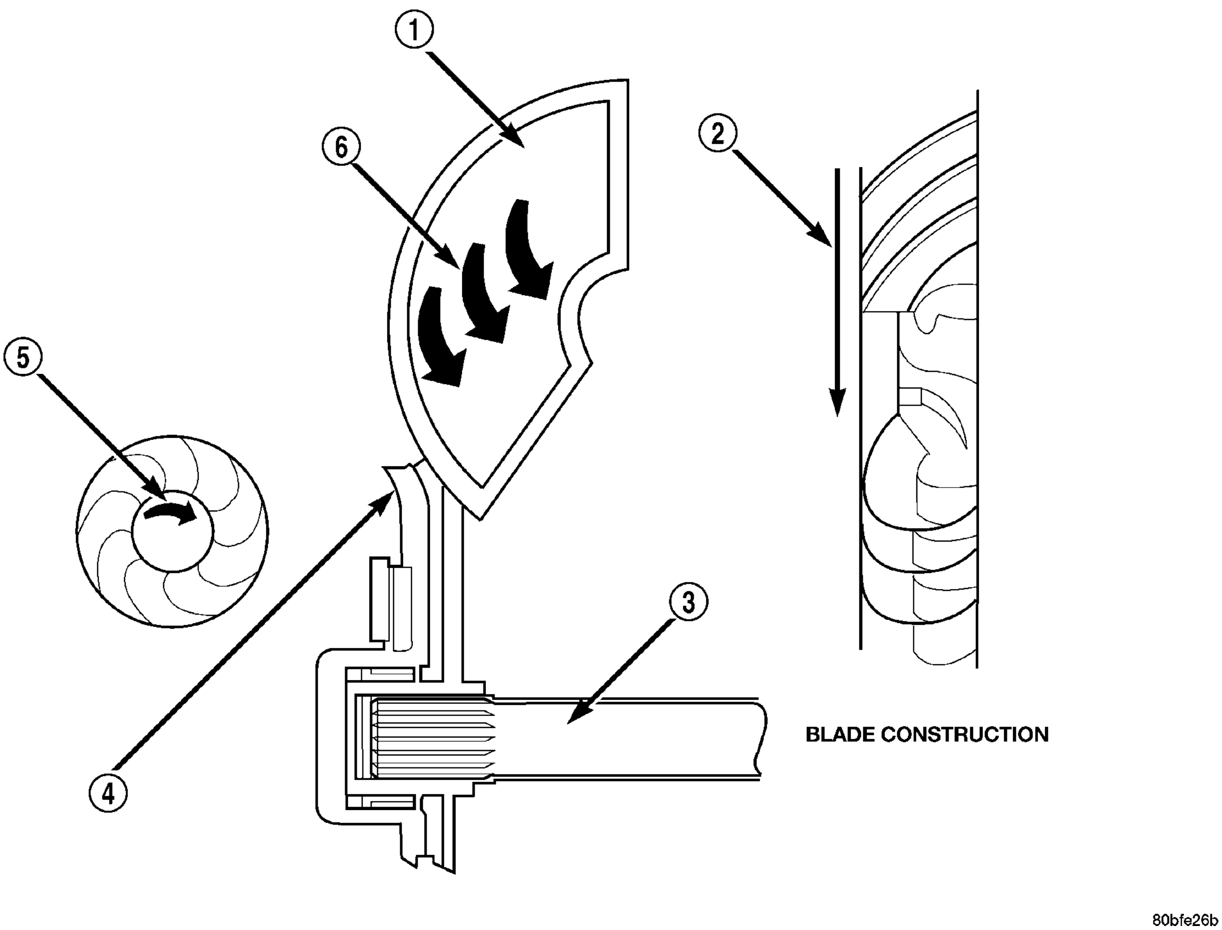


Fig. 241 Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

TORQUE CONVERTER (Continued)

STATOR

The stator assembly (Fig. 242) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 243). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

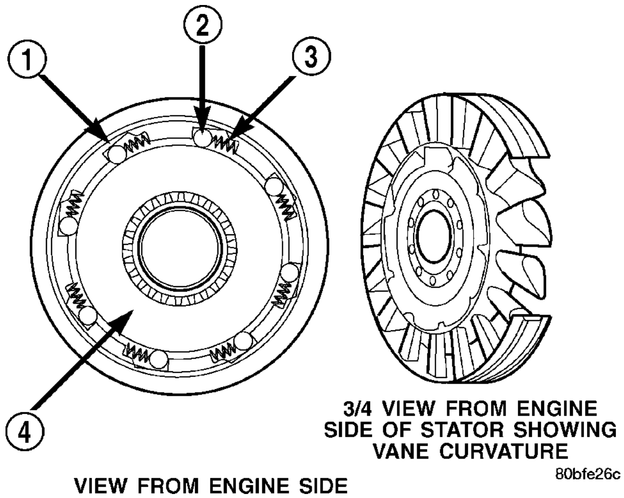


Fig. 242 Stator Components

1 - CAM (OUTER RACE)
2 - ROLLER
3 - SPRING
4 - INNER RACE

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 244) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.

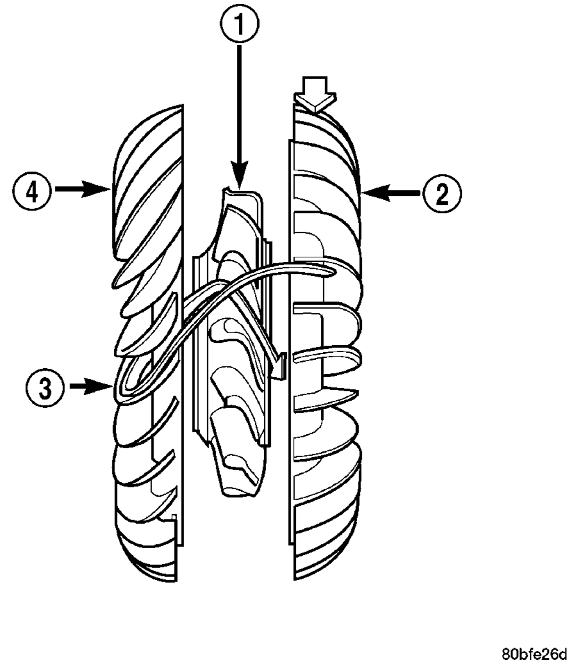


Fig. 243 Stator Location

1 - STATOR
2 - IMPELLER
3 - FLUID FLOW
4 - TURBINE

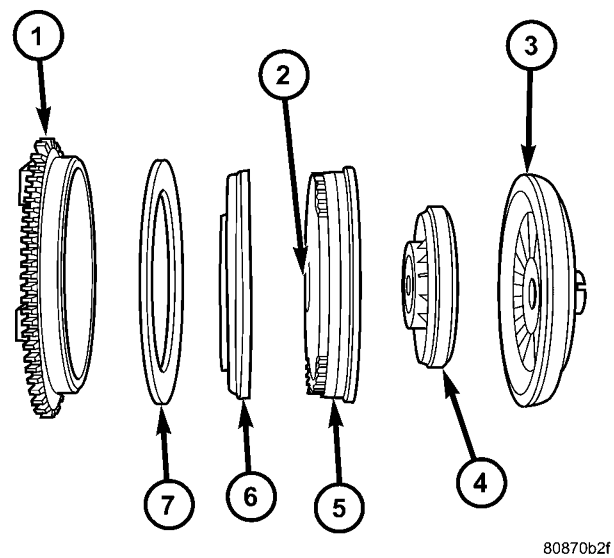


Fig. 244 Torque Converter Clutch (TCC)

1 - IMPELLER FRONT COVER
2 - THRUST WASHER ASSEMBLY
3 - IMPELLER
4 - STATOR
5 - TURBINE
6 - PISTON
7 - FRICTION DISC

OPERATION

The converter impeller (Fig. 245) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

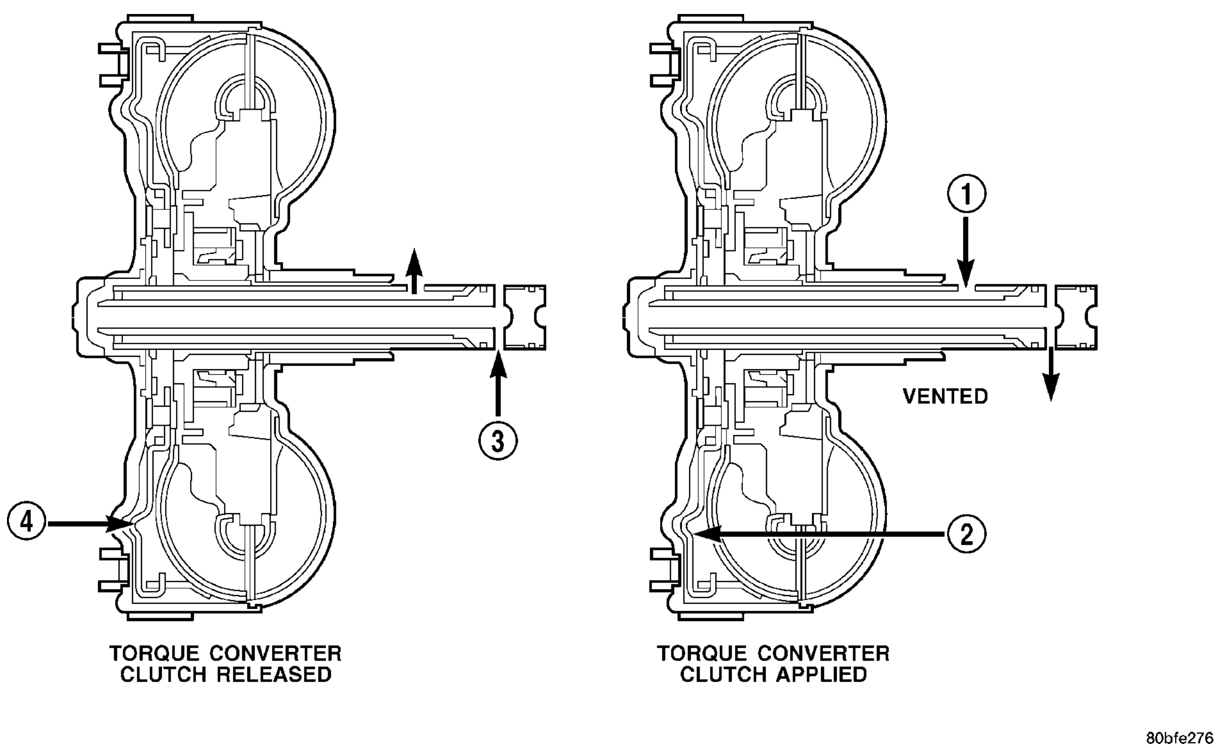


Fig. 245 Torque Converter Fluid Operation

1 - APPLY PRESSURE
2 - THE PISTON MOVES SLIGHTLY FORWARD
3 - RELEASE PRESSURE
4 - THE PISTON MOVES SLIGHTLY REARWARD

TORQUE CONVERTER (Continued)

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 246). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counter-clockwise direction. When this happens the overrunning clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

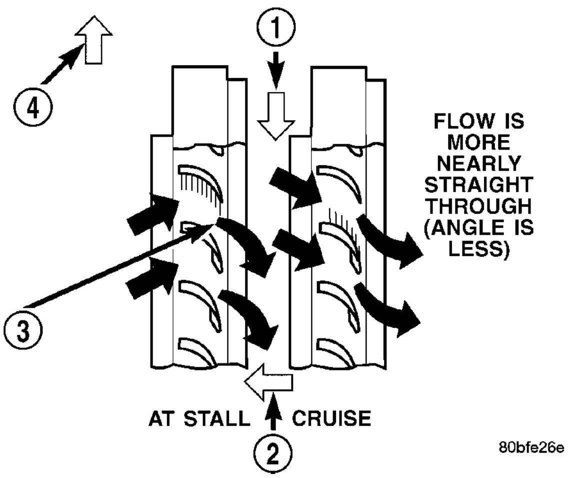


Fig. 246 Stator Operation

1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 - FRONT OF ENGINE
3 - INCREASED ANGLE AS OIL STRIKES VANES
4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

TORQUE CONVERTER CLUTCH (TCC)

The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased.

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

TORQUE CONVERTER (Continued)

(6) Check converter seating with a scale and straightedge (Fig. 247). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

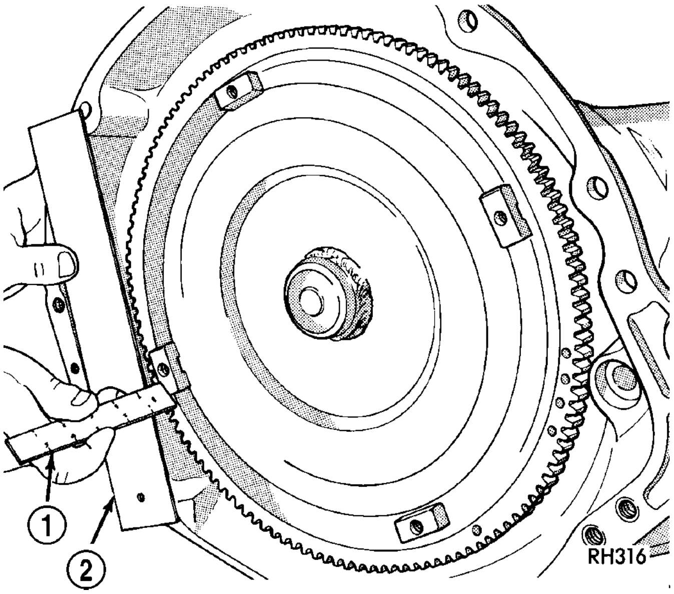


Fig. 247 Checking Torque Converter Seating - Typical

1 - SCALE
2 - STRAIGHTEDGE

TRANSMISSION CONTROL RELAY

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is “off”, no power is supplied to the solenoid pack and the transmission is in “limp-in” mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

TRANSMISSION RANGE SENSOR

DESCRIPTION

The Transmission Range Sensor (TRS) is mounted to the top of the valve body inside the transmission and can only be serviced by removing the valve body assembly. The electrical connector extends through the transmission case (Fig. 248).

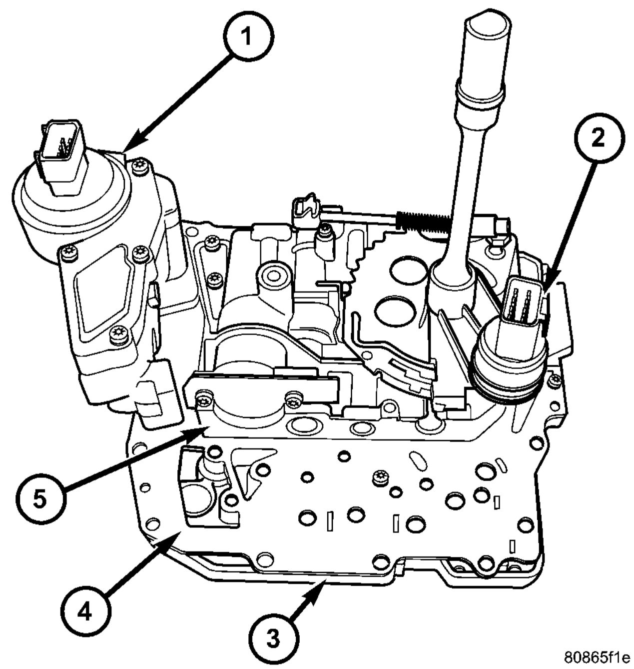


Fig. 248 Valve Body Assembly

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - TRS
3 - TRANSFER PLATE
4 - SEPARATOR PLATE
5 - VALVE BODY

The Transmission Range Sensor (TRS) has four switch contacts that monitor shift lever position and send the information to the PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position (SLP) to the PCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the PCM receives from four sense circuits. The PCM interprets this information and determines the appropriate transmission gear position and shift schedule.

Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as “between gear” codes. This results in six codes which should never occur. These

TRANSMISSION RANGE SENSOR (Continued)

are called “invalid” codes. An invalid code will result in a DTC, and the PCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

TRS SWITCH STATES

SLP	T42	T41	T3	T1
P	CL	CL	CL	OP
R	CL	OP	OP	OP
N	CL	CL	OP	CL
D	OP	OP	OP	CL
2	OP	OP	CL	OP
1	CL	OP	CL	CL

REMOVAL

(1) Disconnect the TRS connector.
(2) Remove valve body assembly from vehicle.
(3) Remove the manual shaft seal (Fig. 249).

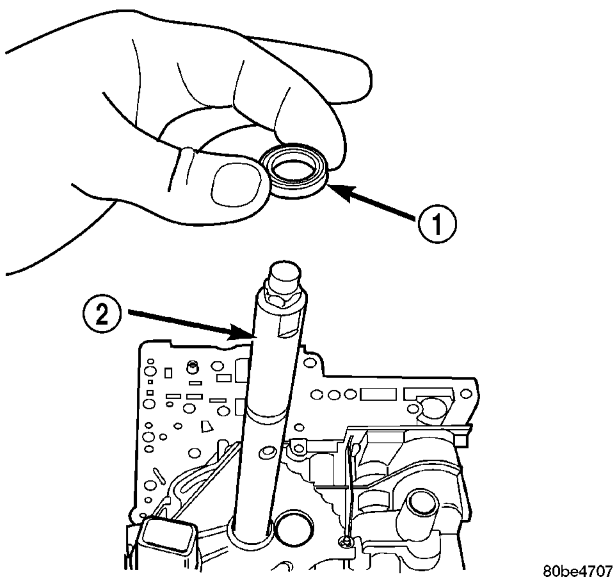


Fig. 249 Manual Shaft Seal - Typical

1 - SEAL
2 - MANUAL SHAFT

(4) Remove manual shaft/TRS retaining screw (Fig. 250).
(5) Slide TRS off of manual valve shaft.

INSTALLATION

(1) Install the TRS to the manual shaft. Make sure TRS locating pin rests in manual valve bore slot.
(2) Install the TRS/manual shaft retaining screw and torque to 5 N·m (45 in. lbs.) torque.
(3) Install the manual shaft seal.
(4) Install valve body to the transmission.

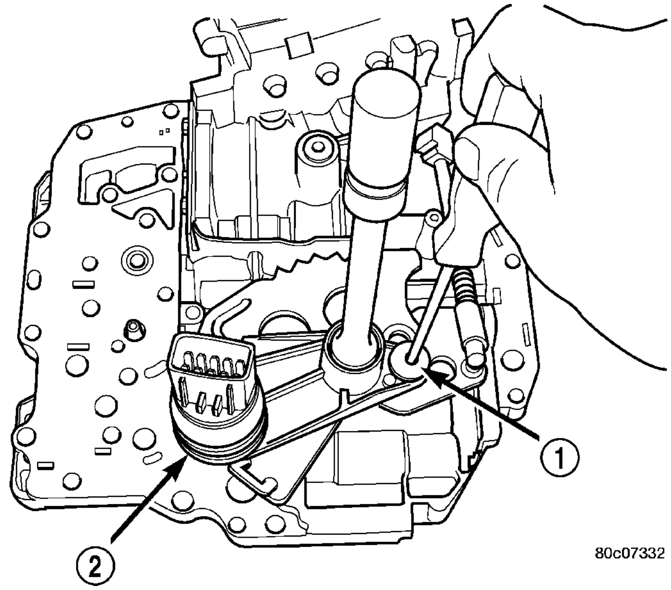


Fig. 250 Manual Shaft Retaining Screw

1 - SCREW
2 - TRS

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

The transmission temperature sensor (Fig. 251) is located in the transmission range sensor and communicates transmission sump temperature to the PCM.

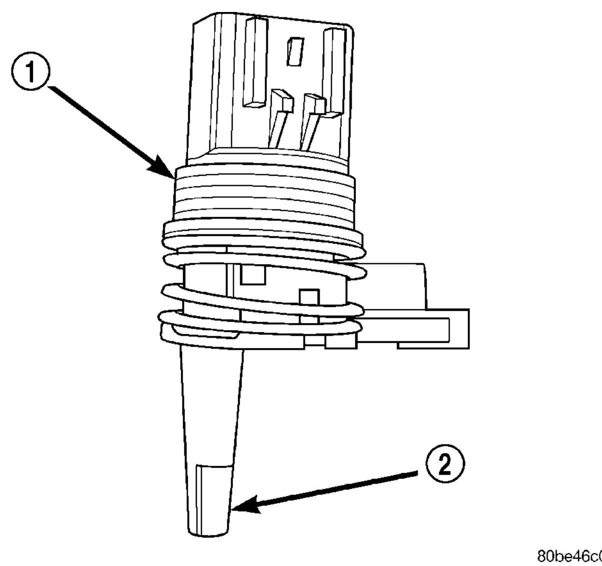


Fig. 251 Transmission Temperature Sensor

1 - TRANSMISSION RANGE SENSOR
2 - TEMPERATURE SENSOR

OPERATION

The TRS has an integrated thermistor that the PCM uses to monitor the transmission's sump temperature. Since fluid temperature can affect transmission shift quality and convertor lock up, the PCM requires this information to determine which shift schedule to operate in. The PCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission "overheat" condition exists. If the thermistor circuit fails, the PCM will revert to calculated oil temperature usage.

CALCULATED TEMPERATURE

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

VALVE BODY

DESCRIPTION

The valve body assembly (Fig. 252) consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, solenoid/pressure switch assembly, and frictional clutches.

Also mounted to the valve body assembly are the solenoid/pressure switch assembly and the transmission range sensor (Fig. 252).

The valves contained within the valve body include the following (Fig. 253):

- Regulator valve
- Solenoid switch valve
- Manual valve
- Converter clutch switch valve
- Converter clutch control valve
- Torque converter regulator valve
- Low/Reverse switch valve

In addition, the valve body also contains the thermal valve, #2, 3, 4 & 5 check balls and the 2/4 accumulator assembly.

OPERATION

NOTE: (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE - SCHEMATICS AND DIAGRAMS) for a visual aid in determining valve location, operation and design.

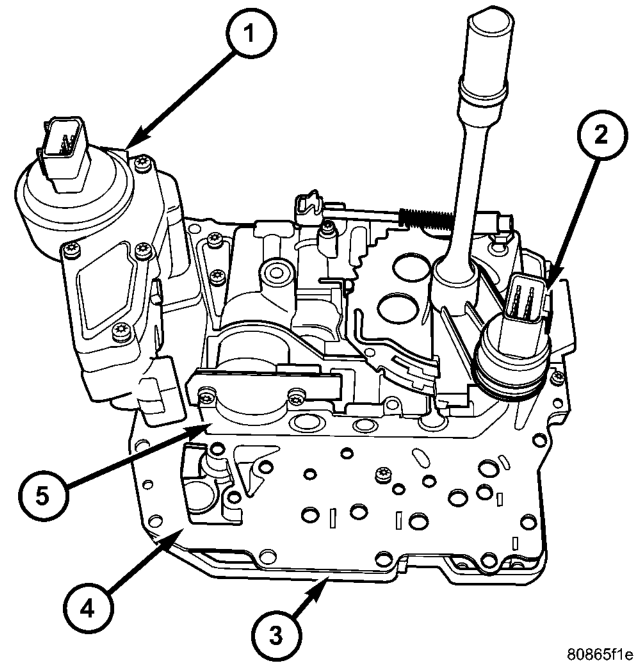


Fig. 252 Valve Body Assembly

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - TRS
3 - TRANSFER PLATE
4 - SEPARATOR PLATE
5 - VALVE BODY

THERMAL VALVE

The thermal valve is a bi-metallic shudder valve that helps control the venting rate of oil pressure in the underdrive clutch passage during release of the clutch (Fig. 254). When the oil temperature is approximately 20 degrees Fahrenheit or less, the valve is fully open to assist in venting oil past the U1 orifice. At temperatures above 20 degrees, the valve starts to close and becomes fully closed at approximately 140 degrees. The thermal valve is located in the transfer plate of the valve body.

REGULATOR VALVE

The regulator valve (Fig. 255) controls hydraulic pressure in the transmission. It receives unregulated pressure from the pump, which works against spring tension to maintain oil at specific pressures. A system of sleeves and ports allows the regulator valve to work at one of three predetermined pressure levels. Regulated oil pressure is also referred to as "line pressure."

VALVE BODY (Continued)

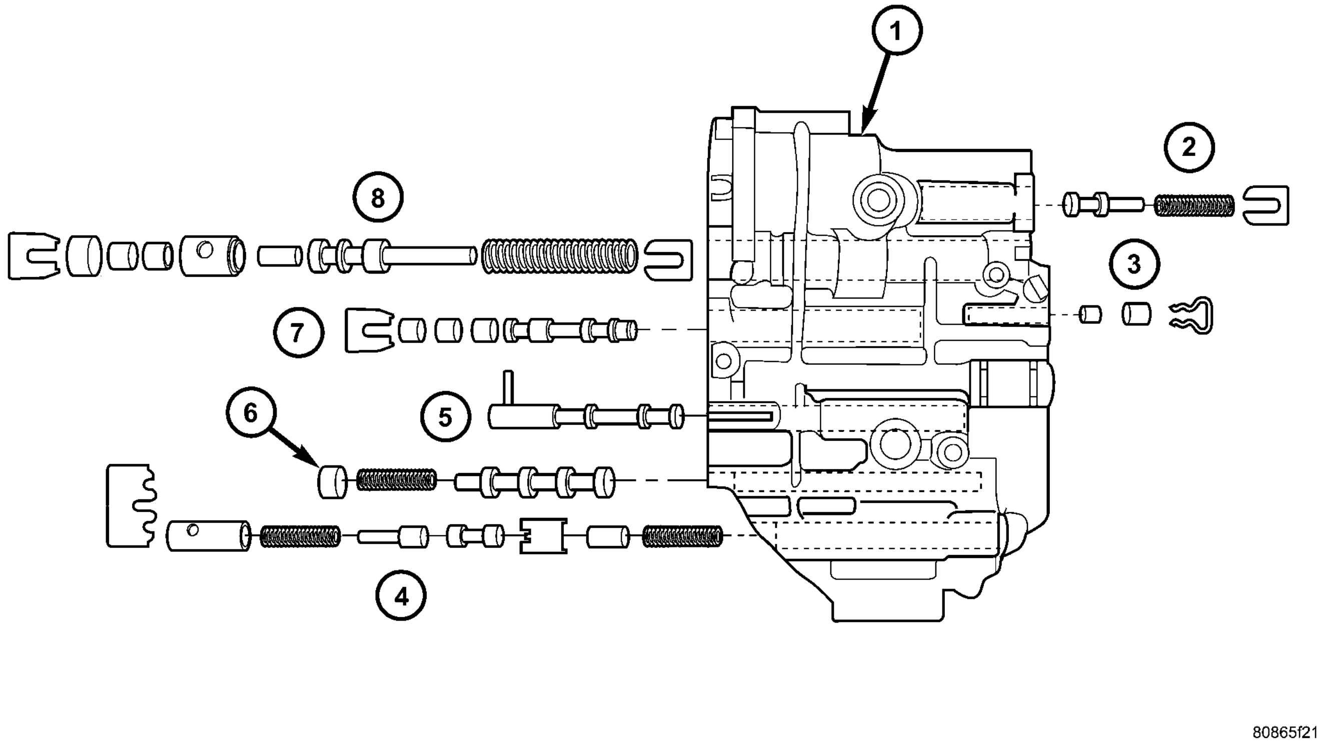


Fig. 253 Valve Body - Exploded

1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

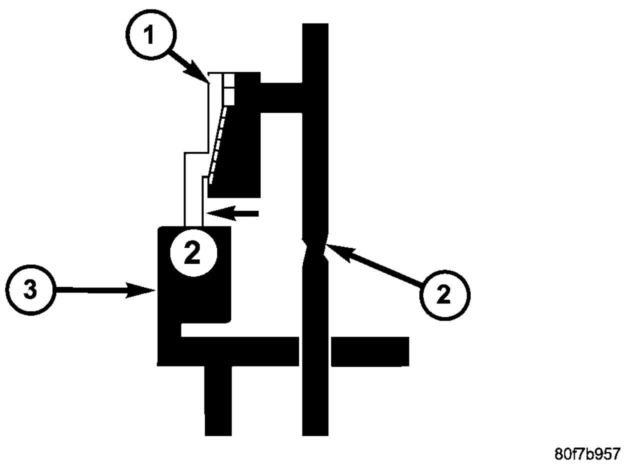


Fig. 254 Thermal Valve

1 - THERMAL VALVE
2 - U1 ORIFICE
3 - NUMBER 2 CHECK BALL

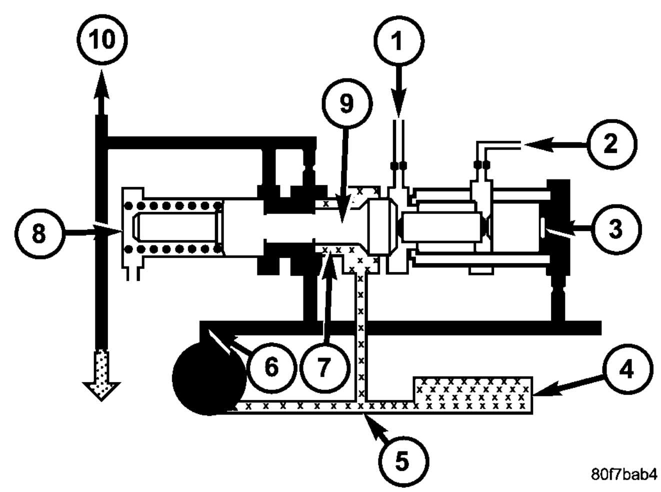


Fig. 255 Regulator Valve

1 - FROM OVERDRIVE CLUTCH CIRCUIT
2 - FROM MANUAL VALVE
3 - HYDRAULIC PRESSURE
4 - FILTER
5 - PUMP INLET
6 - PUMP OUTLET
7 - OIL PRESSURE REGULATED AT THIS POINT
8 - SPRING TENSION
9 - REGULATOR VALVE
10 - TORQUE CONVERTER CONTROL VALVE

VALVE BODY (Continued)

SOLENOID SWITCH VALVE

The solenoid switch valve (Fig. 256) controls line pressure from the LR/CC solenoid. In one position, it allows the low/reverse clutch to be pressurized. In the other, it directs line pressure to the converter control and converter clutch valves.

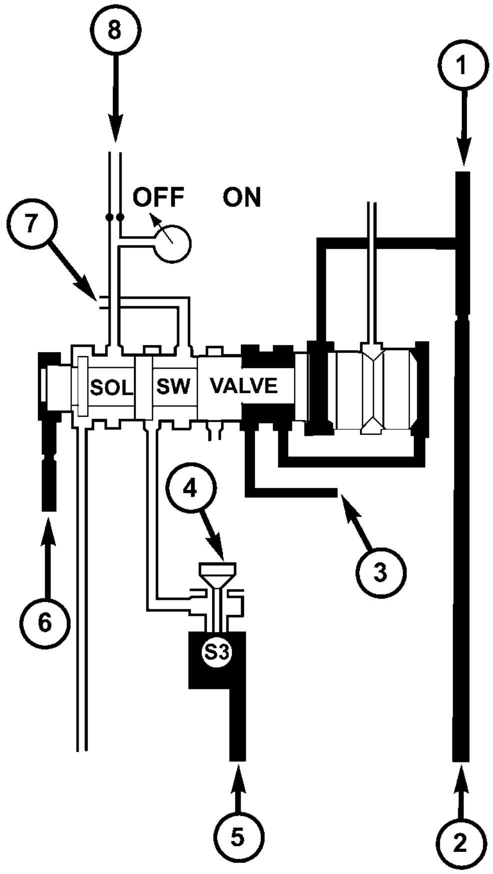


Fig. 256 Solenoid Switch Valve De-Energized

1 - 2/4 CLUTCH
2 - MANUAL VALVE
3 - UD CLUTCH
4 - LR/CC SOLENOID DE-ENERGIZED
5 - MANUAL VALVE
6 - LINE PRESSURE
7 - CONVERTER CLUTCH SWITCH AND CONTROL VALVES
8 - LR CLUTCH

MANUAL VALVE

The manual valve (Fig. 257) is operated by the mechanical shift linkage. Its primary responsibility is to send line pressure to the appropriate hydraulic circuits and solenoids. The valve has three operating ranges or positions.

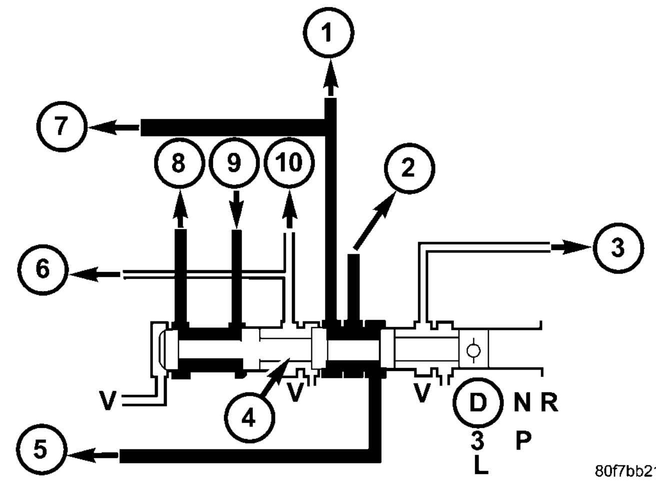


Fig. 257 Manual Valve

1 - UD CLUTCH
2 - LR/CC CLUTCH
3 - REVERSE CLUTCH
4 - MANUAL VALVE
5 - REGULATOR VALVE
6 - REGULATOR VALVE
7 - CONVERTER CLUTCH CONTROL VALVE
8 - 2/4 CLUTCH
9 - 2/4 - L/R SOLENOID
10 - L/R CLUTCH

VALVE BODY (Continued)

CONVERTER CLUTCH SWITCH VALVE

The main responsibility of the converter clutch switch valve (Fig. 258) is to control hydraulic pressure applied to the front (off) side of the converter clutch piston. Line pressure from the regulator valve is fed to the torque converter regulator valve. The pressure is then directed to the converter clutch switch valve and to the front side of the converter clutch piston. This pressure pushes the piston back and disengages the converter clutch.

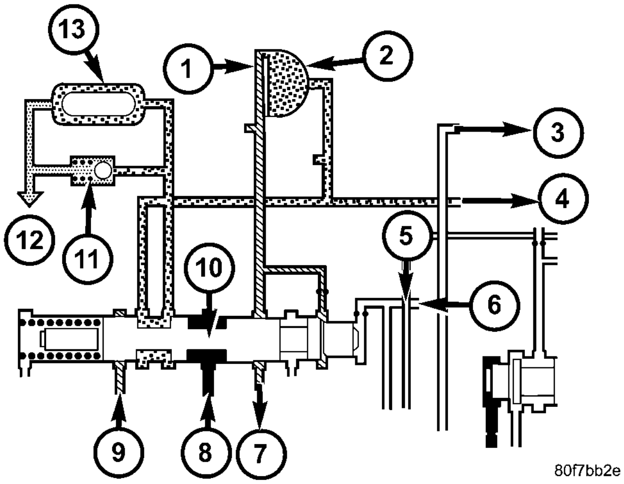


Fig. 258 Converter Clutch Switch Valve

1 - CONVERTER CLUTCH
2 - TORQUE CONVERTER
3 - LR CLUTCH
4 - DRIBBLERS
5 - REGULATOR VALVE
6 - SOLENOID SWITCH VALVE
7 - CONVERTER CLUTCH CONTROL VALVE
8 - REGULATOR VALVE
9 - CONVERTER CLUTCH CONTROL VALVE
10 - CONVERTER CLUTCH SWITCH VALVE
11 - BYPASS VALVE
12 - LUBE
13 - COOLER

CONVERTER CLUTCH CONTROL VALVE

The converter clutch control valve (Fig. 259) controls the back (on) side of the torque converter clutch. When the controller energizes or modulates the LR/CC solenoid to apply the converter clutch piston, both the converter clutch control valve and the converter control valve move, allowing pressure to be applied to the back side of the clutch.

T/C REGULATOR VALVE

The torque converter regulator valve slightly regulates the flow of fluid to the torque converter.

LOW/REVERSE SWITCH VALVE

The low/reverse clutch is applied from different sources, depending on whether low (1st) gear or reverse is selected. The low/reverse switch valve alternates positions depending on from which direc-

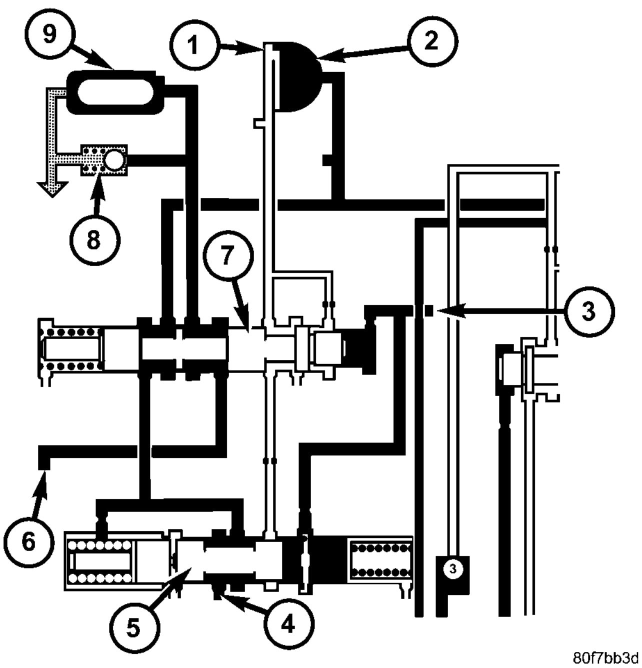


Fig. 259 Converter Clutch Control Valve

1 - CONVERTER CLUTCH
2 - TORQUE CONVERTER
3 - LR/CC SOLENOID
4 - FROM MANUAL VALVE
5 - CONVERTER CLUTCH CONTROL VALVE
6 - TORQUE CONVERTER REGULATOR VALVE
7 - CONVERTER CLUTCH SWITCH VALVE
8 - BYPASS VALVE
9 - COOLER

tion fluid pressure is applied. By design, when the valve is shifted by fluid pressure from one channel, the opposing channel is blocked. The switch valve alienates the possibility of a sticking ball check, thus providing consistent application of the low/reverse clutch under these operating conditions.

REMOVAL

NOTE: If valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure.(Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

(1) Disconnect the TRS and solenoid wiring connectors.

(2) Disconnect the shift cable from the shift lever (at the transmission).

(3) Move the manual shift lever clockwise as far as it will go. This should be one position past the L position. Then remove the manual shift lever.

NOTE: One of the oil pan bolts has a sealing patch applied from the factory. Seperate this bolts for reuse.

VALVE BODY (Continued)

(4) Remove transmission pan bolts (Fig. 260).

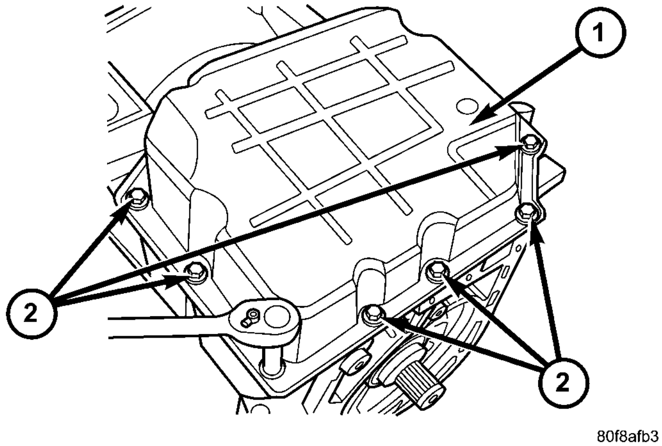


Fig. 260 Remove Transmission Oil Pan Bolts

1 - TRANSMISSION OIL PAN
2 - BOLTS

(5) Remove transmission oil pan (Fig. 261).

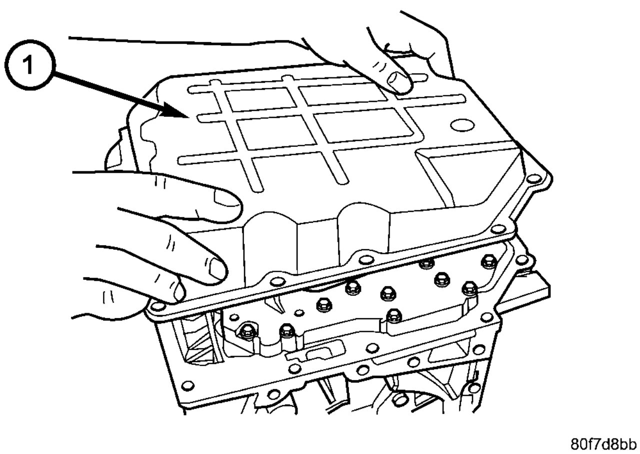


Fig. 261 Remove Transmission Oil Pan

1 - TRANSMISSION OIL PAN

(6) Remove oil filter from valve body (Fig. 262). It is held in place by two screws.

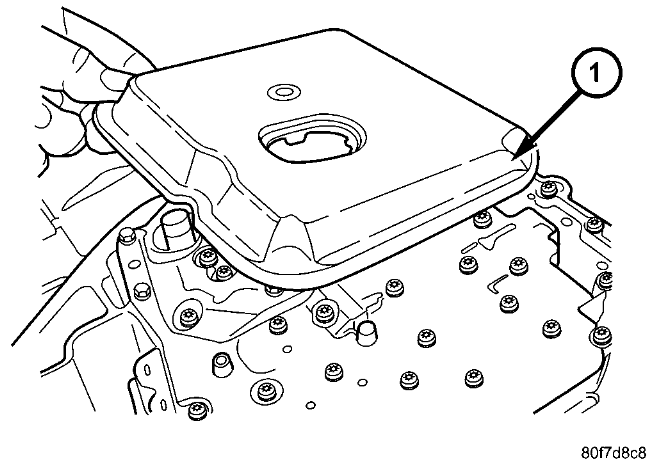


Fig. 262 Remove Transmission Filter

1 - TRANSMISSION FILTER

(7) Remove valve body bolts-to-case (Fig. 263).

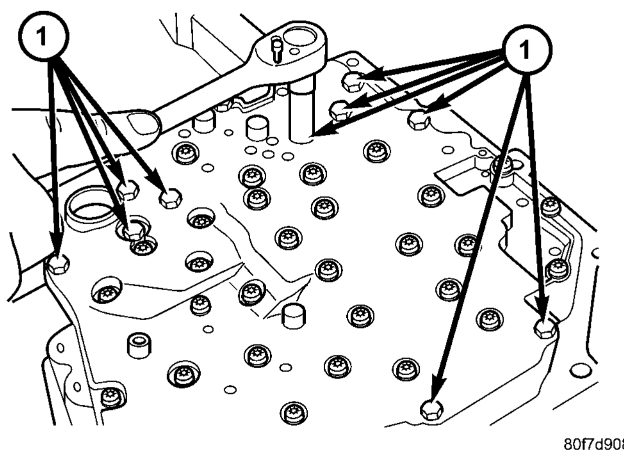


Fig. 263 Remove Valve Body Bolts

1 - BOLTS

VALVE BODY (Continued)

(8) Carefully remove valve body assembly from transmission (Fig. 264).

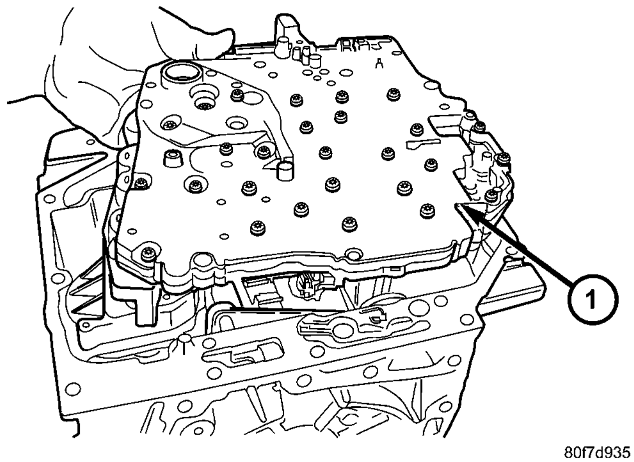


Fig. 264 Remove Valve Body From Transmission

1 - VALVE BODY

CAUTION: The overdrive and underdrive accumulators and springs may fall out when removing the valve body.

DISASSEMBLY

NOTE: If the valve body is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

(1) Remove manual shaft seal.
(2) Remove manual shaft screw (Fig. 265).
(3) Remove Transmission Range Sensor (TRS) and manual shaft (Fig. 266).

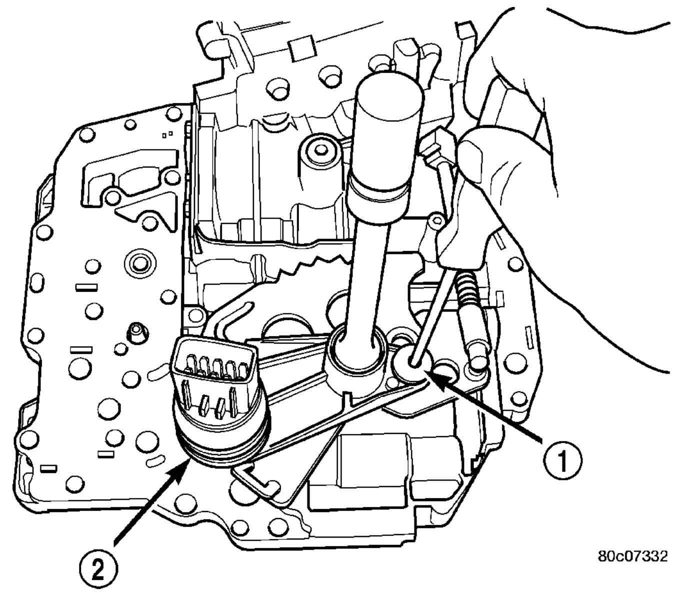


Fig. 265 Manual Shaft Retaining Screw

1 - SCREW
2 - TRS

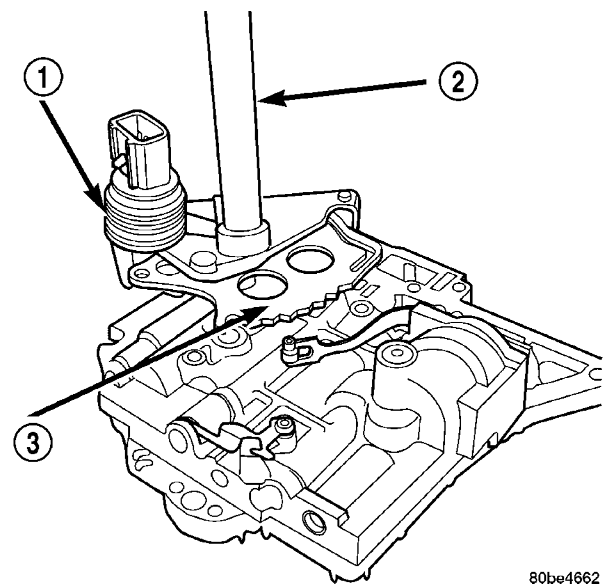


Fig. 266 Manual Shaft/Rooster Comb and Transmission Range Sensor

1 - TRANSMISSION RANGE SENSOR
2 - MANUAL SHAFT
3 - ROOSTER COMB

VALVE BODY (Continued)

(4) Remove Solenoid/Pressure Switch Assembly from valve body (Fig. 267).

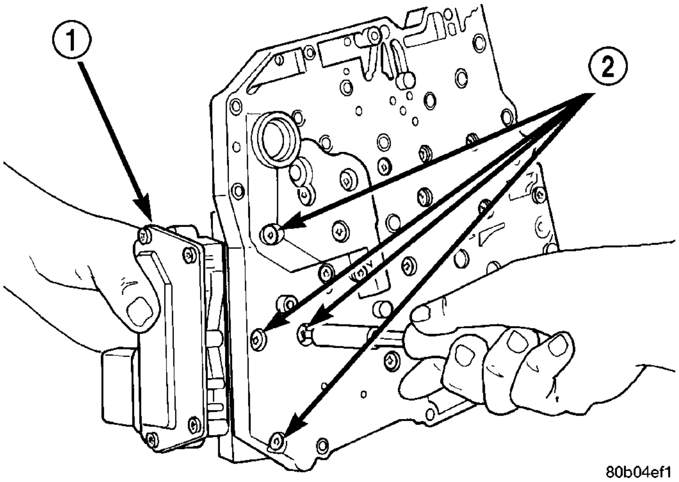


Fig. 267 Solenoid Retaining Screws

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - RETAINING SCREWS

(5) Remove valve body stiffener plate (Fig. 268).

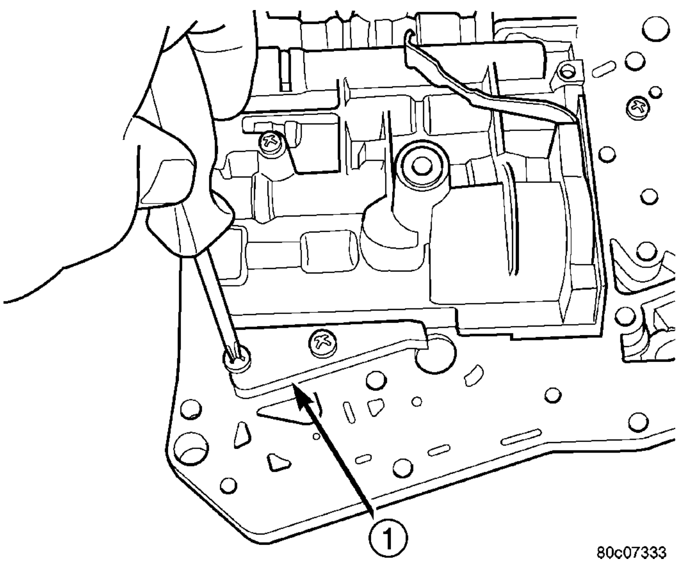


Fig. 268 Remove Stiffener Plate

1 - STIFFENER PLATE

(6) Invert valve body assembly and remove transfer plate-to-valve body screws (Fig. 269).

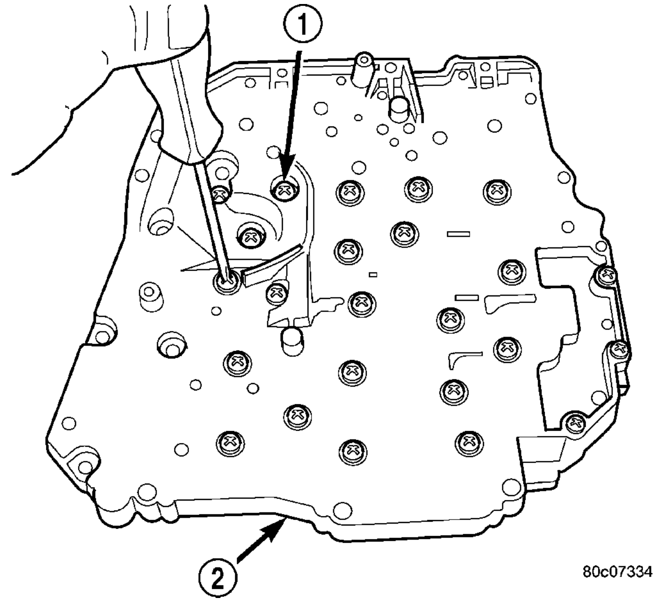


Fig. 269 Remove Transfer Plate-to-Valve Body Screws

1 - SCREW (24)
2 - TRANSFER PLATE

(7) Remove transfer/separator plate from valve body (Fig. 270)

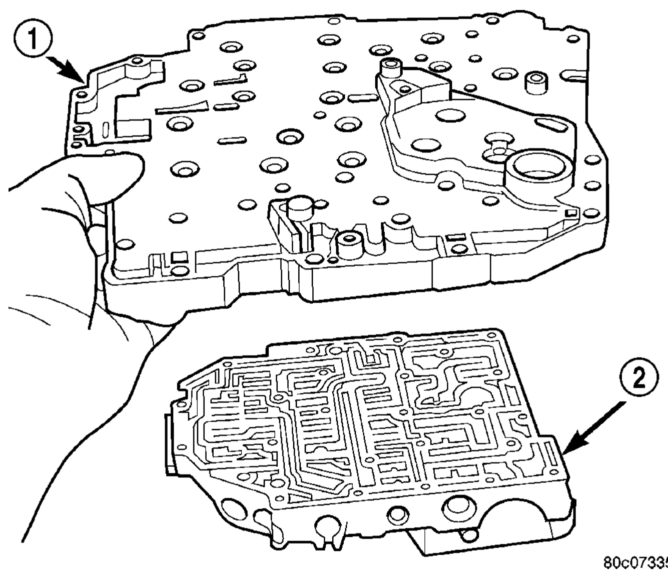


Fig. 270 Remove Transfer Plate to Valve Body

1 - TRANSFER PLATE
2 - VALVE BODY

VALVE BODY (Continued)

(8) Remove separator plate-to-transfer plate screws (Fig. 271).

(9) Remove separator plate from transfer plate (Fig. 272).

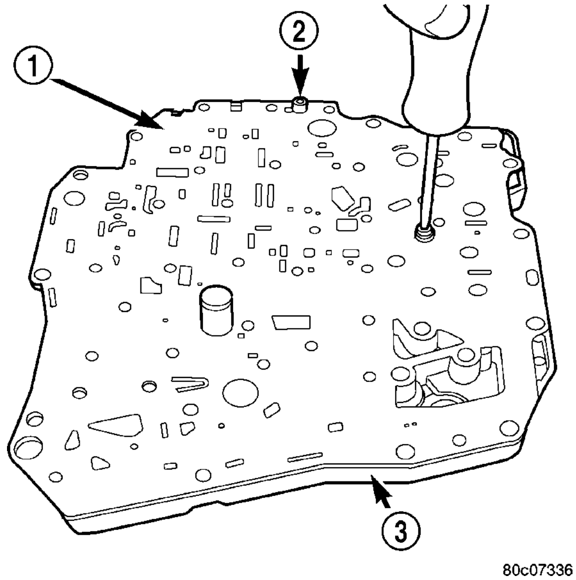


Fig. 271 Remove Separator Plate-to-Transfer Plate Screws

1 - SEPARATOR PLATE
2 - SCREW (2)
3 - TRANSFER PLATE

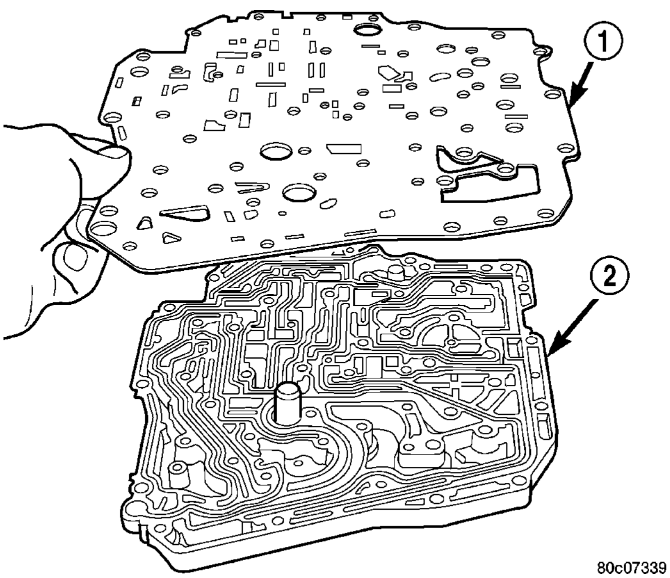


Fig. 272 Remove Separator Plate to Transfer Plate

1 - SEPARATOR PLATE
2 - TRANSFER PLATE

(10) Remove the oil screen from the transfer plate (Fig. 273).

(11) Remove thermal valve (Fig. 274) from transfer plate.

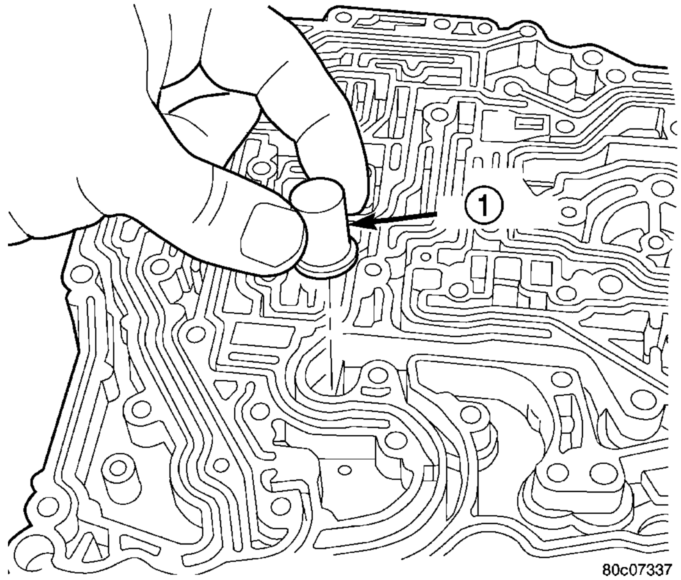


Fig. 273 Remove Oil Screen to Transfer Plate

1 - OIL SCREEN

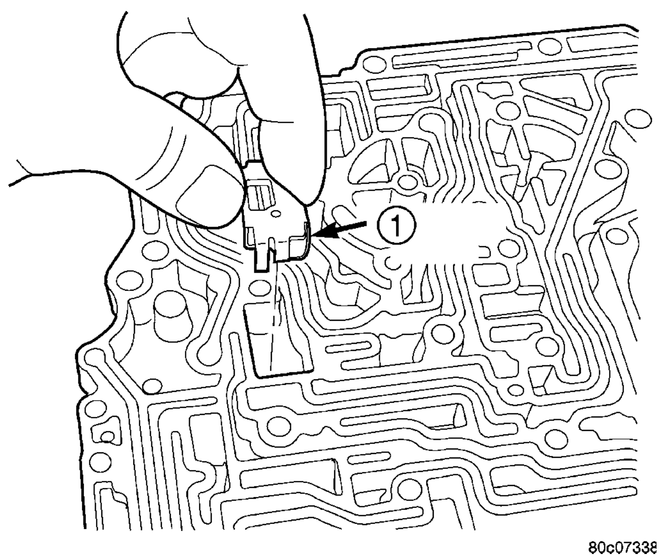


Fig. 274 Remove Thermal Valve to Transfer Plate

1 - THERMAL VALVE

VALVE BODY (Continued)

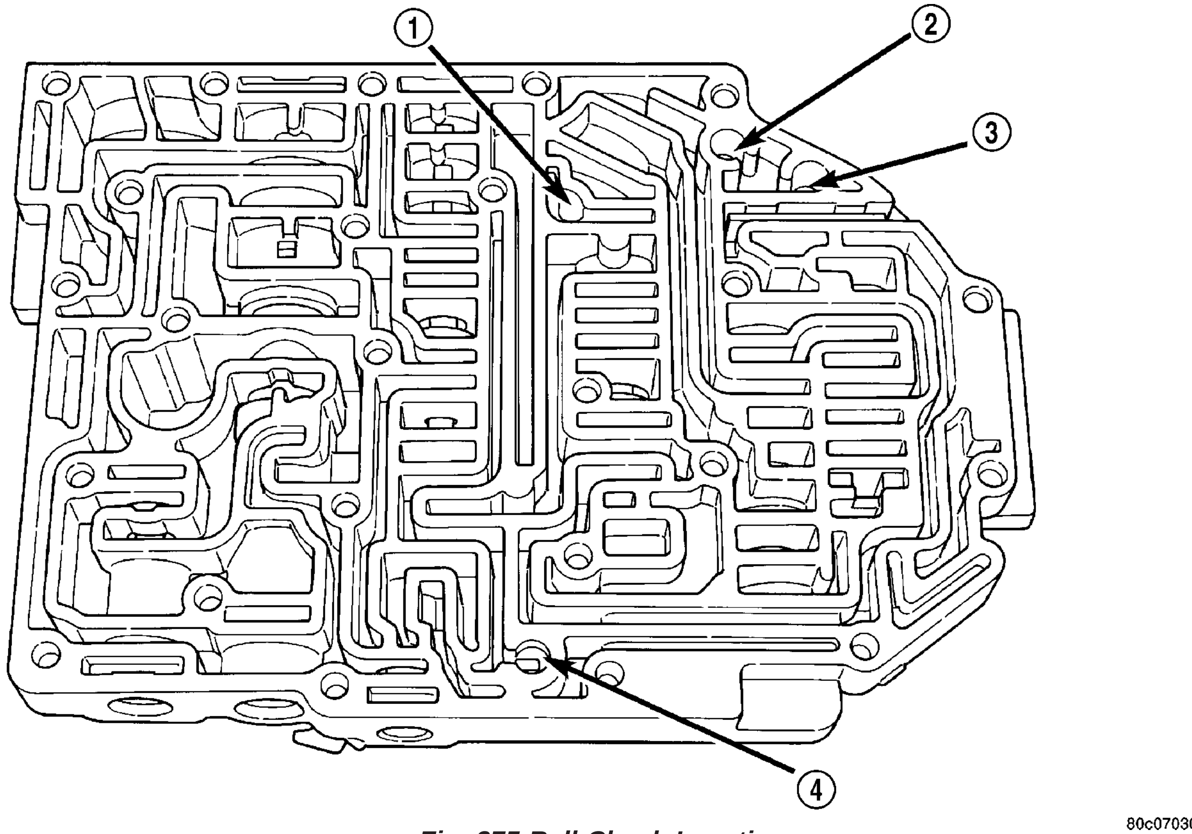


Fig. 275 Ball Check Location

1 - (#4) BALL CHECK LOCATION
2 - (#2) BALL CHECK LOCATION
3 - (#5) BALL CHECK LOCATION
4 - (#3) BALL CHECK LOCATION

(12) Remove valve body check balls. Note their location for assembly ease (Fig. 275).

(13) Remove 2/4 accumulator assembly as shown in (Fig. 276).

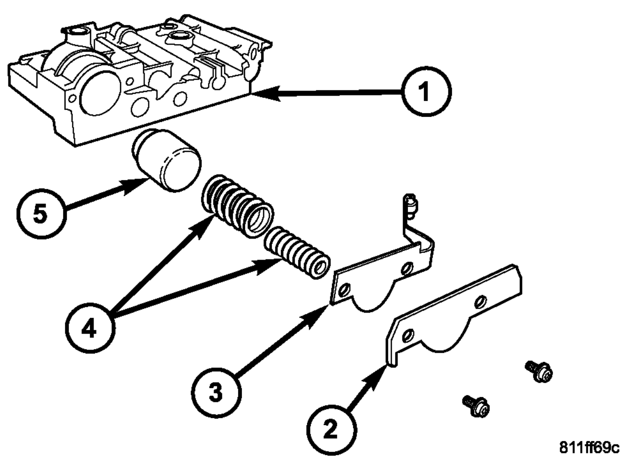


Fig. 276 2/4 Accumulator Assembly

1 - VALVE BODY
2 - RETAINER PLATE
3 - DETENT SPRING
4 - RETURN SPRINGS
5 - PISTON

(14) Remove dual retainer plate from valve body. Use special tool 6301 to remove plate (Fig. 277).

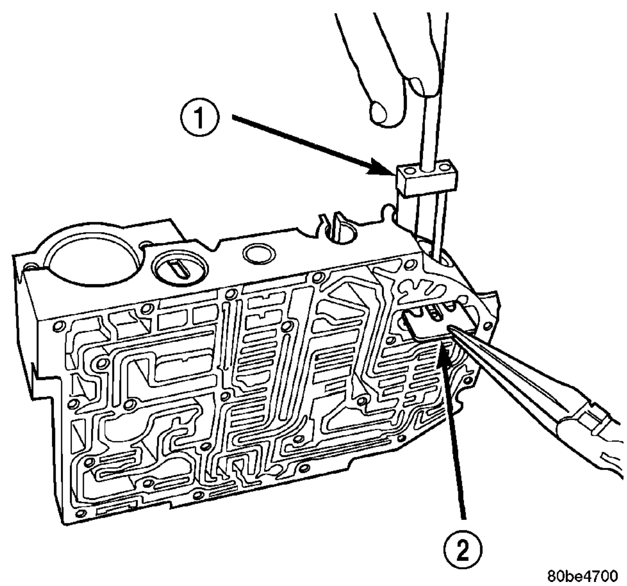


Fig. 277 Remove Dual Retainer Plate using Tool 6301

1 - TOOL 6301
2 - RETAINER

VALVE BODY (Continued)

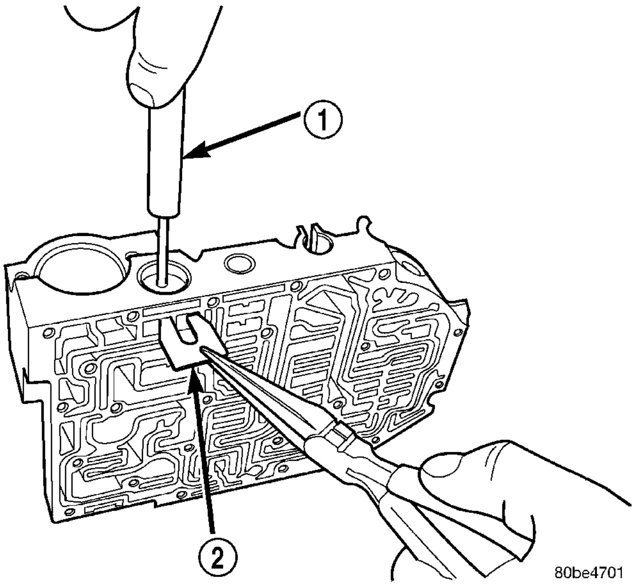


Fig. 278 Remove Regulator Valve Spring Retainer using Tool 6302

1 - TOOL 6302
2 - RETAINER

(15) Remove regulator valve spring retainer (Fig. 278).

(16) Remove remaining retainers as shown in (Fig. 279).

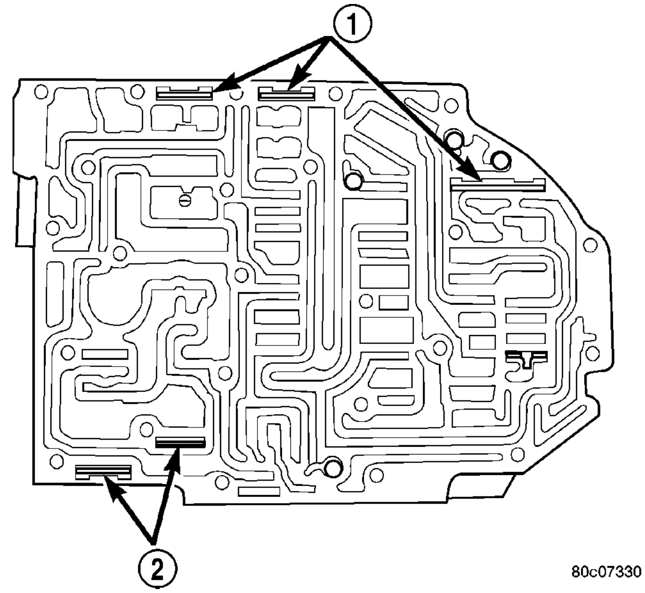


Fig. 279 Valve Retainer Location

1 - RETAINER
2 - RETAINER

(17) Remove valves and springs as shown in (Fig. 280).

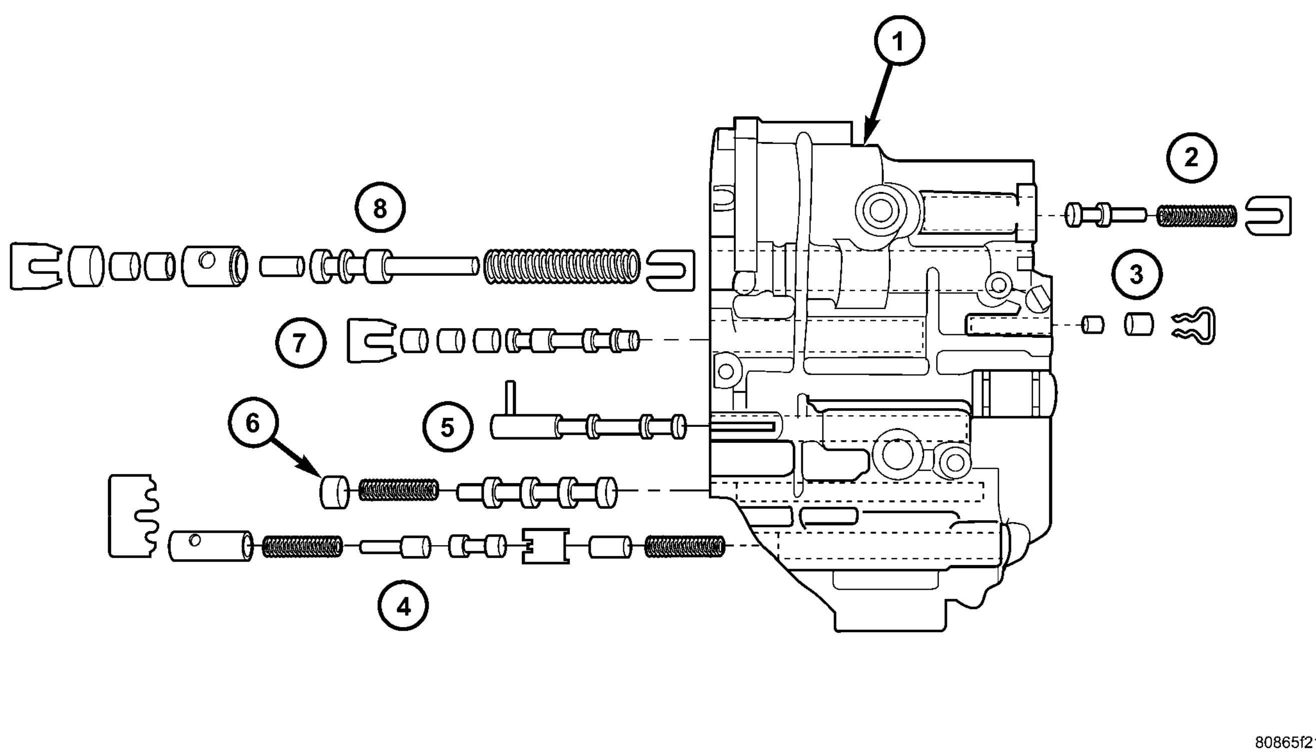


Fig. 280 Valve Body Assembly

1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

VALVE BODY (Continued)

(18) Cleanliness through entire disassembly and assembly of the valve body cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the valve body are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

ASSEMBLY

NOTE: If the valve body assembly is being reconditioned or replaced, it is necessary to perform the Quick Learn Procedure using the DRBIII® Scan Tool. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

(1) Install valves and springs as shown in (Fig. 281).

(2) Install regulator valve spring retainer (Fig. 282).

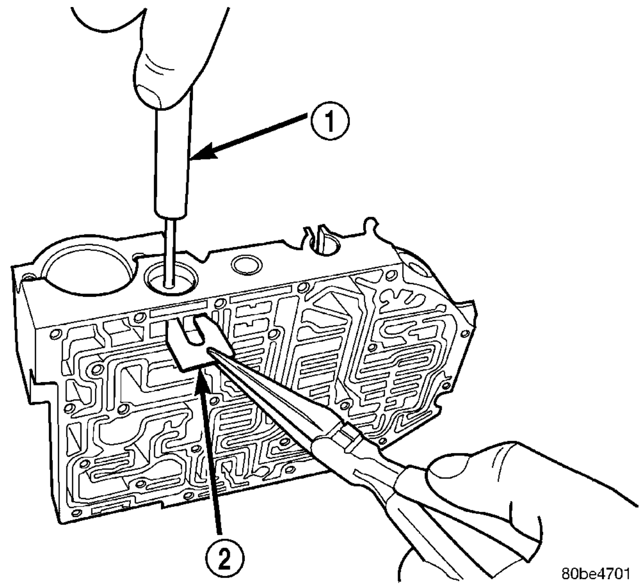


Fig. 282 Install Regulator Valve Spring Retainer using Tool 6302

1 - TOOL 6302
2 - RETAINER

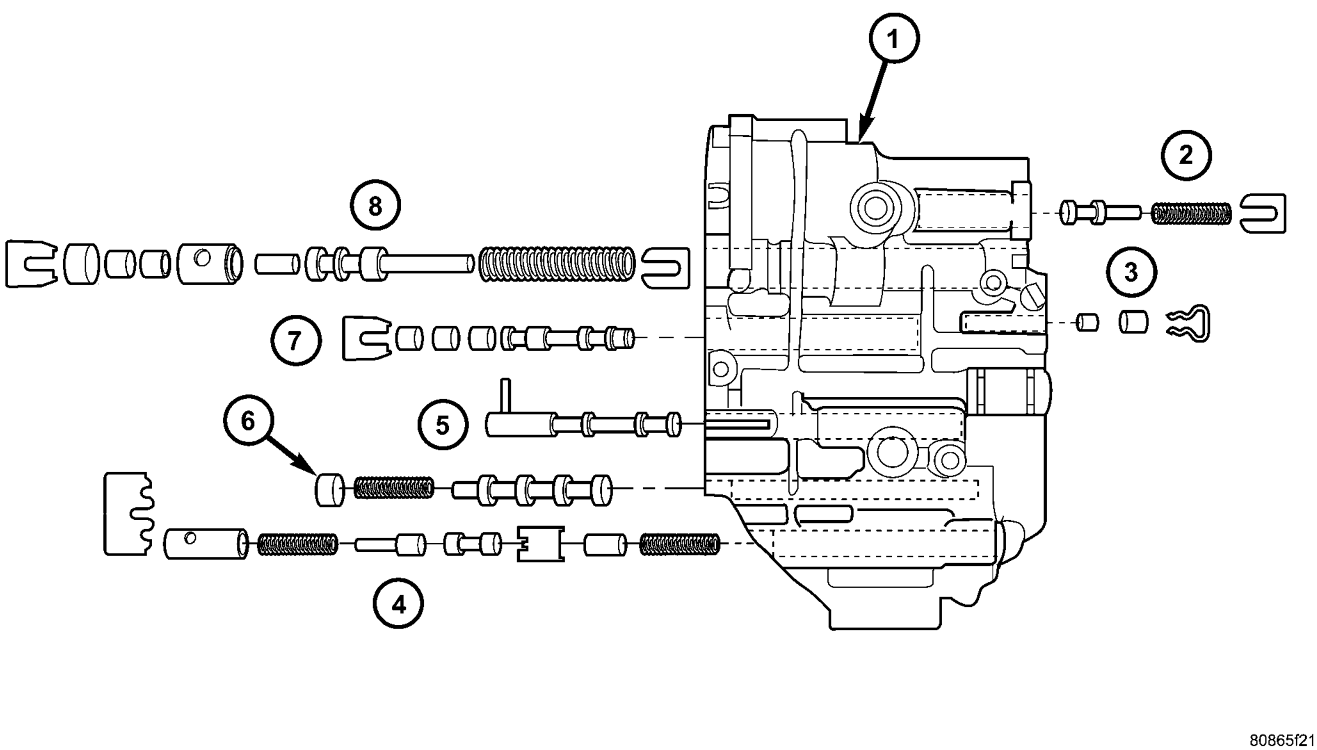


Fig. 281 Valve Body Assembly

1 - VALVE BODY
2 - T/C REGULATOR VALVE
3 - L/R SWITCH VALVE
4 - CONVERTER CLUTCH CONTROL VALVE
5 - MANUAL VALVE
6 - CONVERTER CLUTCH SWITCH VALVE
7 - SOLENOID SWITCH VALVE
8 - REGULATOR VALVE

VALVE BODY (Continued)

(3) Install dual retainer plate using Tool 6301 (Fig. 283).

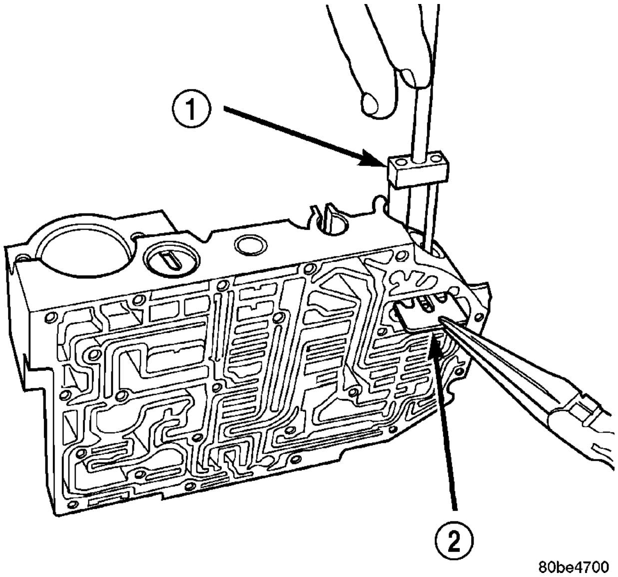


Fig. 283 Install Dual Retainer Plate using Tool 6301

1 - TOOL 6301
2 - RETAINER

(4) Verify that all retainers are installed as shown in (Fig. 284). Retainers should be flush or below valve body surface.

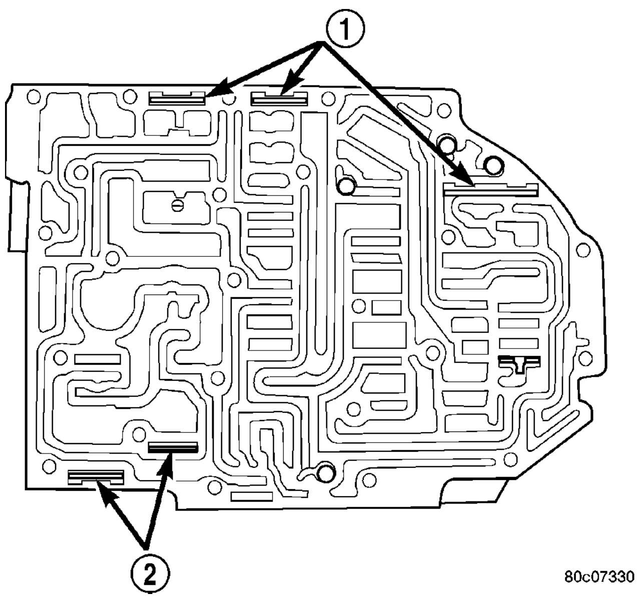


Fig. 284 Valve Retainer Location

1 - RETAINER
2 - RETAINER

(5) Install 2/4 Accumulator components as shown in (Fig. 285). Torque 2/4 Accumulator retainer plate to 5 N·m (45 in. lbs.).

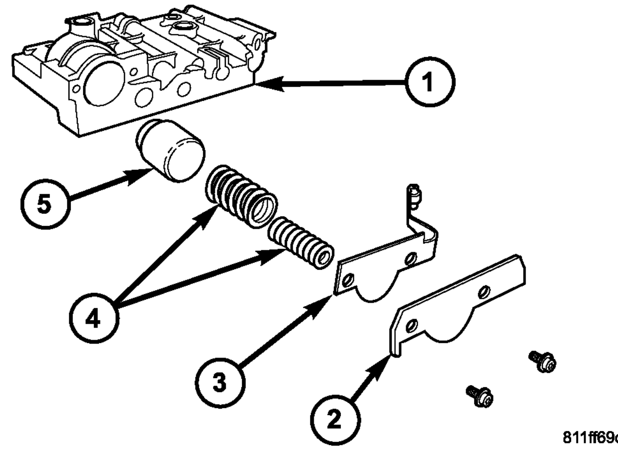


Fig. 285 2/4 Accumulator Assembly

1 - VALVE BODY
2 - RETAINER PLATE
3 - DETENT SPRING
4 - RETURN SPRINGS
5 - PISTON

VALVE BODY (Continued)

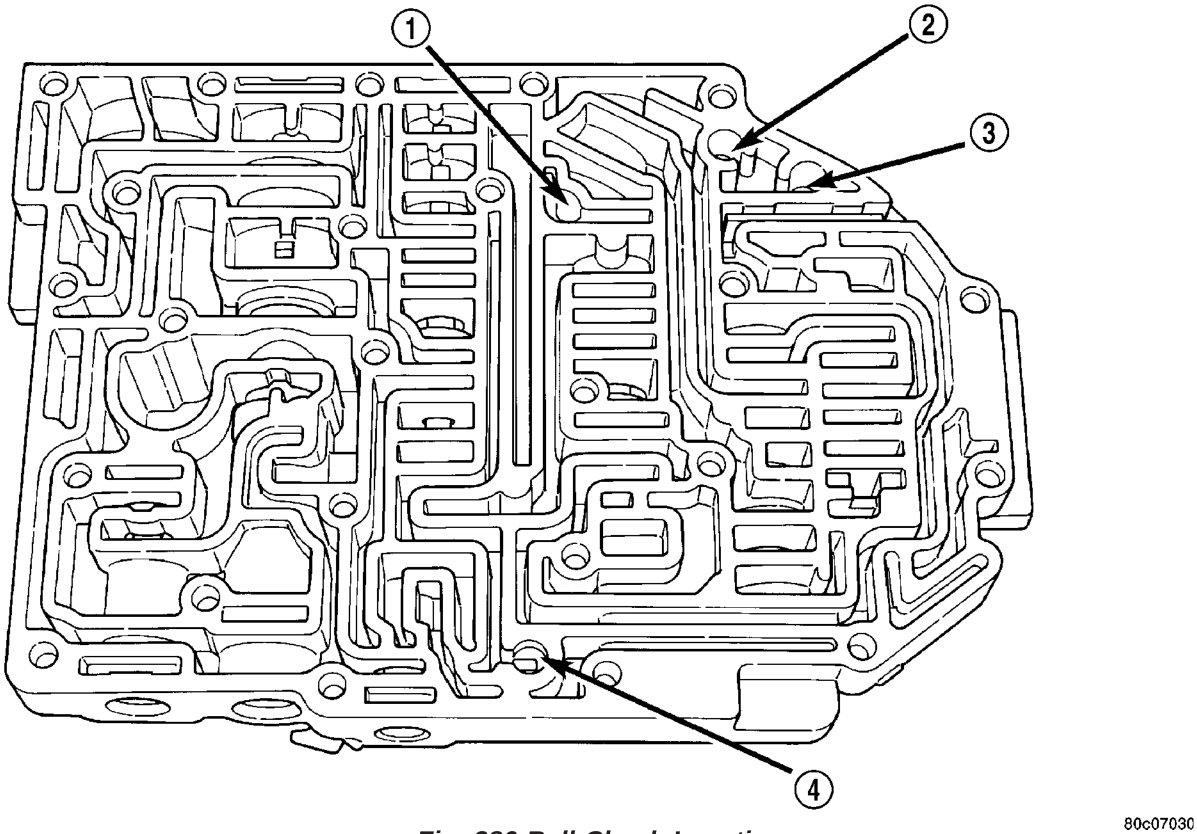


Fig. 286 Ball Check Location

1 - (#4) BALL CHECK LOCATION
2 - (#2) BALL CHECK LOCATION
3 - (#5) BALL CHECK LOCATION
4 - (#3) BALL CHECK LOCATION

(6) Install check balls into position as shown in (Fig. 286). If necessary, secure them with petrolatum or transmission assembly gel for assembly ease.

(7) Install thermal valve to the transfer plate (Fig. 287).

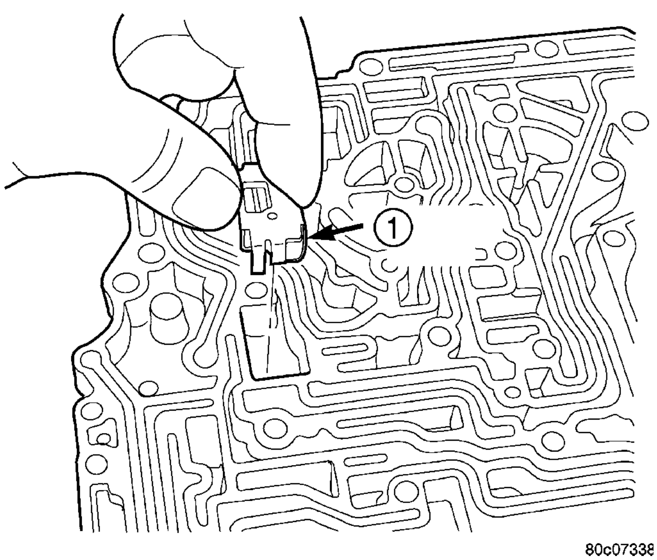


Fig. 287 Install Thermal Valve to Transfer Plate

1 - THERMAL VALVE

(8) Install the oil screen to the transfer plate (Fig. 288).

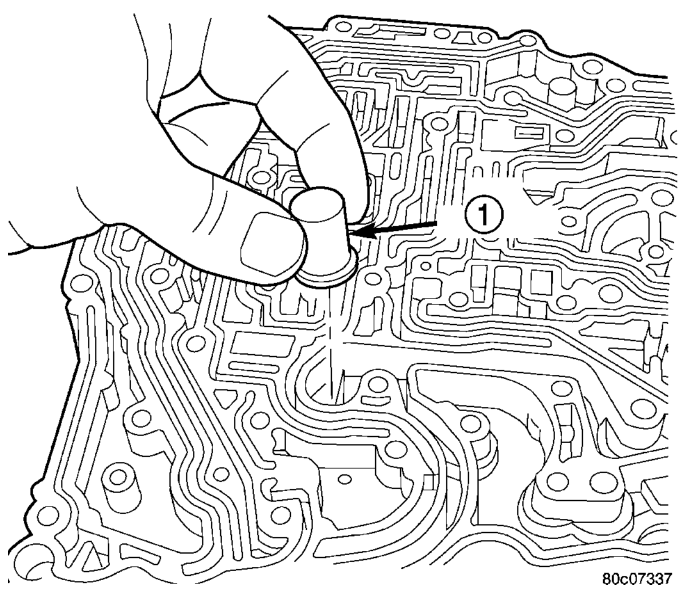


Fig. 288 Install Oil Screen to Transfer Plate

1 - OIL SCREEN

VALVE BODY (Continued)

(9) Install separator plate to transfer plate (Fig. 289).

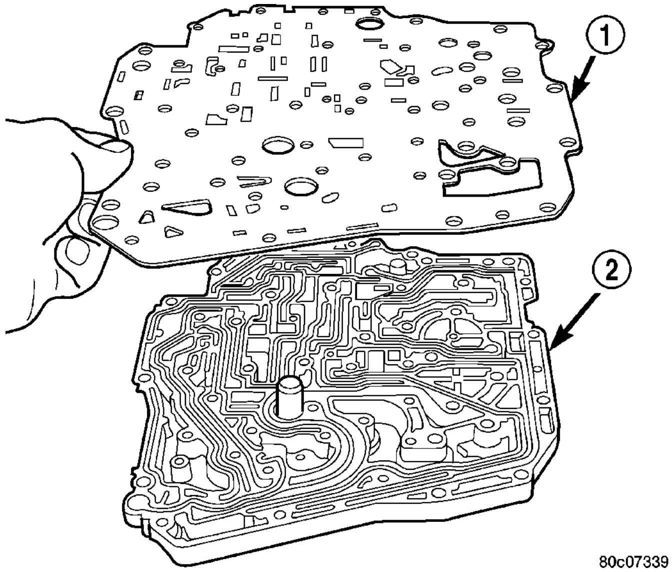


Fig. 289 Install Separator Plate to Transfer Plate

1 - SEPARATOR PLATE
2 - TRANSFER PLATE

(10) Install the two separator plate-to-transfer plate screws (Fig. 290).

(11) Install the transfer plate to the valve body (Fig. 291).

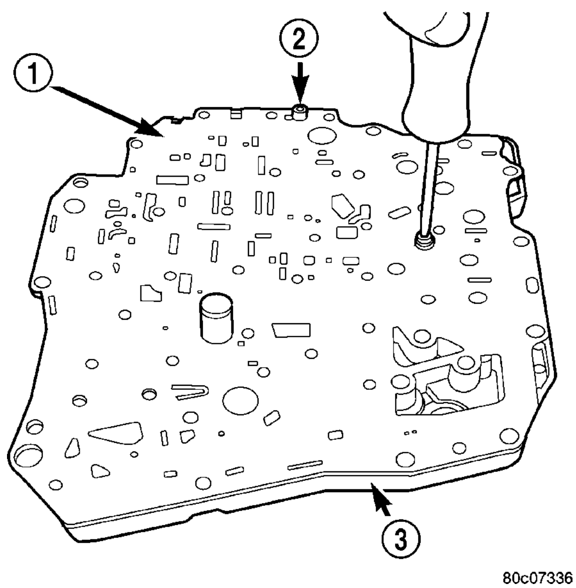


Fig. 290 Install Separator Plate-to-Transfer Plate Screws

1 - SEPARATOR PLATE
2 - SCREW (2)
3 - TRANSFER PLATE

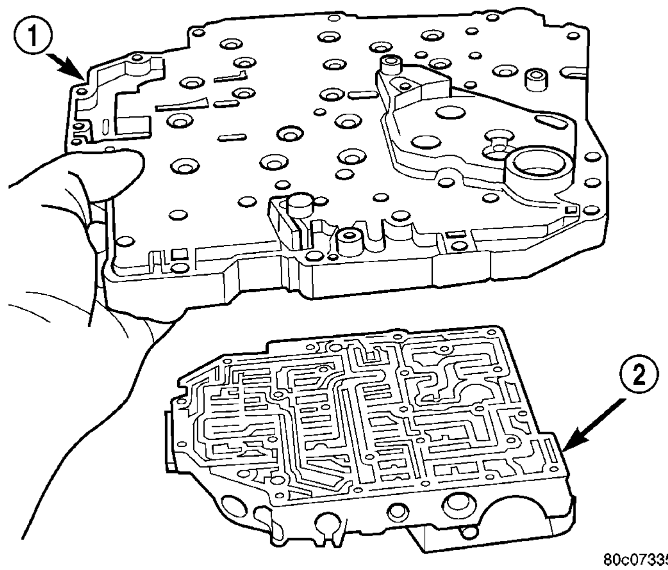


Fig. 291 Install Transfer Plate to Valve Body

1 - TRANSFER PLATE
2 - VALVE BODY

(12) Install the transfer plate-to-valve body screws (Fig. 292) and torque to 5 N·m (45 in. lbs.).

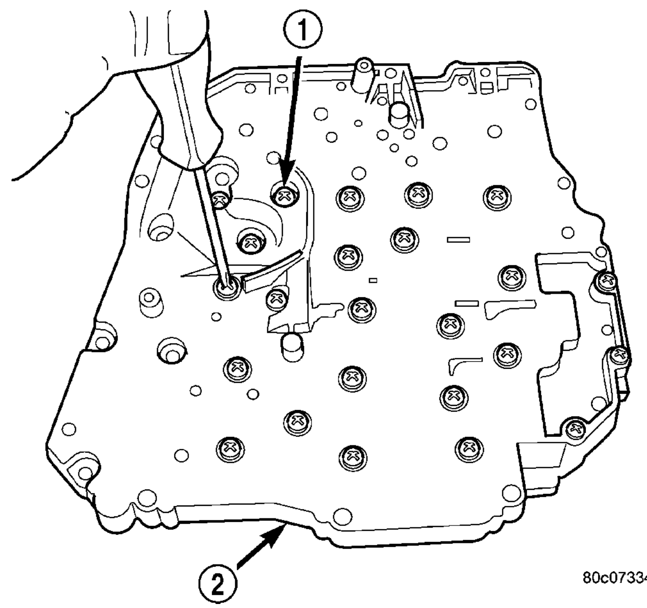


Fig. 292 Install Transfer Plate-to-Valve Body Screws

1 - SCREW (24)
2 - TRANSFER PLATE

VALVE BODY (Continued)

2(13) Install the stiffener plate (Fig. 293).

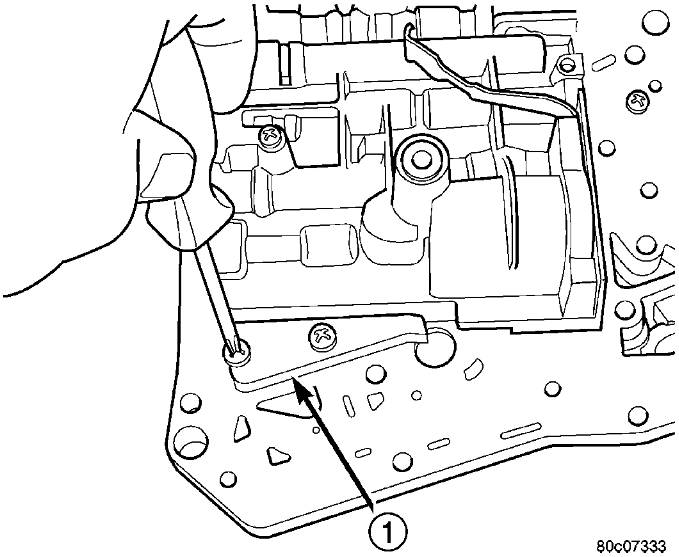


Fig. 293 Install Stiffener Plate

1 - STIFFENER PLATE

(14) Install the solenoid/pressure switch assembly and to the transfer plate (Fig. 294) and torque to 5.5 N·m (50 in. lbs.).

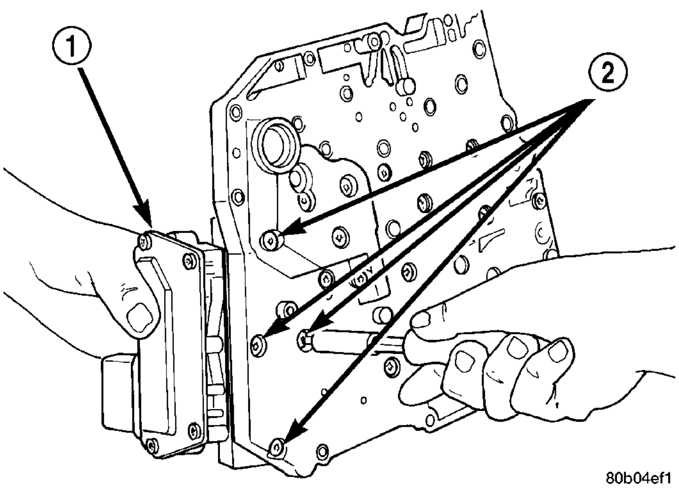


Fig. 294 Solenoid Retaining Screws

1 - SOLENOID/PRESSURE SWITCH ASSEMBLY
2 - RETAINING SCREWS

(15) Install the manual shaft/rooster comb and transmission range sensor to the valve body (Fig. 295).

(16) Install the TRS/manual shaft retaining screw (Fig. 296) and torque to 5 N·m (45 in. lbs.).

(17) Install manual shaft seal.

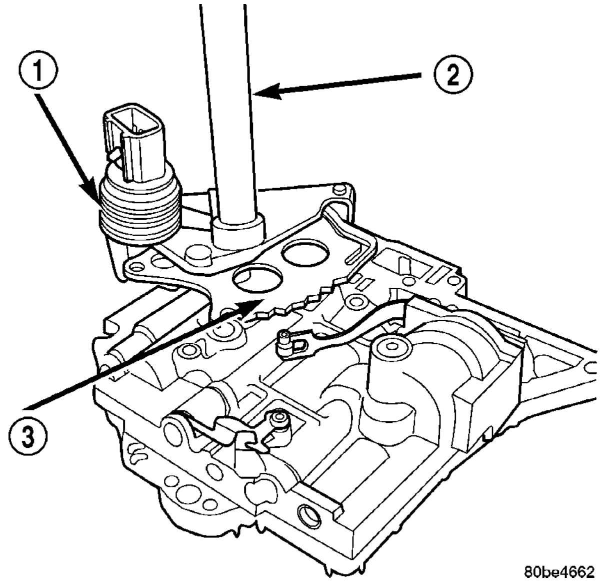


Fig. 295 Manual Shaft/Rooster Comb and Transmission Range Sensor

1 - TRANSMISSION RANGE SENSOR
2 - MANUAL SHAFT
3 - ROOSTER COMB

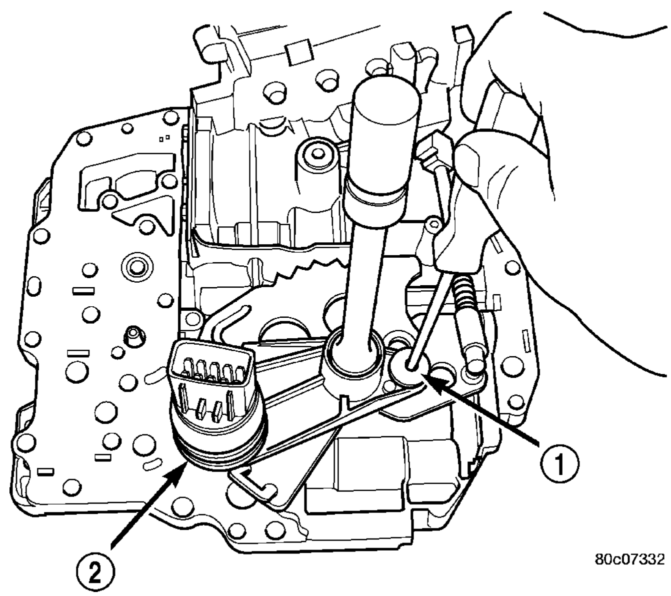


Fig. 296 Manual Shaft Retaining Screw

1 - SCREW
2 - TRS

VALVE BODY (Continued)

INSTALLATION

(1) Install valve body into position and start bolts. Torque valve body to transmission case bolts (Fig. 297) to 12 N·m (105 in. lbs.) torque.

(2) Install transmission oil filter (Fig. 298).

NOTE: Before installing the oil pan bolt in the bolt hole located between the torque converter clutch on and U/D clutch pressure tap circuits (Fig. 299), it will be necessary to replentish the sealing patch on the bolt using Mopar® Lock & Seal Adhesive.

(3) Make sure oil pan and case rail are clean and dry. Install an 1/8” bead of RTV to the transmission oil pan and install to case. Tighten bolts (Fig. 300) to 20 N·m (14.5 ft. lbs.).

(4) Lower vehicle and connect the TRS connector.

(5) Connect solenoid/pressure switch assembly connector.

(6) Lower vehicle.

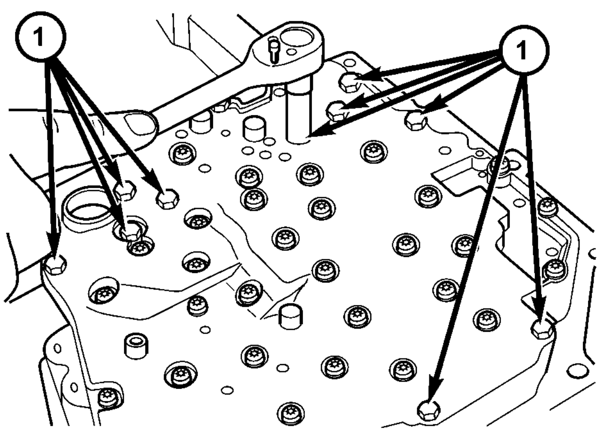


Fig. 297 Install Valve Body Bolts

1 - BOLTS

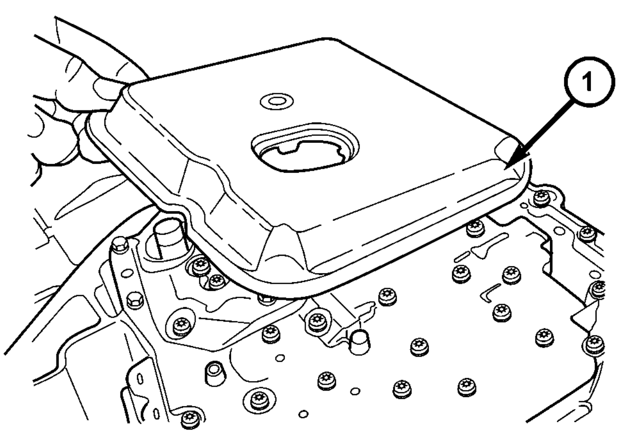


Fig. 298 Install Transmission Filter

1 - TRANSMISSION FILTER

(7) Fill transmission with ATF+4, Automatic Transmission Fluid. Verify proper fluid level. (Refer to 21 - TRANSMISSION/AUTOMATIC - 42RLE/ FLUID - STANDARD PROCEDURE)

NOTE: If the valve body has been reconditioned or replaced, it is necessary to perform the Quick Learn Procedure. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/TRANSMISSION CONTROL MODULE - STANDARD PROCEDURE)

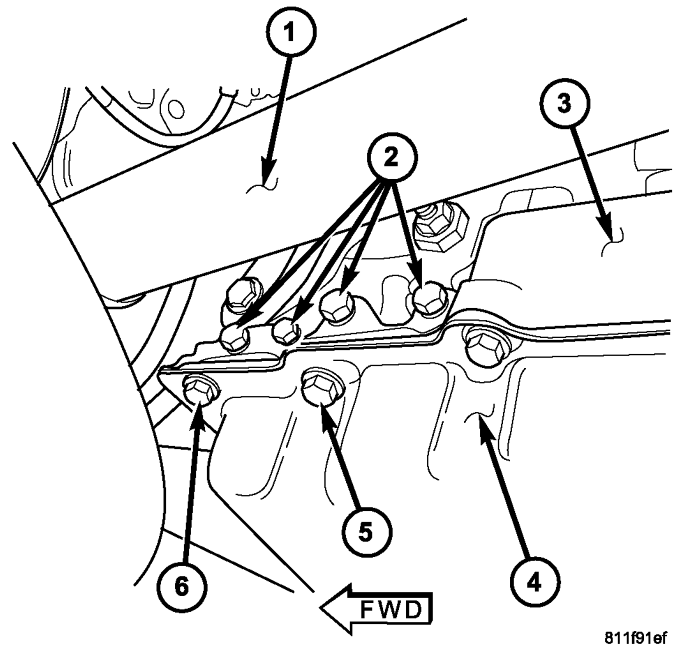


Fig. 299 Pan Fastener Location

1 - FRONT DRIVESHAFT
2 - PRESSURE PORTS
3 - TRANSMISSION CASE
4 - TRANSMISSION OIL PAN
5 - SECOND TRANSMISSION OIL PAN BOLT ON LEFT SIDE
6 - FIRST TRANSMISSION OIL PAN BOLT

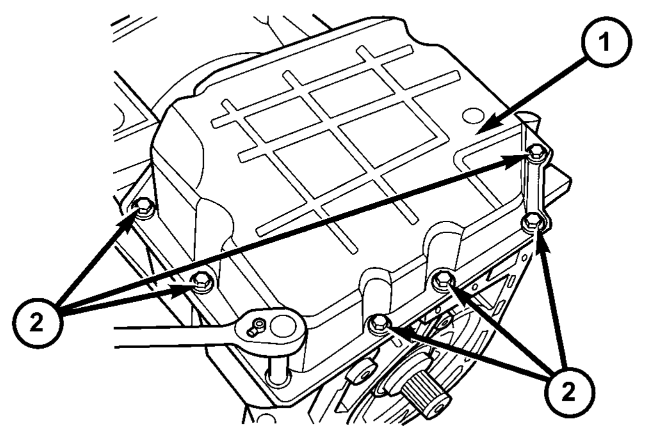


Fig. 300 Install Transmission Oil Pan Bolts

1 - TRANSMISSION OIL PAN
2 - BOLTS

TRANSFER CASE - NV231

TABLE OF CONTENTS

TRANSFER CASE - NV231

DESCRIPTION

The NV231 is a part-time transfer case with a low range reduction gear system. The NV231 has three operating ranges plus a NEUTRAL position. A low range system provides a reduction ratio for increased low speed torque capability.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

OPERATING RANGES

Transfer case operating ranges are:

- 2WD (2-wheel drive)
- 4x4 (4-wheel drive)
- 4 Lo (4-wheel drive low range

The 2WD range is for use on any road surface at any time.

The 4x4 and 4 Lo ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is wet or slippery or covered by ice and snow.

The low range reduction gear system is operative in 4 Lo range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

SHIFT MECHANISM

Operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the shifter bezel cover plate.

IDENTIFICATION

A circular ID tag is attached to the rear case of each transfer case (Fig. 1). The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

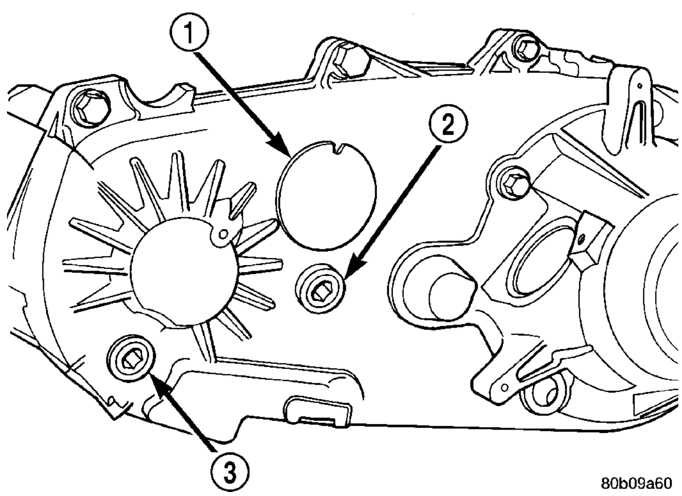


Fig. 1 Fill/Drain Plug And I.D. Tag Locations - Typical

1 - I.D. TAG
2 - FILL PLUG
3 - DRAIN PLUG

TRANSFER CASE - NV231 (Continued)

OPERATION

The input gear is splined to the transmission output shaft. The input gear drives the mainshaft through the planetary assembly and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchronizer mechanism for shifting.

DIAGNOSIS AND TESTING - TRANSFER CASE - NV231

DIAGNOSIS CHART

Condition	Possible Cause	Correction
Transfer case difficult to shift or will not shift into desired range.	1) Vehicle speed to great to permit shifting.	1) Slow vehicle and shift into desired range.
	2) If vehicle was operated for an extended period in 4H mode on dry surface, driveline torque load may cause difficulty.	2) Stop vehicle and shift transfer case to Neutral position. Transfer case can then be shifted to the desired mode.
	3) Transfer case shift linkage binding.	3) Repair or replace linkage as necessary.
	4) Insufficient or incorrect lubricant.	4) Drain and refill transfer case with the correct type and quantity of lubricant.
	5) Internal transfer case components binding, worn, or damaged.	5) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct type and quantity of lubricant.
Transfer case noisy while in, or jumps out of, 4L mode.	1) Transfer case not completely engaged in 4L position.	1) Slow vehicle, shift transfer case to the Neutral position, and then shift into the 4L mode.
	2) Transfer case shift linkage out of adjustment.	2) Adjust linkage as necessary.
	3) Transfer case shift linkage loose or binding.	3) Repair, replace, or tighten linkage components as necessary.
	4) Range fork damaged, inserts worn, or fork is binding on the shift rail.	4) Repair or replace components as necessary.
	5) Low range gear worn or damaged.	5) Repair or replace components as necessary.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Abnormal tire wear.	1) Extended operation in 4H mode on dry surfaces,	1) Operate vehicle in 2H mode on dry surfaces.

TRANSFER CASE - NV231 (Continued)

REMOVAL

(1) Shift transfer case into NEUTRAL.
(2) Raise vehicle.
(3) Drain transfer case lubricant.
(4) Mark front and rear propeller shaft yokes for alignment reference.
(5) Support transmission with jack stand.
(6) Remove rear crossmember, or skid plate.
(7) Disconnect front/rear propeller shafts at transfer case.
(8) Disconnect vehicle speed sensor wires.
(9) Disconnect transfer case linkage rod from range lever.
(10) Disconnect transfer case vent hose (Fig. 2) and indicator switch harness, if necessary.
(11) Support transfer case with transmission jack.
(12) Secure transfer case to jack with chains.
(13) Remove nuts attaching transfer case to transmission.
(14) Pull transfer case and jack rearward to disengage transfer case.
(15) Remove transfer case from under vehicle.

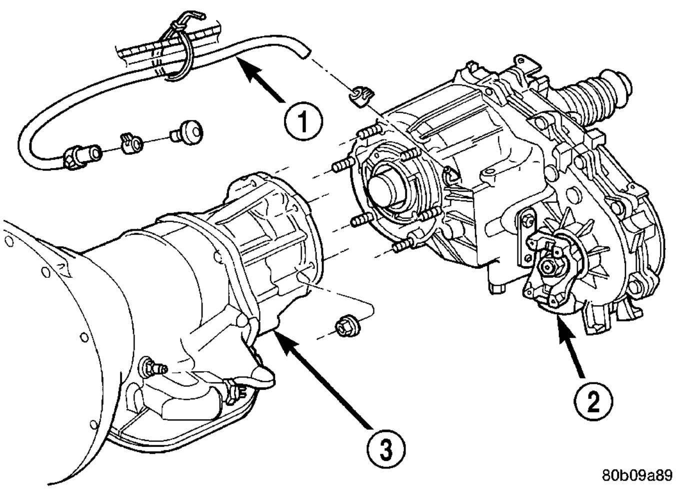


Fig. 2 Transfer Case Mounting

1 - VENT TUBE
2 - TRANSFER CASE
3 - TRANSMISSION

DISASSEMBLY

Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

REAR RETAINER AND OIL PUMP

(1) Remove the speedometer adapter.
(2) Spread band clamp which holds output shaft boot to the output shaft slinger, or output shaft damper, with a suitable awl, or equivalent.

NOTE: Vehicles built with a 4.0L engine and a manual transmission use a damper weight on the transfer case output shaft. Be sure to identify the transfer case before proceeding.

(3) Remove output shaft boot from slinger, or output shaft damper, and output shaft.
(4) If the vehicle is not equipped with an output shaft damper, remove the output shaft rear slinger using Puller MD-998056-A (Fig. 3).

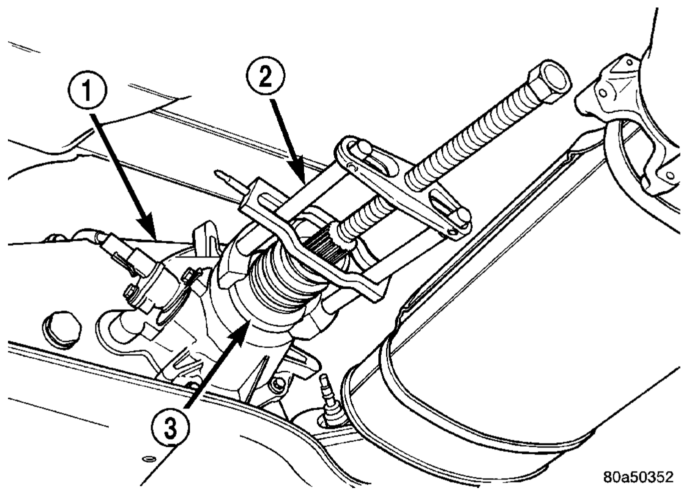


Fig. 3 Rear Slinger Removal

1 - TRANSFER CASE
2 - SPECIAL TOOL MD-998056-A
3 - SLINGER

(5) If the vehicle is equipped with an output shaft damper, use Screws 8421 and the puller yoke and forcing screw from a bolt-grip puller set, such as those used to remove steering wheels and harmonic balancers, to remove the transfer case output shaft damper.
(6) Use a suitable pry tool, or a slide hammer mounted screw, to remove the seal from the rear retainer (Fig. 4).

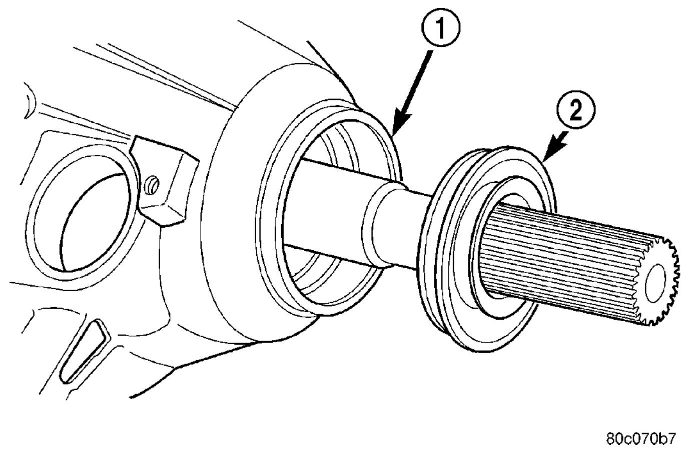


Fig. 4 Rear Retainer Seal

1 - REAR RETAINER
2 - OUTPUT SHAFT SEAL

TRANSFER CASE - NV231 (Continued)

(7) Remove the rear output bearing I.D. retaining ring (Fig. 5).

(8) Remove the bolts holding the rear retainer to the rear case half.

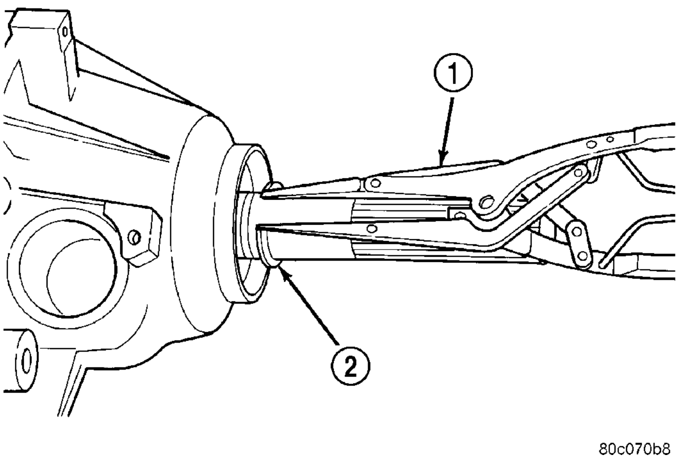


Fig. 5 Output Shaft Rear Bearing Retaining Ring

1 - SNAP-RING PLIERS
2 - REAR BEARING I.D. RETAINING RING

(9) Tap rear retainer with rawhide or rubber mallet to loosen sealer bead.

(10) Remove rear retainer from rear case half (Fig. 6).

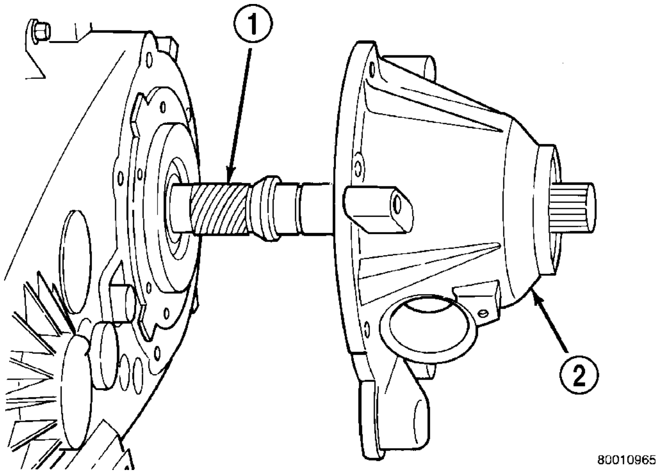


Fig. 6 Rear Retainer Removal

1 - MAINSHAFT
2 - REAR RETAINER

(11) Remove snap-ring holding oil pump in position on output shaft.

(12) Disengage oil pickup tube from oil pump and remove oil pump assembly. Remove oil pump by tilting the edge of the oil pump from under the edge of the rear case half and sliding the pump (Fig. 7).

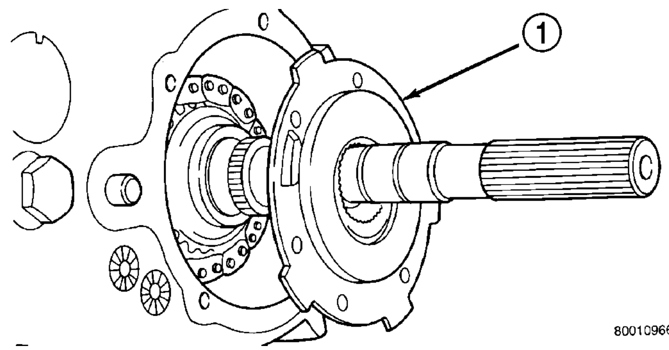


Fig. 7 Oil Pump Removal

1 - OIL PUMP

(13) Remove pick-up tube o-ring from oil pump (Fig. 8), if necessary. Do not disassemble the oil pump, it is not serviceable.

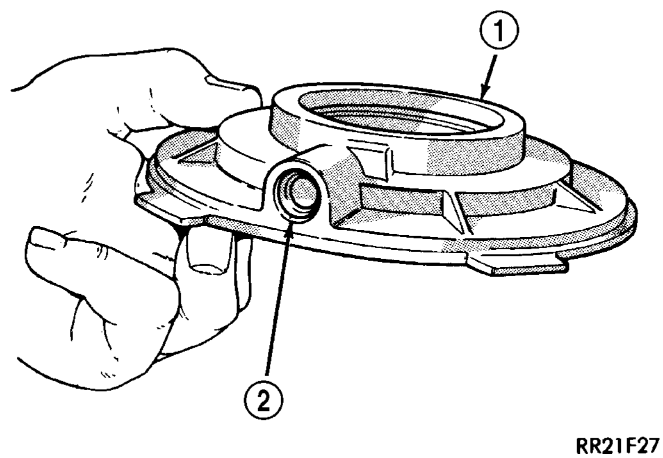


Fig. 8 Pick-up Tube O-ring Location

1 - OIL PUMP
2 - O-RING

TRANSFER CASE - NV231 (Continued)

YOKE AND RANGE LEVER

(1) Remove transfer case indicator switch.

(2) Remove front yoke nut as follows:

(a) Move range lever to 4L position.

(b) Then remove nut with socket and impact wrench (Fig. 9).

(3) Remove yoke. If yoke is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller (Fig. 10). Be sure puller tool is positioned on yoke and not on slinger as slinger will be damaged.

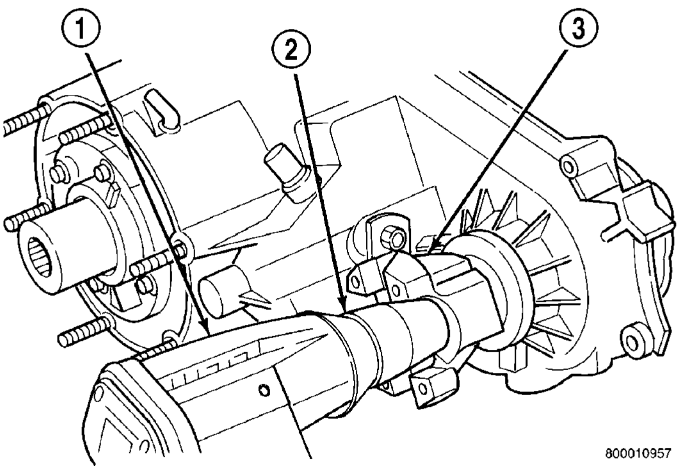


Fig. 9 Yoke Nut Removal

1 - IMPACT WRENCH
2 - SOCKET
3 - YOKE

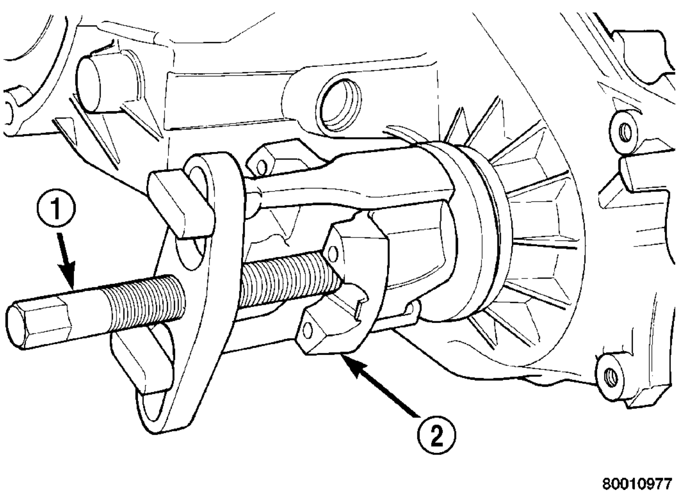


Fig. 10 Yoke Removal

1 - PULLER TOOL
2 - YOKE

(4) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(5) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft (Fig. 11).

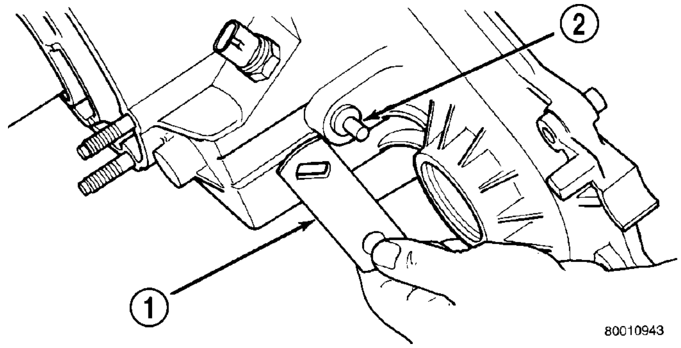


Fig. 11 Range Lever Removal

1 - RANGE LEVER
2 - SECTOR SHAFT

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Support transfer case so rear case is facing upward.

(2) Remove bolts holding front case to rear case. The case alignment bolts require flat washers (Fig. 12).

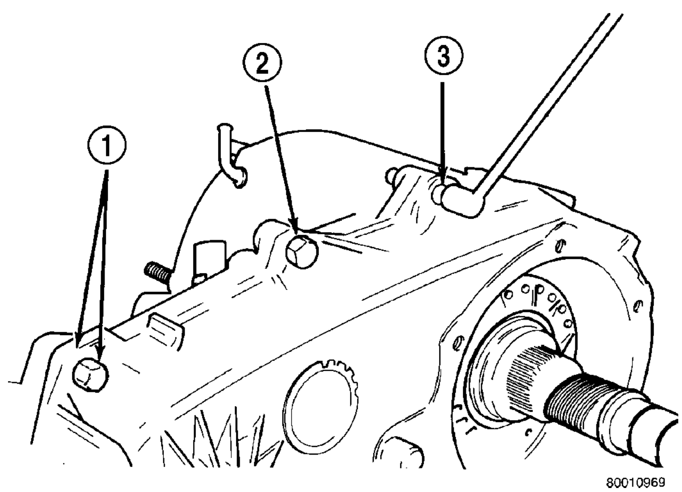


Fig. 12 Rear Case Alignment Bolt Locations

1 - DOWEL BOLT AND WASHER (2)
2 - CASE BOLT (5)
3 - SPLINE HEAD BOLT (1)

TRANSFER CASE - NV231 (Continued)

(3) Loosen rear case with flat blade screwdriver to break sealer bead. Insert pry tool blade only into notches provided at each end of case (Fig. 13).

(4) Remove rear case from front case.

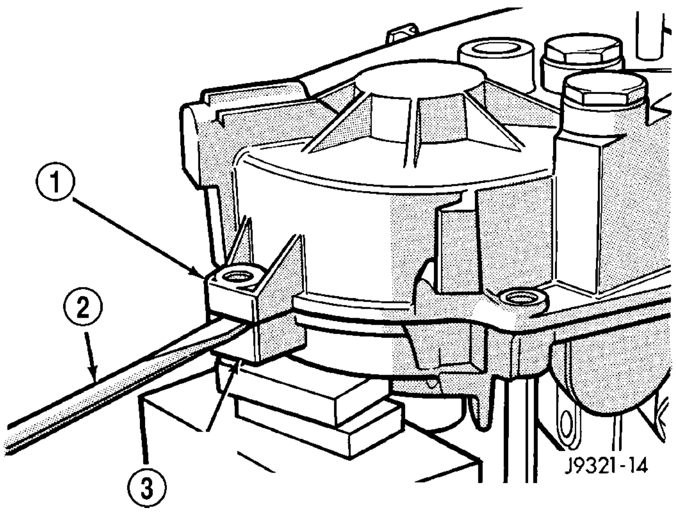


Fig. 13 Loosening Rear Case - Typical

1 - REAR CASE
2 - PRY TOOL (IN CASE SLOT)
3 - FRONT CASE

(5) Remove oil pickup tube from rear case (Fig. 14).

(6) Remove mode fork spring (Fig. 15).

(7) Pull front output shaft upward and out of front output shaft bearing (Fig. 16).

(8) Remove front output shaft and chain.

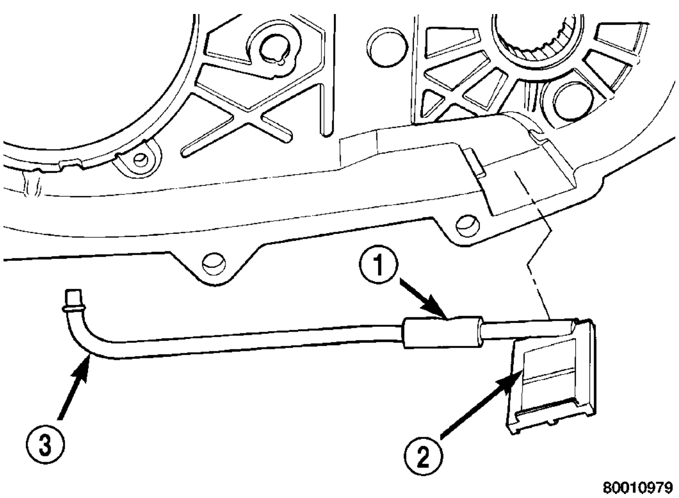


Fig. 14 Oil Pickup Tube Removal

1 - CONNECTING HOSE
2 - PICKUP SCREEN
3 - PICKUP TUBE

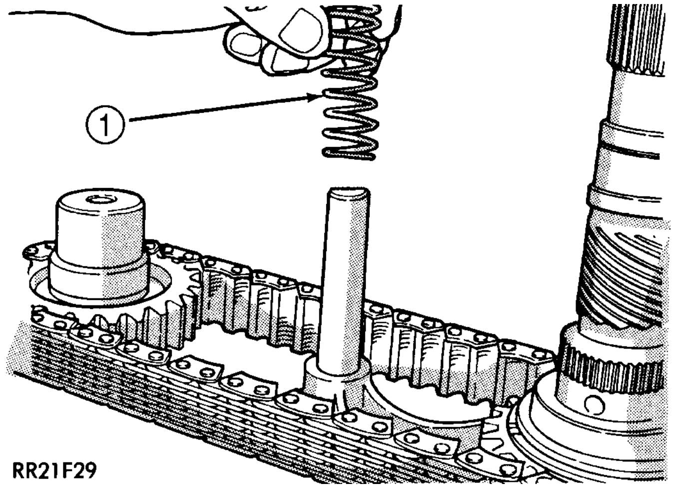


Fig. 15 Mode Fork Spring Removal

1 - MODE SPRING

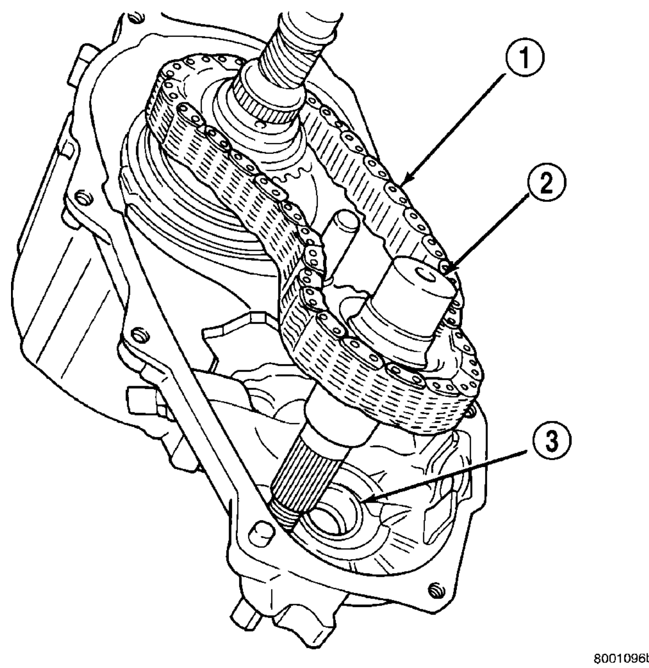


Fig. 16 Remove Front Output Shaft And Chain

1 - DRIVE CHAIN
2 - FRONT OUTPUT SHAFT
3 - SHAFT FRONT BEARING

TRANSFER CASE - NV231 (Continued)

SHIFT FORKS AND MAINSHAFT

(1) Remove detent plug, O-ring, detent spring and detent plunger (Fig. 17).

(2) Remove mainshaft from mode sleeve and input gear pilot bearing.

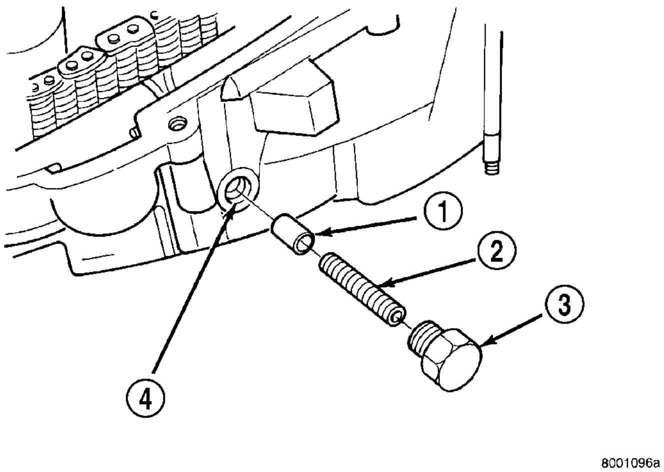


Fig. 17 Detent Plug, Spring And Plunger Removal

1 - POPPET
2 - SPRING
3 - SCREW
4 - POPPET BORE (IN CASE)

(3) Remove mode fork and sleeve as an assembly (Fig. 18). Note position of sleeve for assembly reference. The short side of the sleeve faces upward.

(4) Remove range fork and hub as an assembly (Fig. 19). Note fork position for installation reference.

(5) Remove shift sector from front case (Fig. 20).

(6) Remove shift sector bushing and O-ring (Fig. 21).

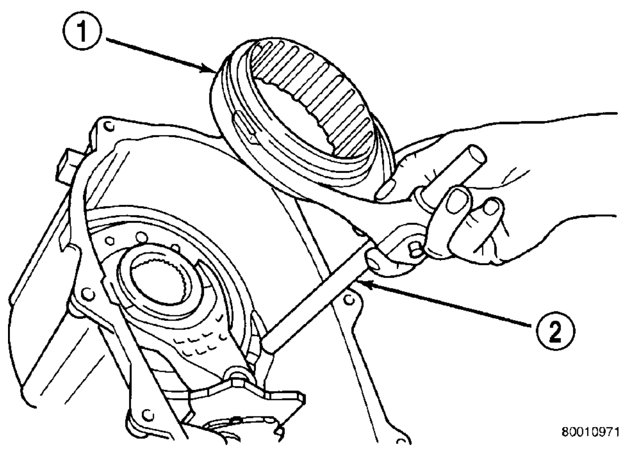


Fig. 18 Mode Fork And Sleeve Removal

1 - MODE SLEEVE
2 - MODE FORK AND RAIL

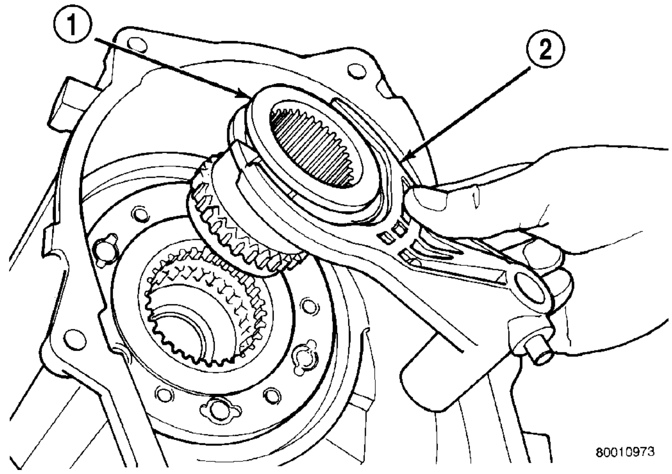


Fig. 19 Range Fork And Sleeve Removal

1 - RANGE HUB
2 - RANGE FORK

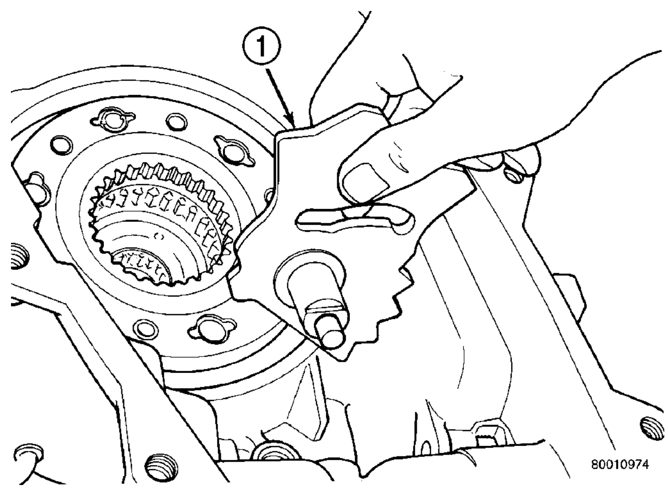


Fig. 20 Shift Sector Removal

1 - SHIFT SECTOR

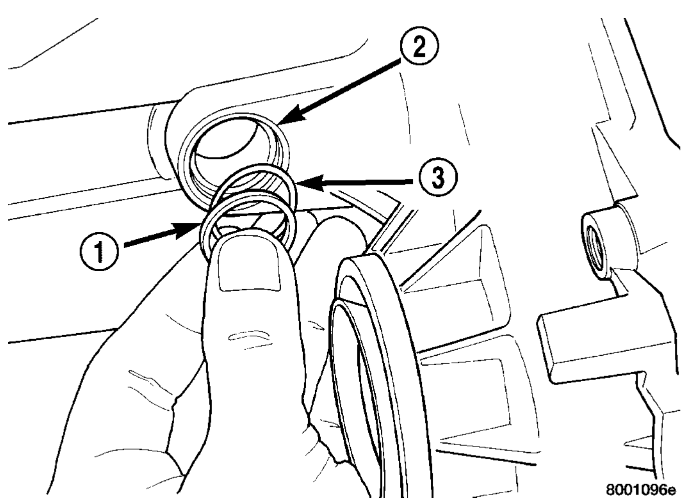


Fig. 21 Sector Bushing And O-Ring Removal

1 - SEAL RETAINER
2 - SECTOR SHAFT BORE
3 - O-RING SEAL

TRANSFER CASE - NV231 (Continued)

MAINSHAFT

(1) Remove mode hub retaining ring with heavy duty snap-ring pliers (Fig. 22).

(2) Slide mode hub off mainshaft (Fig. 23).

(3) Slide drive sprocket off mainshaft (Fig. 24).

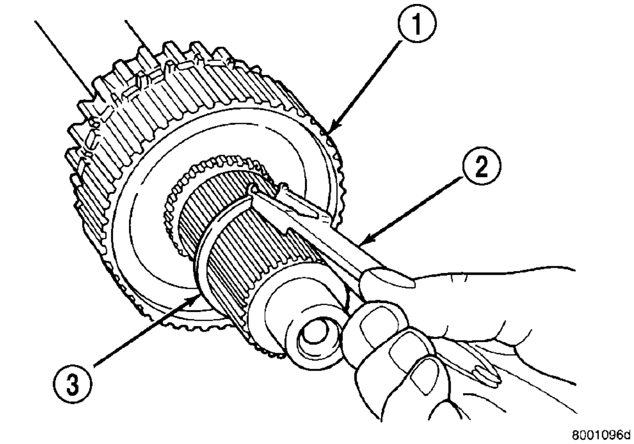


Fig. 22 Mode Hub Retaining Ring Removal

1 - MODE HUB
2 - SNAP-RING PLIERS (HEAVY DUTY)
3 - MODE HUB RETAINING RING

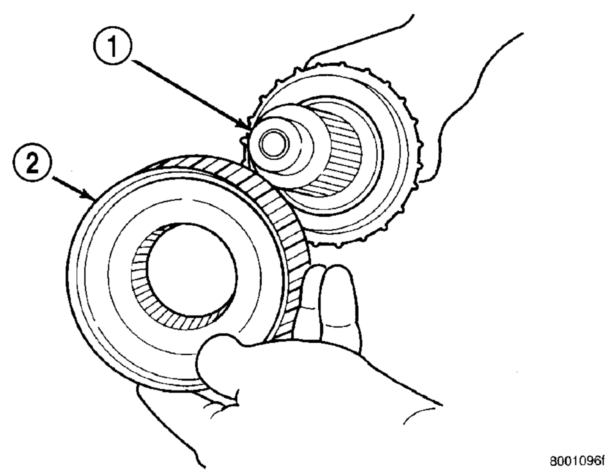


Fig. 23 Mode Hub Removal

1 - MAINSHAFT
2 - MODE HUB

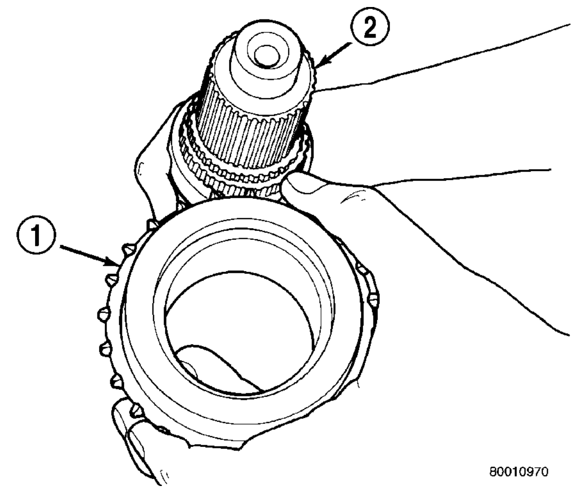


Fig. 24 Drive Sprocket Removal

1 - DRIVE SPROCKET
2 - MAINSHAFT

INPUT GEAR AND LOW RANGE GEAR

(1) Remove front bearing retainer attaching bolts (Fig. 25).

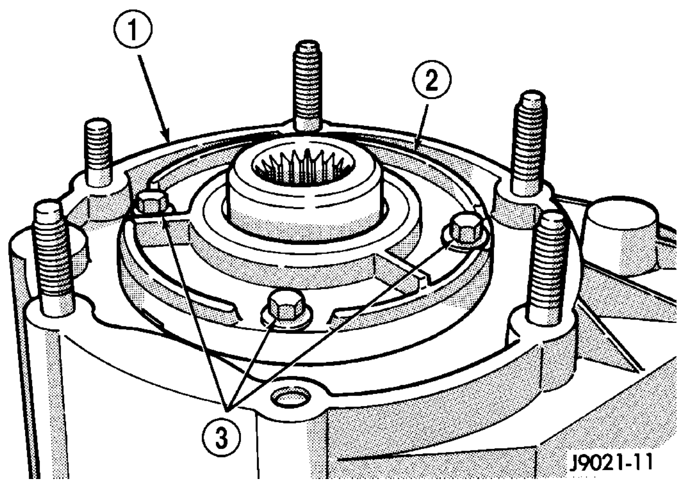


Fig. 25 Front Bearing Retainer Bolts

1 - FRONT CASE
2 - FRONT BEARING RETAINER
3 - RETAINER BOLTS

TRANSFER CASE - NV231 (Continued)

(2) Remove front bearing retainer. Pry retainer loose with pry tool positioned in slots at each end of retainer (Fig. 26).

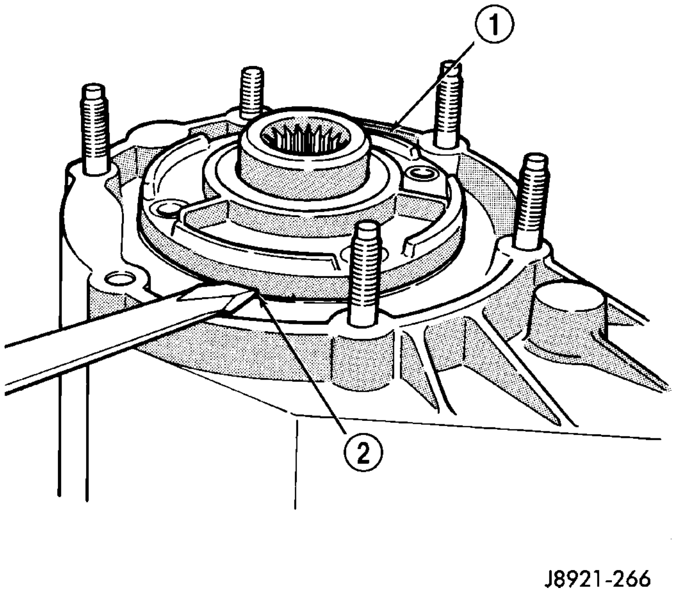


Fig. 26 Front Bearing Retainer Removal

1 - FRONT BEARING RETAINER
2 - RETAINER SLOT

(3) Remove front bearing retainer seal. Tap seal out with drift and hammer.

(4) Remove input gear retaining ring with heavy duty snap-ring pliers (Fig. 27)

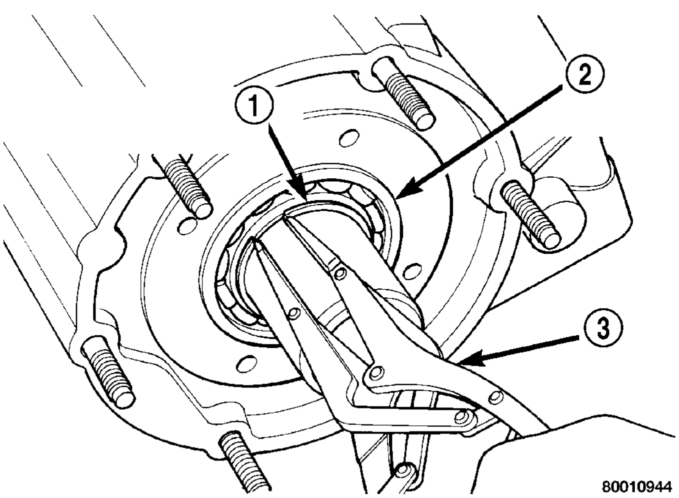


Fig. 27 Removing Input Gear Retaining Ring

1 - INPUT GEAR BEARING RETAINING RING
2 - INPUT GEAR BEARING
3 - SNAP-RING PLIERS

(5) Place front case in horizontal position. Then remove input gear and low range gear as an assembly (Fig. 28). Tap gear out of bearing with plastic mallet if necessary.

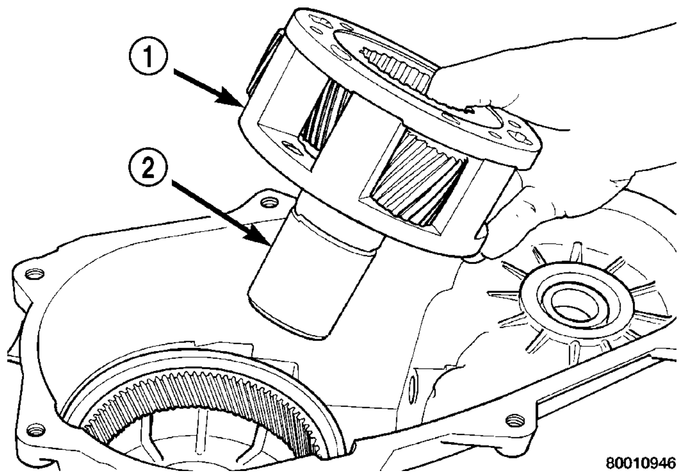


Fig. 28 Input Gear And Planetary Carrier Removal

1 - PLANETARY ASSEMBLY
2 - INPUT GEAR

INPUT AND LOW RANGE GEAR

(1) Remove snap-ring that retains input gear in low range gear (Fig. 29).

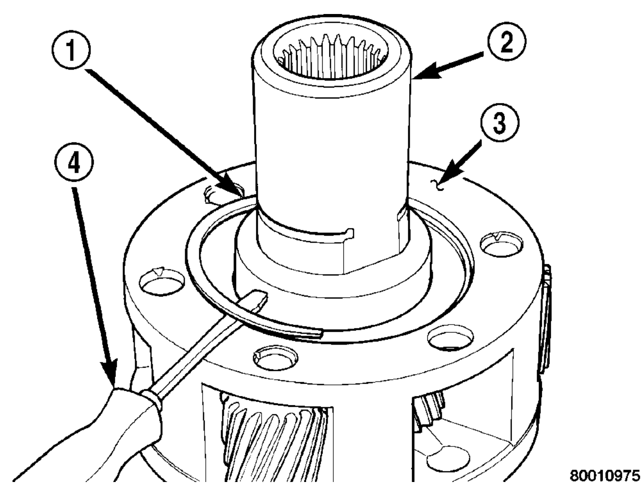


Fig. 29 Input Gear Snap-Ring Removal

1 - CARRIER LOCK RETAINING RING
2 - INPUT GEAR
3 - PLANETARY CARRIER
4 - SCREWDRIVER

TRANSFER CASE - NV231 (Continued)

(2) Remove retainer (Fig. 30).

(3) Remove front tabbed thrust washer (Fig. 31).

(4) Remove input gear (Fig. 32).

(5) Remove rear tabbed thrust washer from low range gear (Fig. 33).

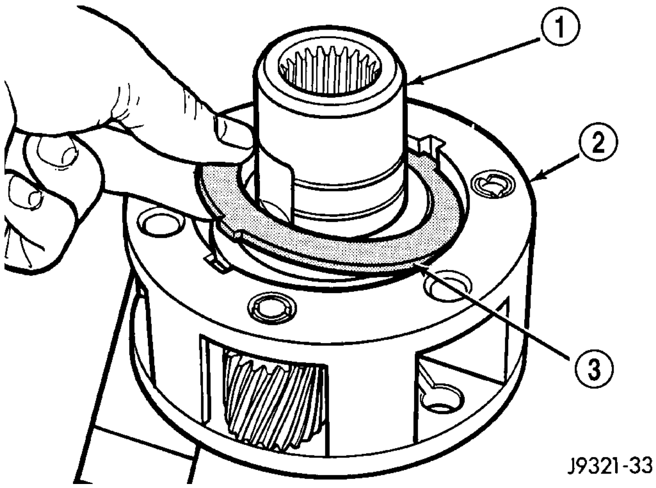


Fig. 30 Input Gear Retainer Removal

1 - INPUT GEAR
2 - LOW RANGE GEAR
3 - RETAINER

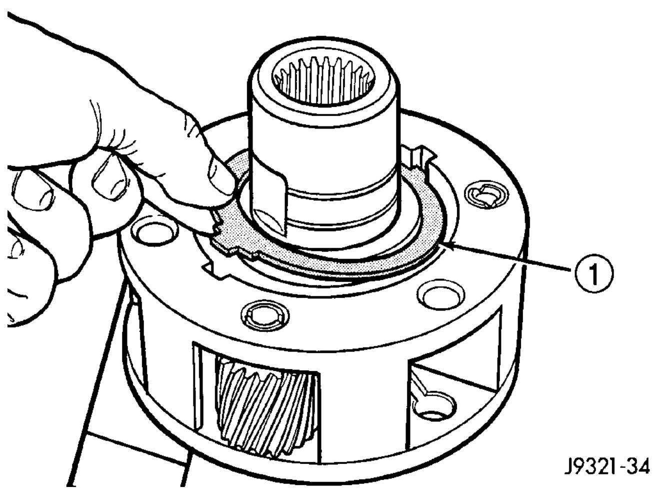


Fig. 31 Front Tabbed Thrust Washer Removal

1 - FRONT TABBED THRUST WASHER

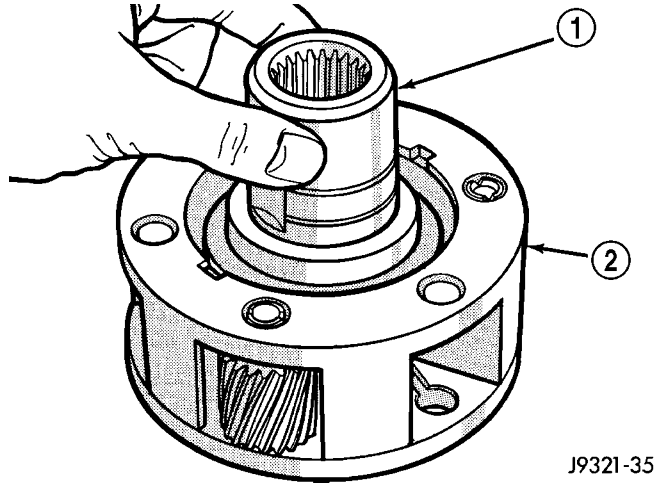


Fig. 32 Input Gear Removal

1 - INPUT GEAR
2 - LOW RANGE GEAR

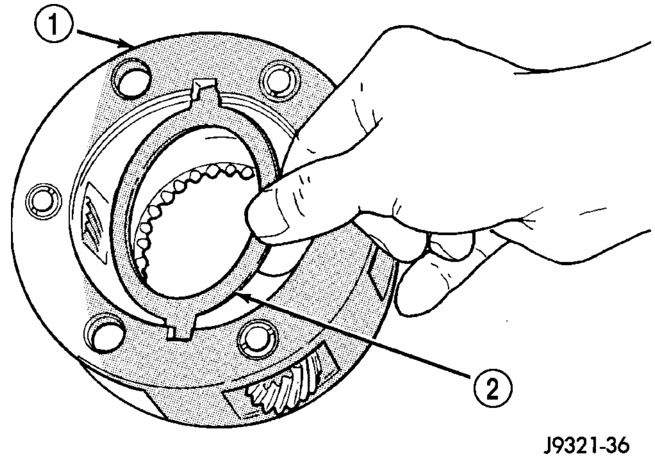


Fig. 33 Rear Tabbed Thrust Washer Removal

1 - LOW RANGE GEAR
2 - REAR TABBED THRUST WASHER

CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

TRANSFER CASE - NV231 (Continued)

INSPECTION

MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket (Fig. 34). Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear (Fig. 35). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

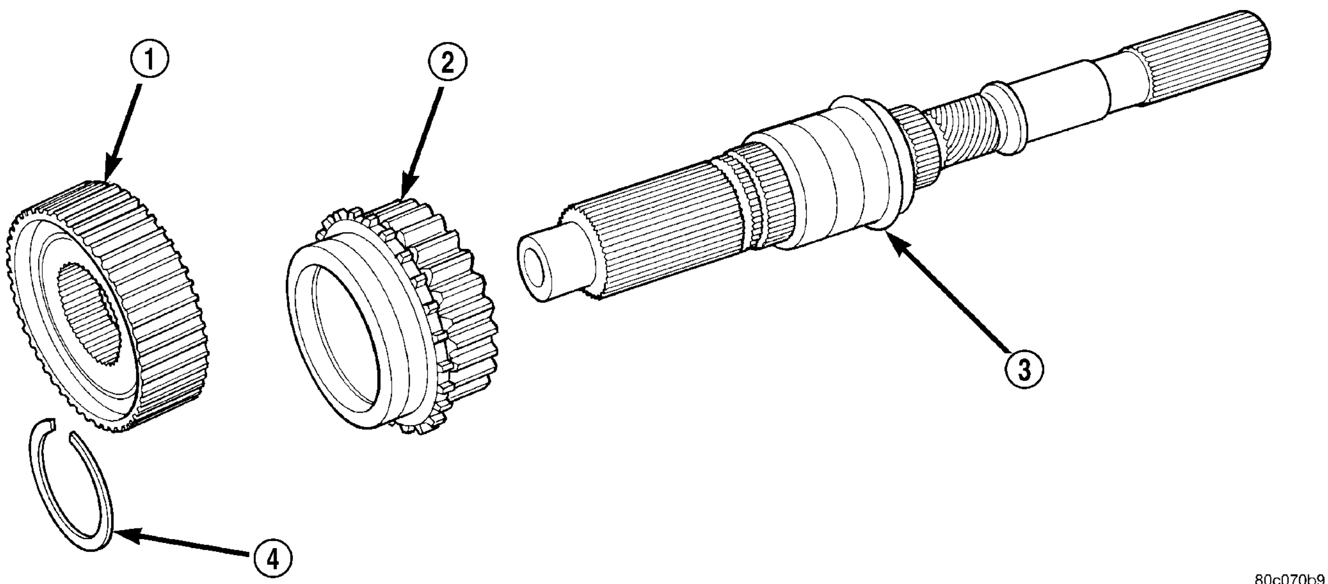


Fig. 34 Mainshaft, Mode Hub, And Drive Sprocket

1 - MODE HUB
2 - DRIVE SPROCKET
3 - MAINSHAFT
4 - MODE HUB RETAINING RING

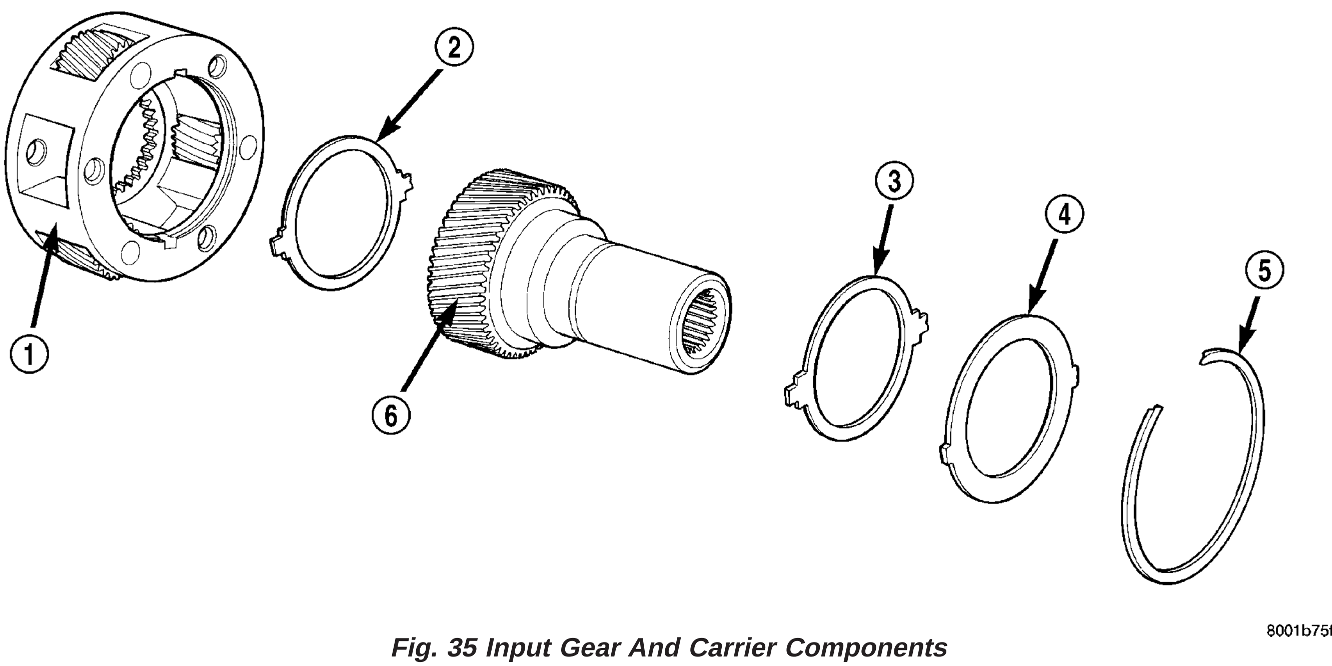


Fig. 35 Input Gear And Carrier Components

1 - PLANETARY CARRIER
2 - REAR THRUST WASHER
3 - FRONT THRUST WASHER
4 - CARRIER LOCK RING
5 - CARRIER LOCK RETAINING RING
6 - INPUT GEAR

TRANSFER CASE - NV231 (Continued)

Check the lock ring and both thrust washers for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (Fig. 36). Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

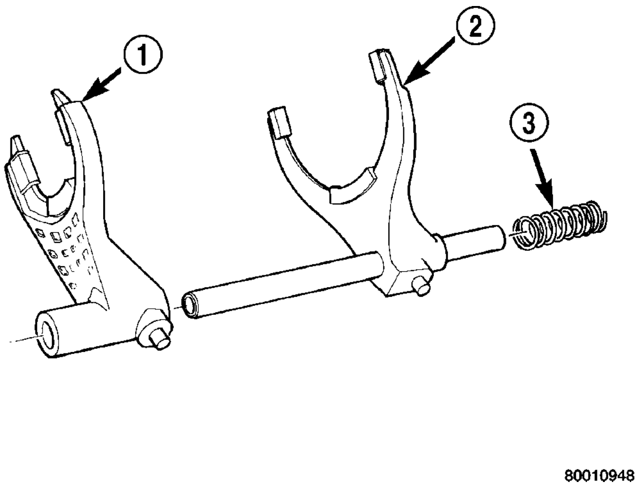


Fig. 36 Shift Forks

1 - RANGE FORK
2 - MODE FORK AND RAIL
3 - MODE SPRING

Inspect the shift fork wear pads (Fig. 37). The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are not serviceable. The fork must be replaced as an assembly if the pads are worn or damaged.

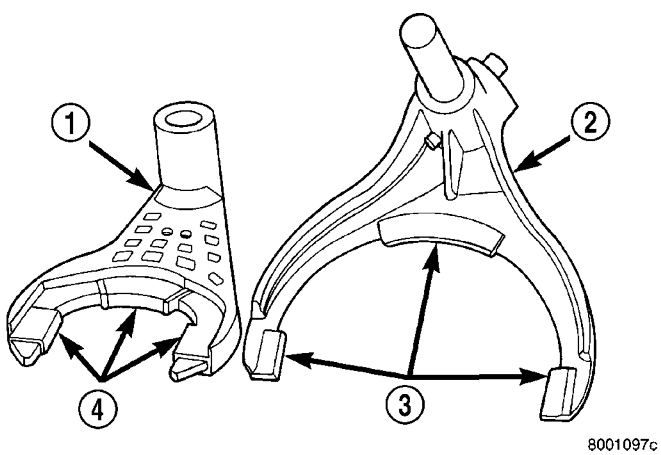


Fig. 37 Shift Fork And Wear Pad Locations

1 - RANGE FORK
2 - MODE FORK
3 - WEAR PADS (SERVICEABLE)
4 - WEAR PADS (NON-SERVICEABLE)

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER/BEARING/ SEAL/SLINGER/BOOT

Inspect the retainer components (Fig. 38). Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

An output shaft slinger is used on some vehicles, while an output shaft damper is used on other vehicles. The output shaft slinger and seal should be replaced outright; do not reuse either part.

Replace any part if distorted, bent, or broken. Also replace the boot if cut or torn. Replace the boot band clamps, do not reuse them.

REAR OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (Fig. 39). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320-400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (Fig. 40)

TRANSFER CASE - NV231 (Continued)

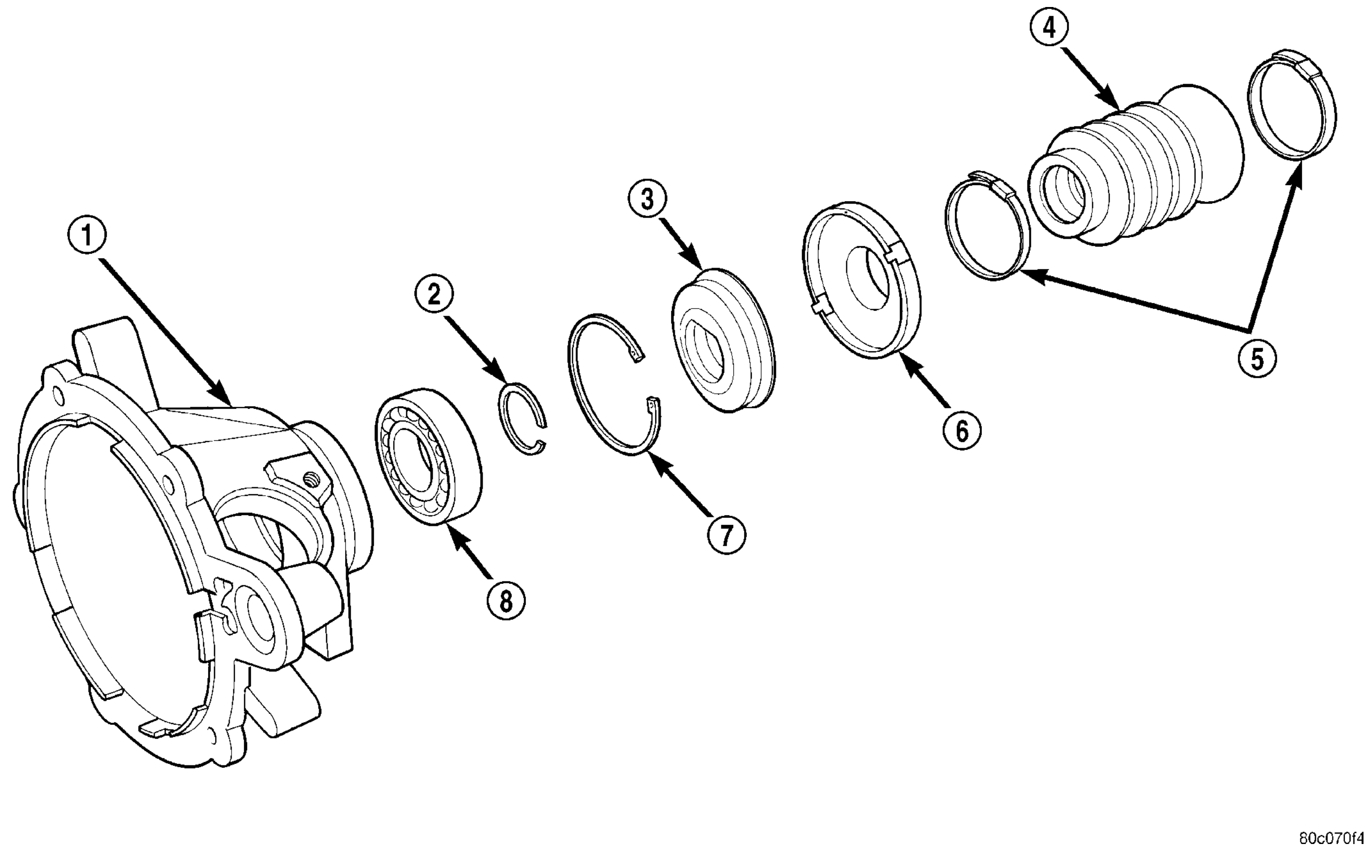


Fig. 38 Rear Retainer Without Output Shaft Damper

1 - REAR RETAINER
2 - REAR BEARING I.D. MAINSHAFT RETAINING RING
3 - REAR SEAL
4 - BOOT
5 - BAND CLAMPS
6 - REAR SLINGER
7 - REAR BEARING O.D. RETAINING RING
8 - REAR BEARING

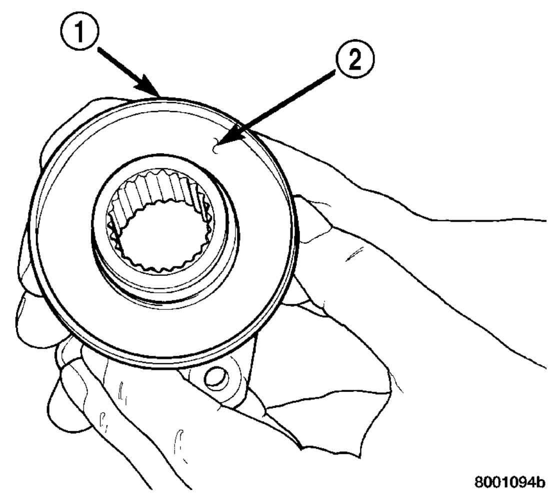


Fig. 39 Seal Contact Surface Of Yoke Slinger

1 - FRONT SLINGER (PART OF YOKE)
2 - SEAL CONTACT SURFACE MUST BE CLEAN AND SMOOTH

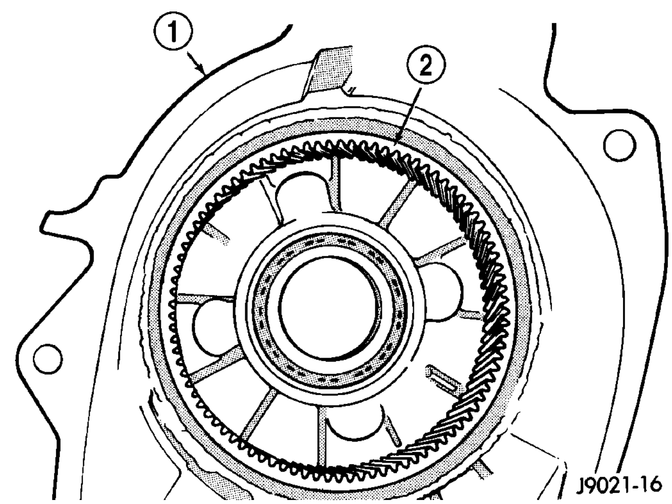


Fig. 40 Low Range Annulus Gear

1 - FRONT CASE
2 - LOW RANGE ANNULUS GEAR

TRANSFER CASE - NV231 (Continued)

FRONT/REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and 3M™ all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

ASSEMBLY

Lubricate transfer case components with Mopar® ATF +4, Automatic Transmission Fluid, or petroleum jelly (where indicated) during assembly.

BEARINGS AND SEALS

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

(1) Remove the front output shaft seal from case with pry tool (Fig. 41).

(2) Remove the front output shaft bearing retaining ring with screwdriver (Fig. 42).

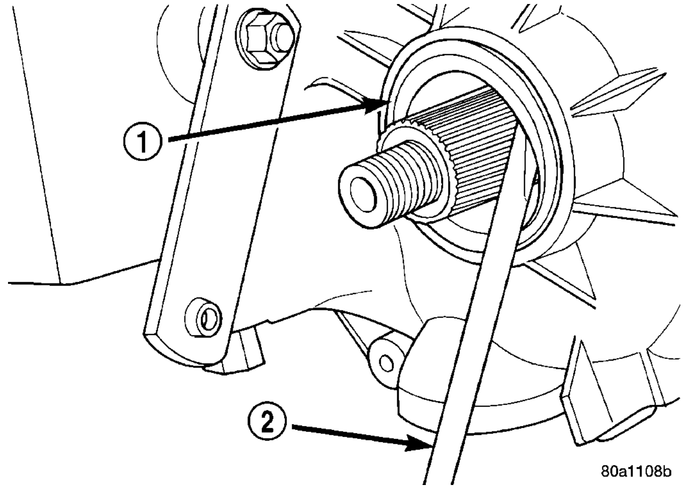


Fig. 41 Front Output Seal Removal - Typical

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

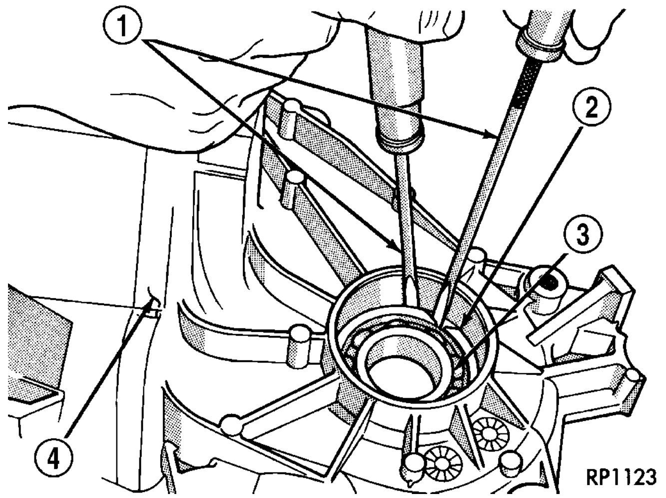


Fig. 42 Front Output Shaft Bearing Retaining Ring Removal

1 - SCREWDRIVERS
2 - SNAP-RING
3 - FRONT OUTPUT SHAFT BEARING
4 - FRONT CASE

TRANSFER CASE - NV231 (Continued)

(3) Remove bearing with Tool Handle C-4171 and Tool 5065 (Fig. 43).

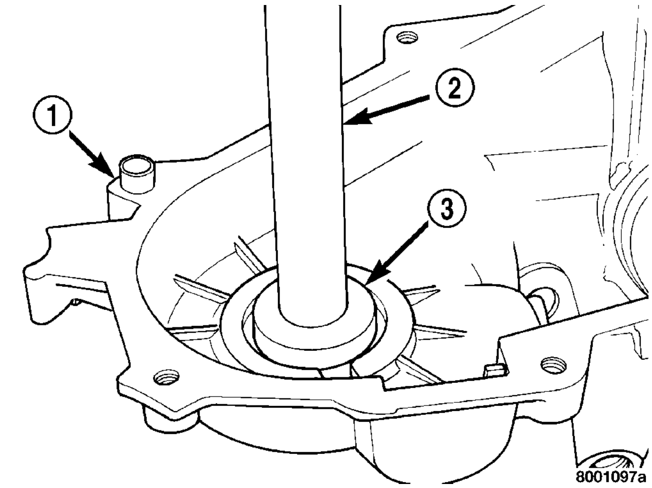


Fig. 43 Front Output Shaft Bearing Removal

1 - FRONT CASE
2 - SPECIAL TOOL C-4171
3 - SPECIAL TOOL 5065

(4) Install front output shaft front bearing in case with Tool Handle C-4171 and Installer 5064 (Fig. 44).

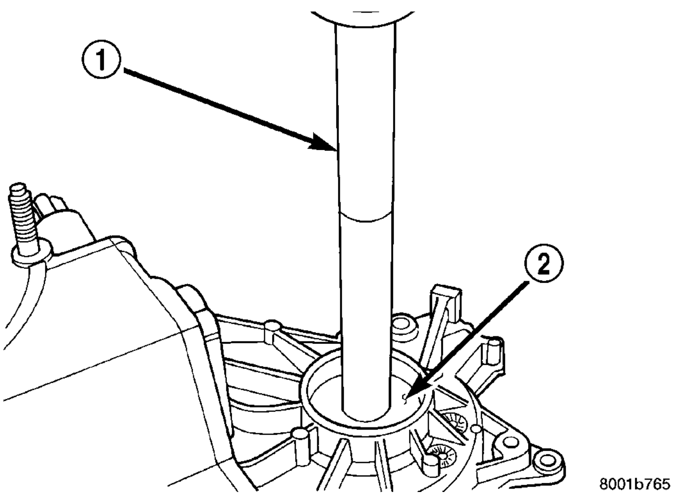


Fig. 44 Front Output Shaft Bearing Installation

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 5064

(5) Install output shaft front bearing retaining ring (Fig. 45). Start ring into place by hand. Then use small screwdriver to work ring into case groove. Be sure ring is fully seated before proceeding.

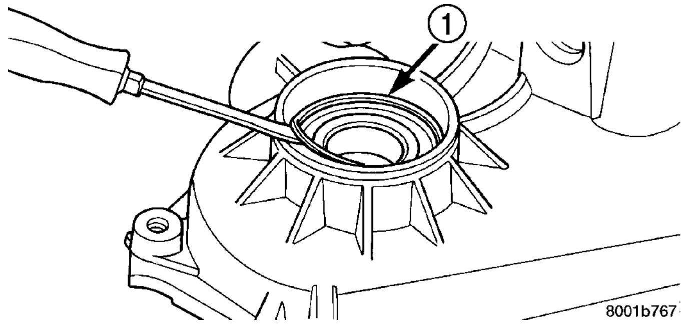


Fig. 45 Installing Output Shaft Front Bearing Retaining Ring

1 - WORK RETAINING RING INTO BORE GROOVE WITH SMALL SCREWDRIVER

(6) Install new front output seal in front case with Installer Tool 8143-A as follows:

(a) Place new seal on tool. **Garter spring on seal goes toward interior of case.**

(b) Start seal in bore with light taps from hammer (Fig. 46). Once seal is started, continue tapping seal into bore until installer tool bottoms against case.

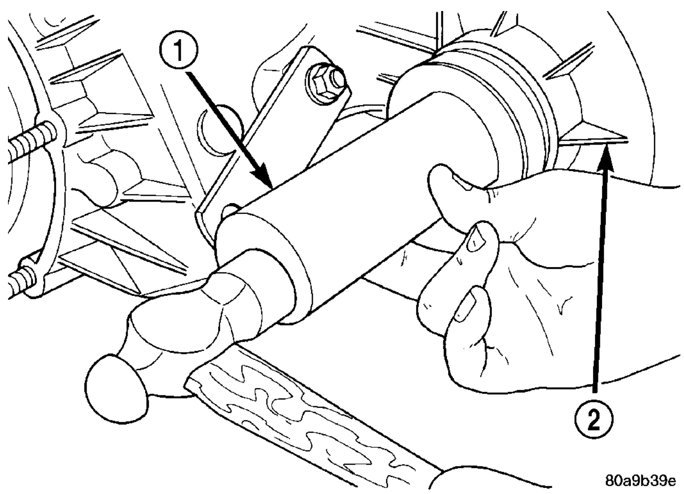


Fig. 46 Front Output Seal Installation - Typical

1 - INSTALLER 8143-A
2 - TRANSFER CASE

TRANSFER CASE - NV231 (Continued)

(7) Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 47).

(8) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 48). The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 49).

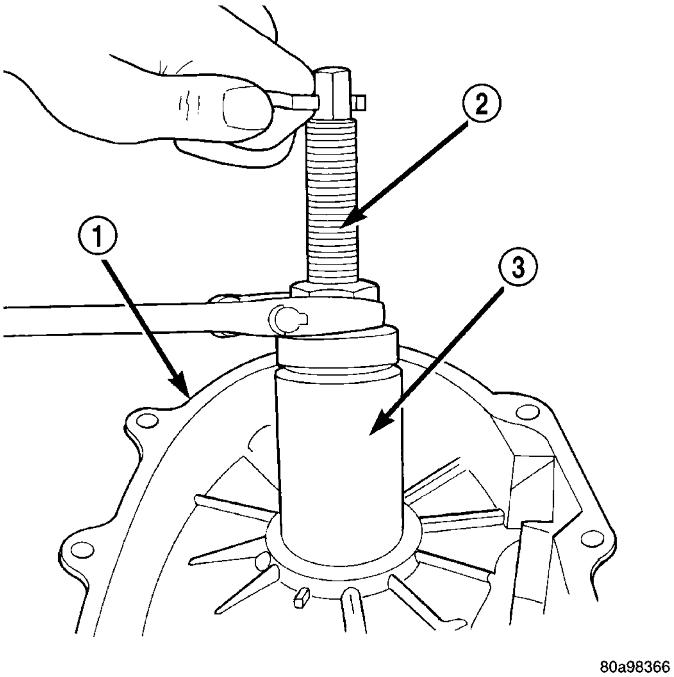


Fig. 47 Output Shaft Rear Bearing Removal

1 - REAR CASE
2 - SPECIAL TOOL L-4454-1 AND L-4454-3
3 - SPECIAL TOOL 8148

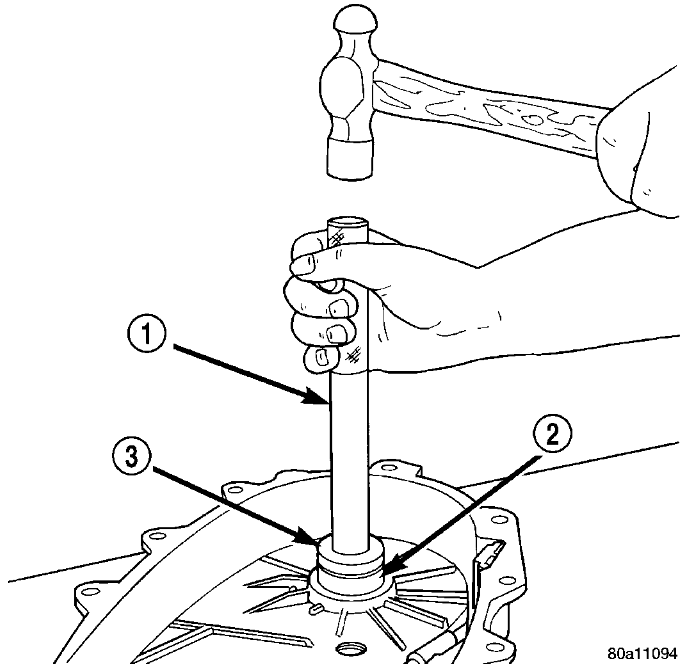


Fig. 48 Output Shaft Rear Bearing Installation

1 - HANDLE C-4171
2 - OUTPUT SHAFT INNER BEARING
3 - INSTALLER 5066

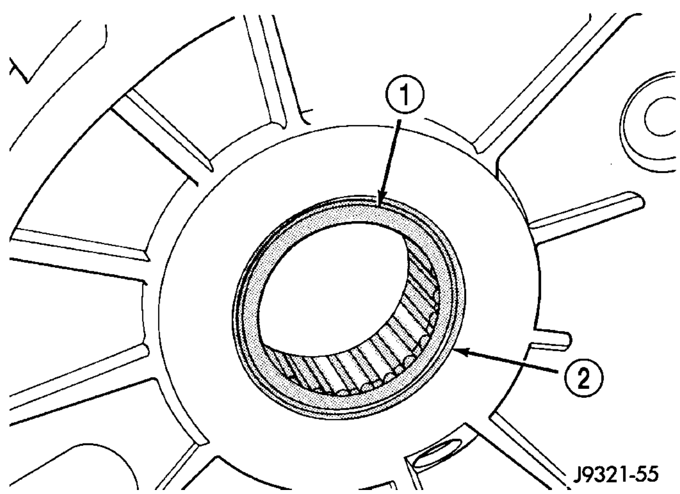


Fig. 49 Output Shaft Rear Bearing Installation Depth

1 - BEARING (SEATED) AT LOWER EDGE OF CHAMFER
2 - CHAMFER

TRANSFER CASE - NV231 (Continued)

(9) Using Remover C-4210 and Handle C-4171, drive input shaft bearing from inside the annulus gear opening in the case (Fig. 50).

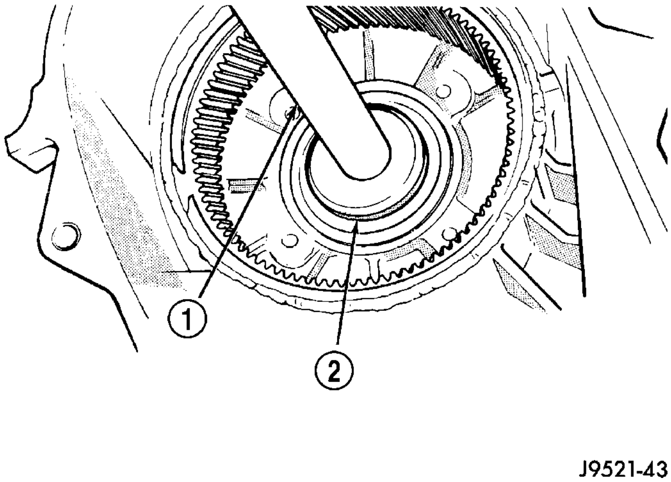


Fig. 50 Input Shaft Bearing Removal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL C-4210

(10) Install locating ring on new bearing.

(11) Position case so forward end is facing upward.

(12) Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring must be fully seated against case surface (Fig. 51).

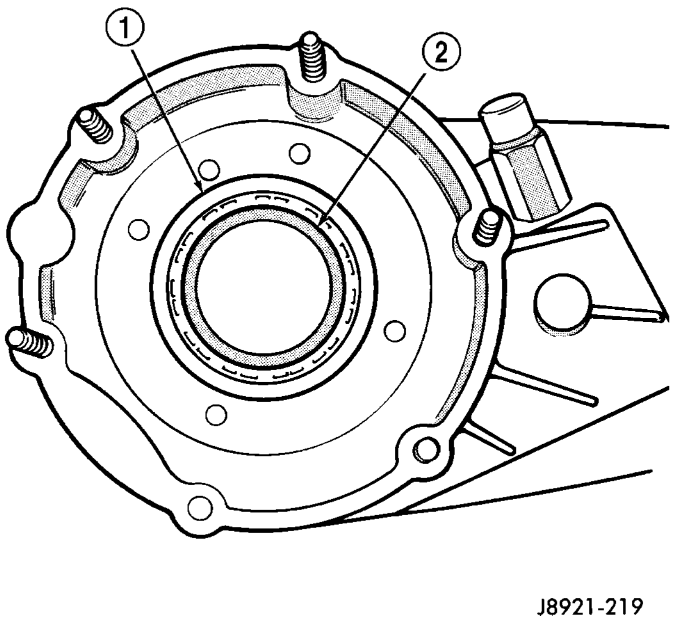


Fig. 51 Seating Input Shaft Bearing

1 - SNAP-RING
2 - INPUT SHAFT BEARING

(13) Remove input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 52).

(14) Install new pilot bearing with Installer 5065 and Handle C-4171 (Fig. 53).

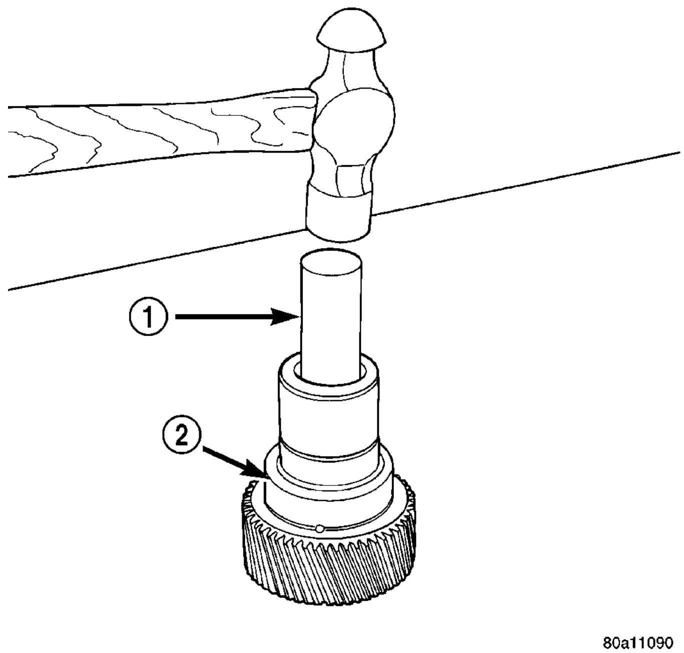


Fig. 52 Remove Input Gear Pilot Bearing

1 - DRIFT
2 - INPUT GEAR

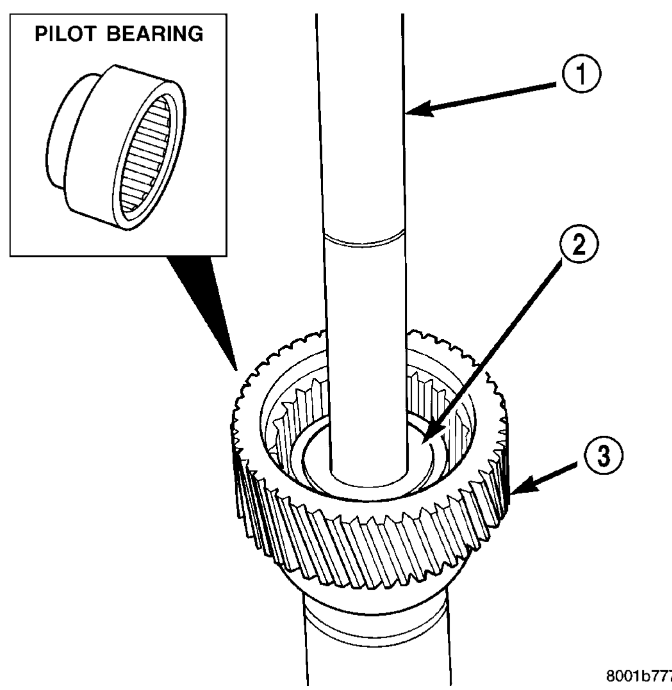


Fig. 53 Install Input Gear Pilot Bearing

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 5065
3 - INPUT GEAR

TRANSFER CASE - NV231 (Continued)

(15) Remove front bearing retainer seal with suitable pry tool.

(16) Install new front bearing retainer seal with Installer 7884 (Fig. 54).

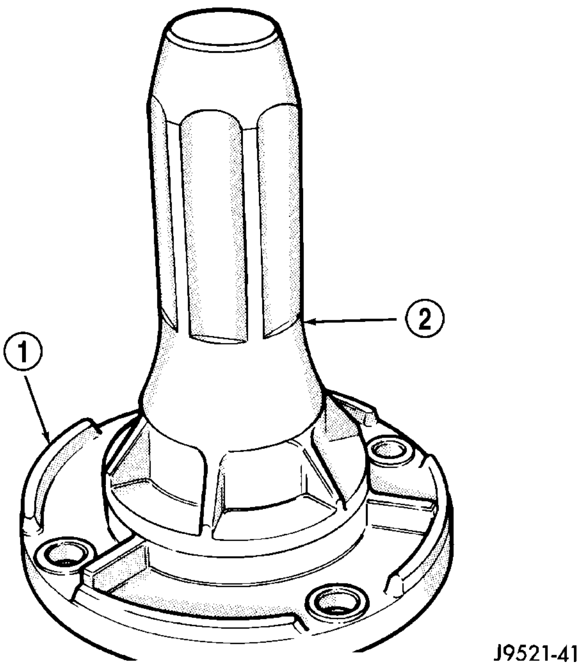


Fig. 54 Install Front Bearing Retainer Seal

1 - FRONT BEARING RETAINER
2 - SPECIAL TOOL 7884

(17) Remove seal from oil pump housing with a suitable pry tool

(18) Install new seal in oil pump housing with Installer 7888 (Fig. 55).

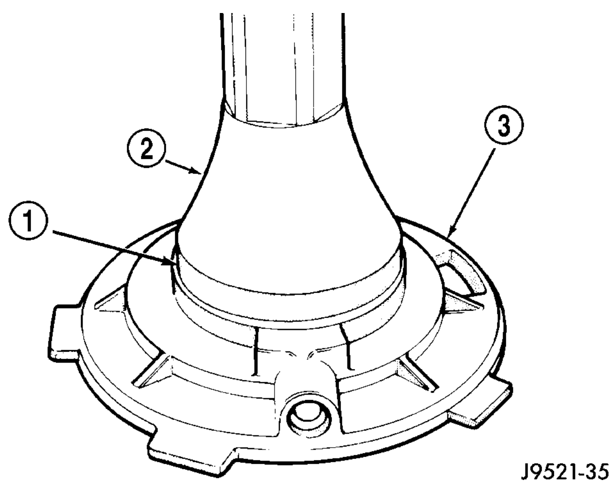


Fig. 55 Oil Pump Seal Installation

1 - HOUSING SEAL
2 - SPECIAL TOOL 7888
3 - OIL PUMP FEED HOUSING

(19) Remove rear retainer bearing with Installer 8128 and Handle C-4171.

(20) Install rear bearing in retainer with Handle C-4171 and Installer 5064 (Fig. 56).

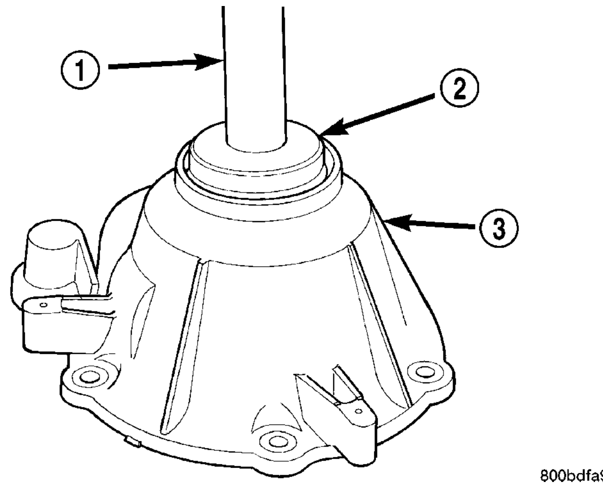


Fig. 56 Installing Rear Bearing In Retainer

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 5064
3 - REAR RETAINER

INPUT AND LOW RANGE GEAR

(1) Install first thrust washer in low range gear (Fig. 57). Be sure washer tabs are properly aligned in gear notches.

(2) Install input gear in low range gear. Be sure input gear is fully seated.

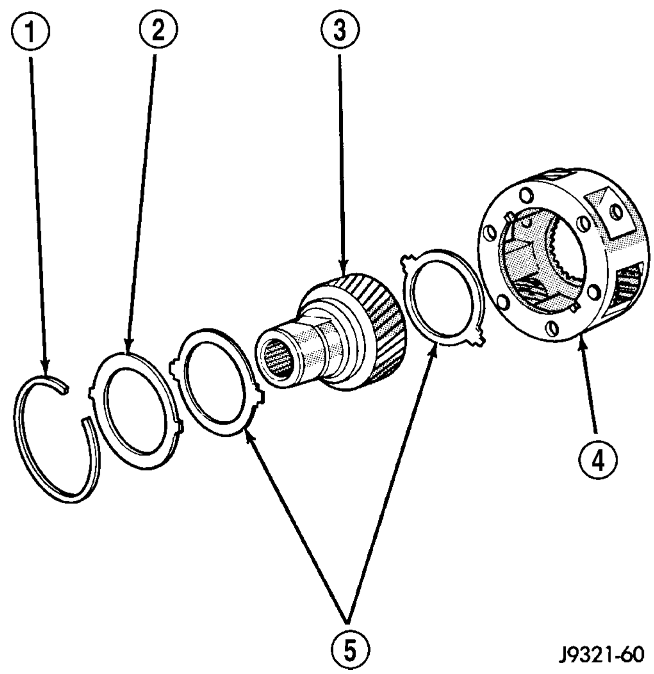


Fig. 57 Input/Low Range Gear Components

1 - SNAP-RING
2 - RETAINER PLATE
3 - INPUT GEAR
4 - LOW RANGE GEAR
5 - THRUST WASHERS

TRANSFER CASE - NV231 (Continued)

(3) Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.

(4) Install retainer on input gear and install snap-ring.

INPUT GEAR AND LOW RANGE GEAR

(1) Align and install low range/input gear assembly in front case (Fig. 58). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

(2) Install snap-ring to hold input/low range gear into front bearing (Fig. 59).

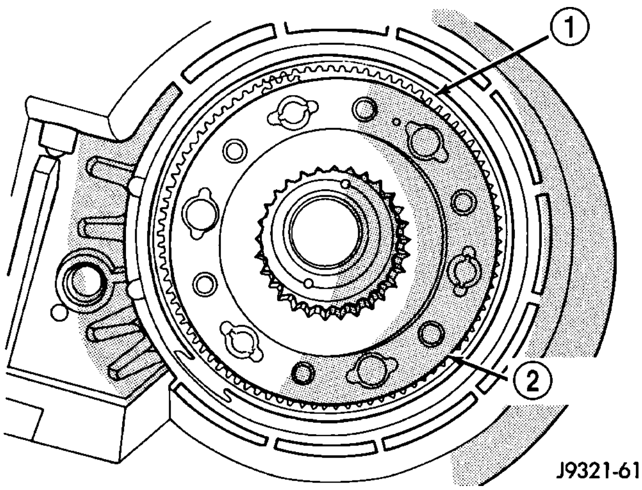


Fig. 58 Input/Low Range Gear Installation

1 - ANNULUS GEAR
2 - INPUT/LOW RANGE GEAR

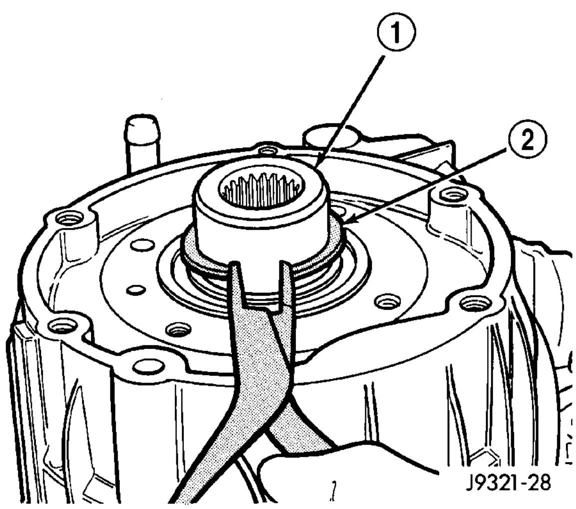


Fig. 59 Install Snap-Ring

1 - INPUT GEAR
2 - SNAP-RING

(3) Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.

(4) Apply a 3 mm (1/8 in.) bead of Mopar® gasket maker or silicone adhesive to sealing surface of retainer.

(5) Align cavity in seal retainer with fluid return hole in front of case.

CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® gasket maker or silicone adhesive sealer. Seal failure and fluid leak can result.

(6) Install bolts to hold retainer to transfer case (Fig. 60). Tighten to 21 N·m (16 ft. lbs.) of torque.

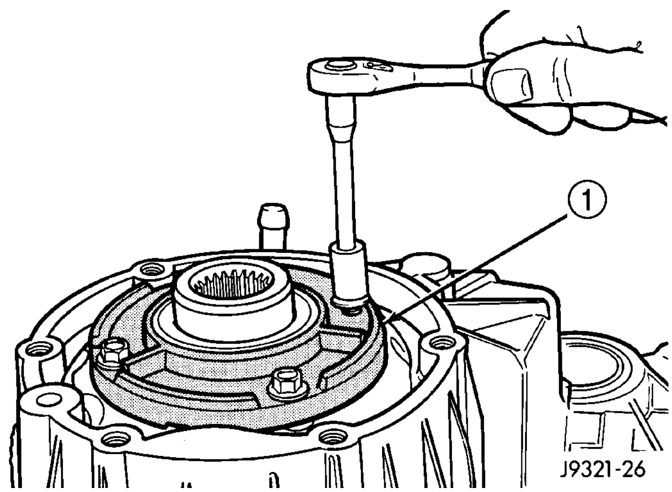


Fig. 60 Install Front Bearing Retainer

1 - FRONT BEARING RETAINER

MAINSHAFT

(1) Lubricate mainshaft splines with recommended transmission fluid.

(2) Slide drive sprocket onto mainshaft.

(3) Slide mode hub onto mainshaft.

(4) Install mode hub retaining ring. Verify that the retaining ring is fully seated in mainshaft groove.

TRANSFER CASE - NV231 (Continued)

SHIFT FORKS AND MAINSHAFT

(1) Install new sector shaft O-ring and bushing (Fig. 61).

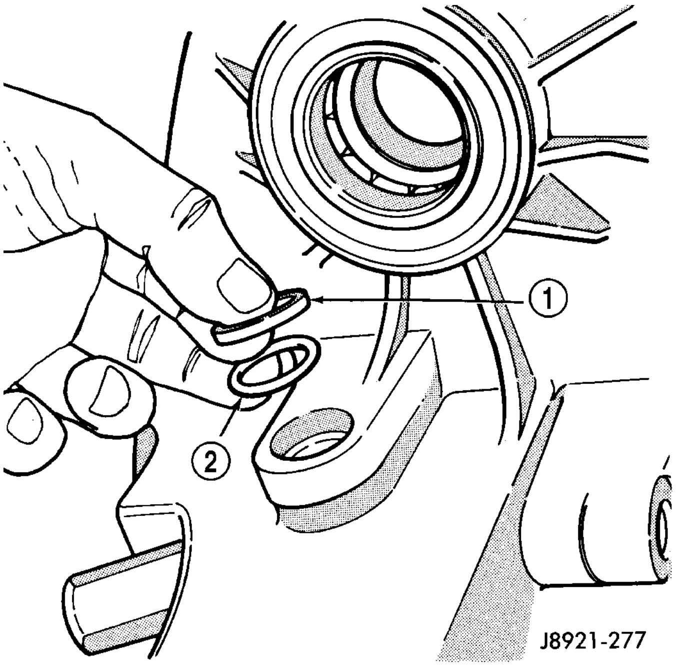


Fig. 61 Sector O-Ring And Bushing Installation

1 - SECTOR BUSHING
2 - O-RING

(2) Install shift sector in case (Fig. 62). Lubricate sector shaft with transmission fluid before installation.

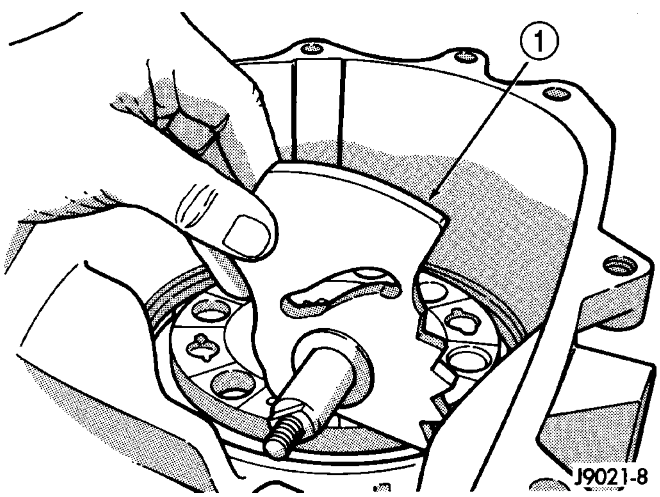


Fig. 62 Shift Sector Installation

1 - SHIFT SECTOR

(3) Install range lever, washer, and nut on sector shaft (Fig. 63). Tighten range lever nut to 27-34 N·m (20-25 ft. lbs.) torque.

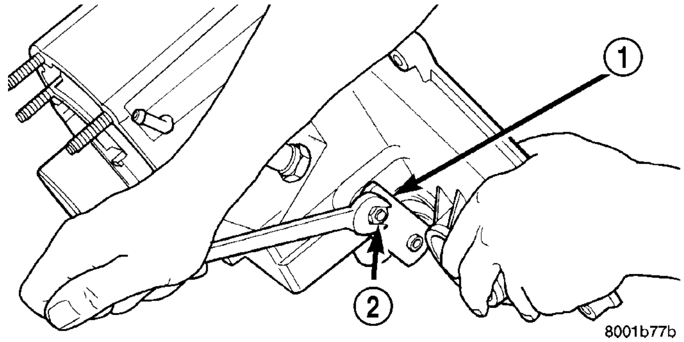


Fig. 63 Range Lever Installation

1 - RANGE LEVER
2 - LEVER NUT

(4) Assemble and install range fork and hub (Fig. 64). Be sure hub is properly seated in low range gear and engaged to the input gear.

(5) Align and insert range fork pin in shift sector slot.

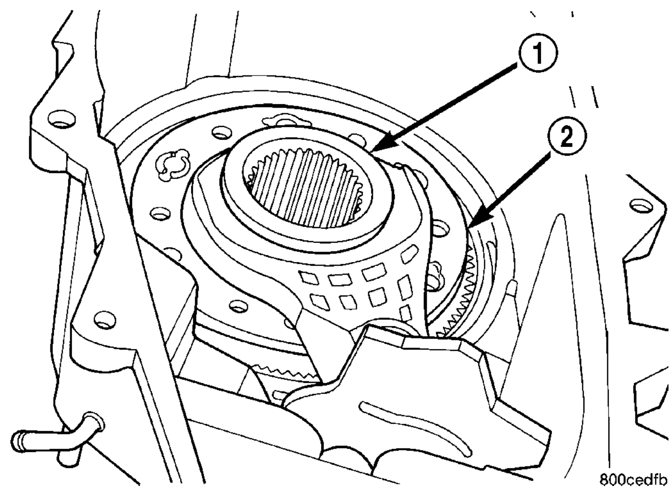


Fig. 64 Install Range Fork And Sleeve Assembly

1 - RANGE HUB
2 - RANGE FORK

TRANSFER CASE - NV231 (Continued)

(6) Install assembled mainshaft (Fig. 65). Be sure shaft is seated in pilot bearing and input gear.

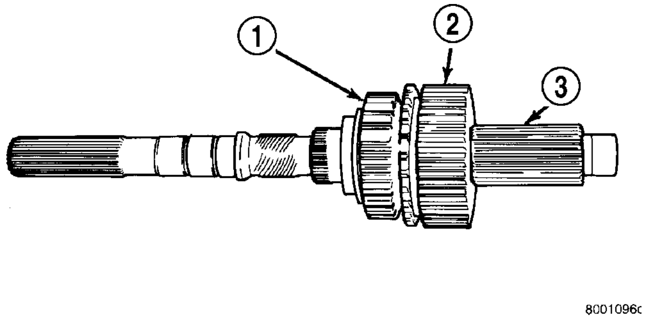


Fig. 65 Mainshaft Assembly Installation

1 - DRIVE SPROCKET
2 - MODE HUB
3 - MAINSHAFT

(7) Install new pads on mode fork if necessary.

(8) Insert mode sleeve in mode fork mode fork. Be sure long side of sleeve is toward long end of shift rail (Fig. 66).

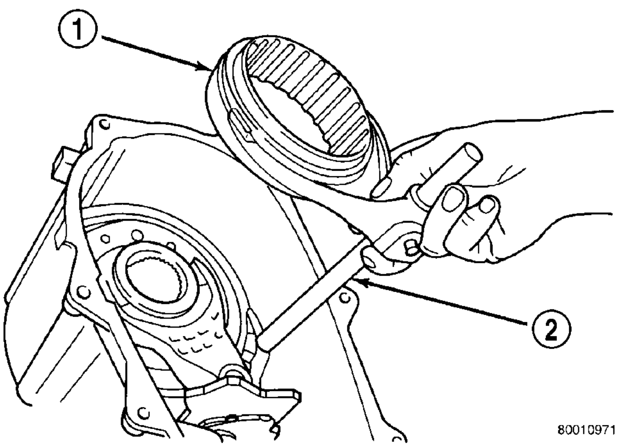


Fig. 66 Assembling Mode Fork And Sleeve

1 - MODE SLEEVE
2 - MODE FORK AND RAIL

(9) Install assembled mode fork and sleeve (Fig. 67). Be sure fork rail goes through range fork and into case bore. Also be sure sleeve is aligned and seated on mainshaft hub.

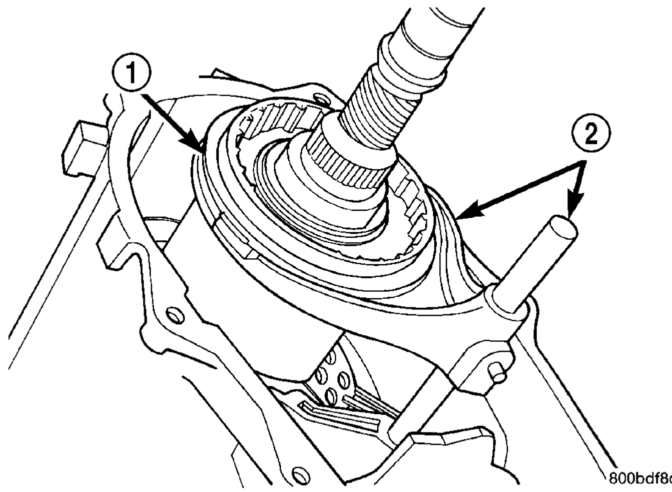


Fig. 67 Mode Fork And Sleeve Installation

1 - MODE SLEEVE
2 - MODE FORK AND RAIL

(10) Rotate sector to NEUTRAL position.

(11) Install new O-ring on detent plug (Fig. 68).

(12) Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.

(13) Install detent plunger, spring and plug (Fig. 68).

(14) Verify that plunger is properly engaged in sector.

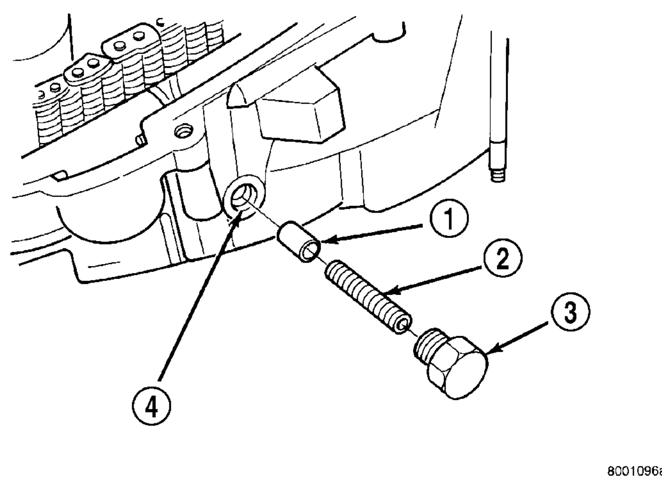


Fig. 68 Shift Detent Components

1 - POPPET
2 - SPRING
3 - SCREW
4 - POPPET BORE (IN CASE)

TRANSFER CASE - NV231 (Continued)

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Lubricate front output shaft-sprocket assembly, drive chain, and drive sprocket with transmission fluid.

(2) Assemble drive chain and front output shaft (Fig. 69).

(3) Start chain on mainshaft drive sprocket.

(4) Guide front shaft into bearing and drive sprocket onto mainshaft drive gear (Fig. 69).

(5) Install mode spring on upper end of mode fork shift rail (Fig. 70).

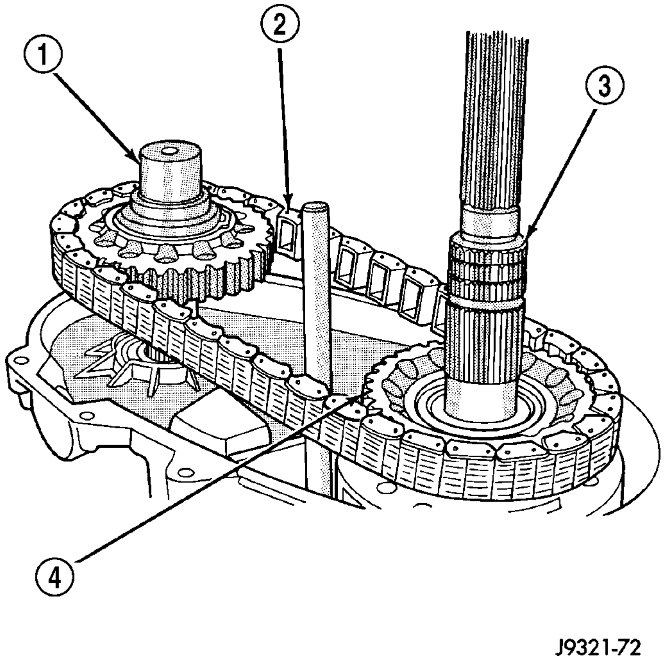


Fig. 69 Installing Drive Chain And Front Output Shaft

1 - FRONT OUTPUT SHAFT
2 - DRIVE CHAIN
3 - MAINSHAFT
4 - DRIVE SPROCKET

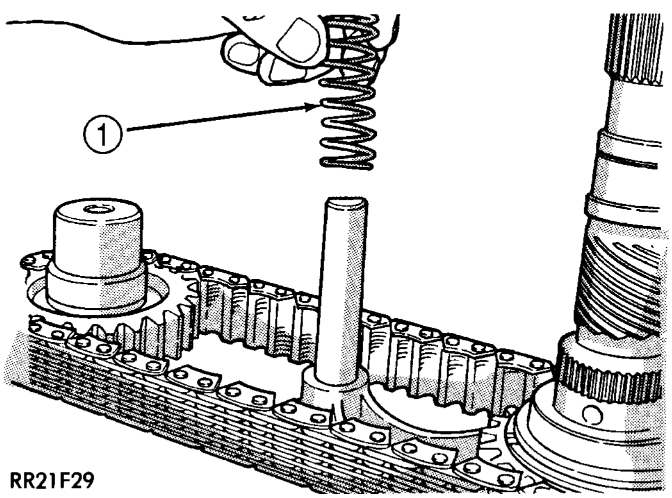


Fig. 70 Install Mode Fork Spring

1 - MODE SPRING

OIL PUMP AND REAR CASE

(1) Install magnet in front case pocket (Fig. 71).

(2) Assemble oil pickup screen, connecting hose, and tube.

(3) Install new pickup tube O-ring in oil pump (Fig. 72).

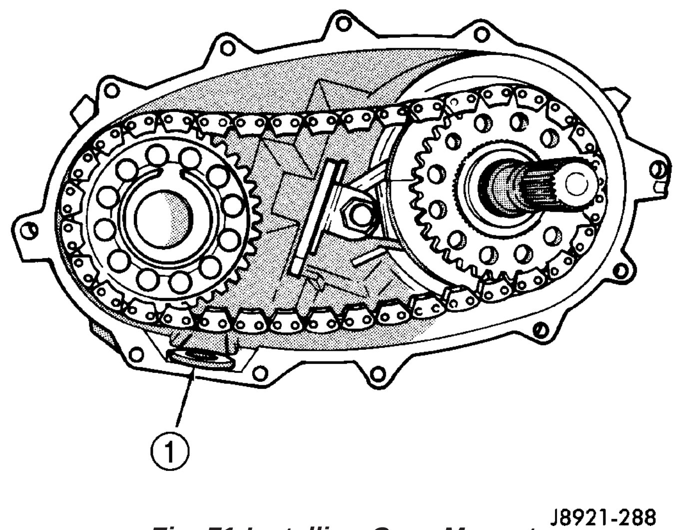


Fig. 71 Installing Case Magnet

1 - MAGNET

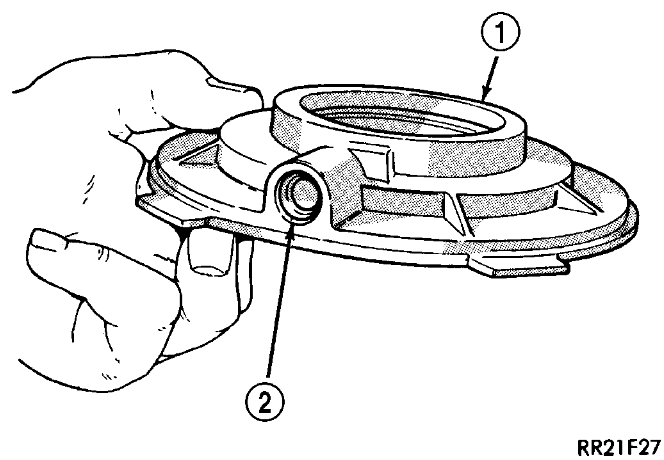


Fig. 72 Pickup Tube O-Ring Position

1 - OIL PUMP
2 - O-RING

TRANSFER CASE - NV231 (Continued)

(4) Insert oil pickup tube in oil pump inlet.

(5) Position assembled oil pump and pickup tube in rear case. Be sure pickup screen is securely seated in case slot. Also be sure oil pump locating tabs are outside rear case (Fig. 73).

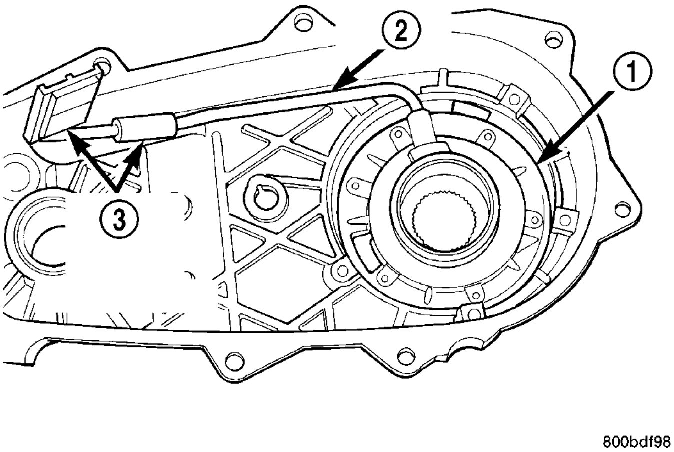


Fig. 73 Oil Pump And Pickup Tube Installation

1 - OIL PUMP
2 - PICKUP TUBE
3 - PICKUP SCREEN AND CONNECTOR

(6) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes.

(7) Lift rear case and oil pump and carefully position assembly on front case. Be sure case dowels are aligned and that mode fork rail extends through rear case before seating rear case on front case.

(8) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 74).

(9) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

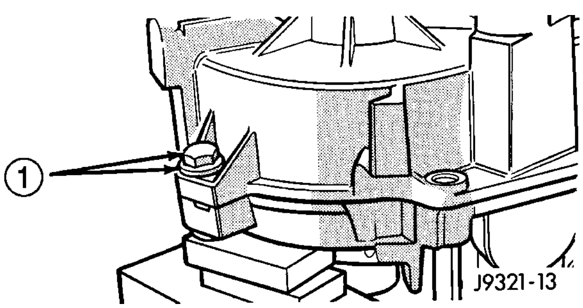


Fig. 74 Alignment Bolt Location

1 - ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

YOKE AND RANGE LEVER

(1) Install indicator switch in front case. Tighten switch to 20-34 N·m (15-25 ft. lbs.) torque.

(2) Install range lever, washer and locknut on sector shaft (Fig. 75). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

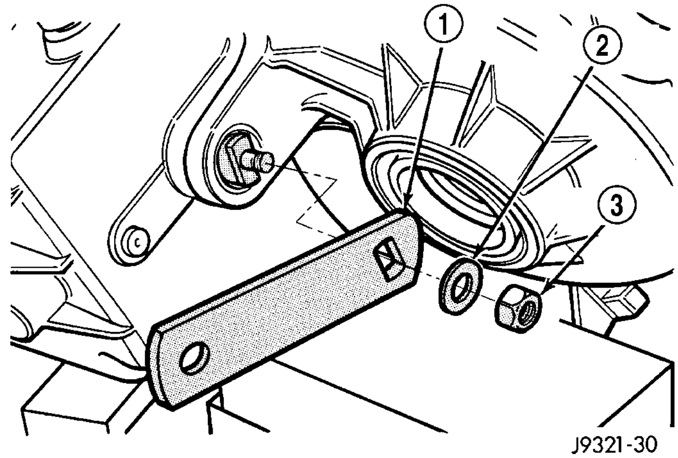


Fig. 75 Range Lever Installation

1 - RANGE LEVER
2 - WASHER
3 - LOCKNUT

(3) Install new seal washer on front output shaft (Fig. 77).

(4) Lubricate yoke hub with transmission fluid and install yoke on front shaft.

(5) Install new seal washer on front shaft.

(6) Install yoke and new yoke nut on front output shaft (Fig. 76).

(7) Tighten yoke nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold yoke while tightening yoke nut.

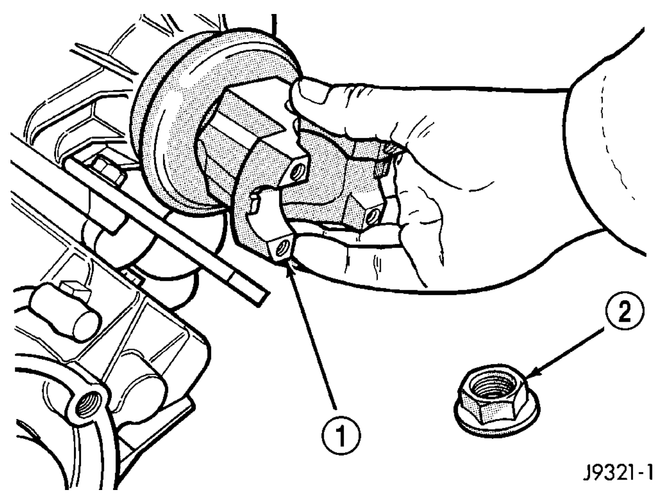


Fig. 76 Output Shaft Yoke Installation

1 - OUTPUT SHAFT YOKE
2 - YOKE NUT

TRANSFER CASE - NV231 (Continued)

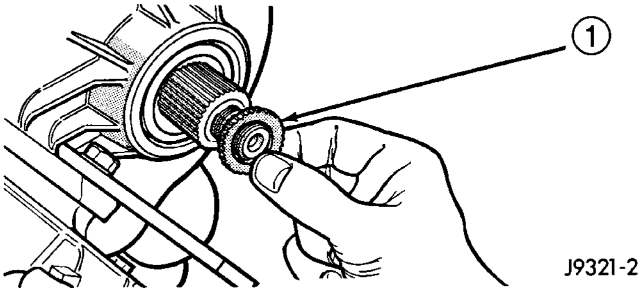


Fig. 77 Seal Washer Installation

1 - YOKE SEAL WASHER

REAR RETAINER

(1) Apply bead of Mopar® Sealer P/N 82300234, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 inch.

(2) Install rear retainer on rear case. Tighten retainer bolts to 20-27 N·m (15-20 ft. lbs.) torque.

(3) Install rear bearing I.D. retaining ring and spacer on output shaft.

(4) Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.

(5) Slide seal onto Seal Protector 6992 (Fig. 78). Slide seal protector and seal onto output shaft.

(6) Slide Installer C-4076-B onto seal protector with the recessed side of the tool toward the seal. Drive seal into rear bearing retainer with Installer C-4076-B and Handle MD-998323 (Fig. 79).

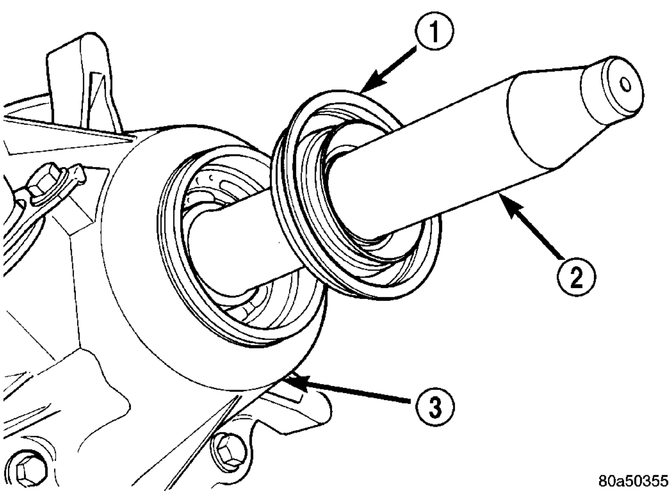


Fig. 78 Output Shaft Seal and Protector

1 - OUTPUT SHAFT SEAL
2 - SPECIAL TOOL 6992
3 - TRANSFER CASE

NOTE: Vehicles built with a 4.0L engine and a manual transmission use a damper weight on the transfer case output shaft. Be sure to identify the transfer case before proceeding.

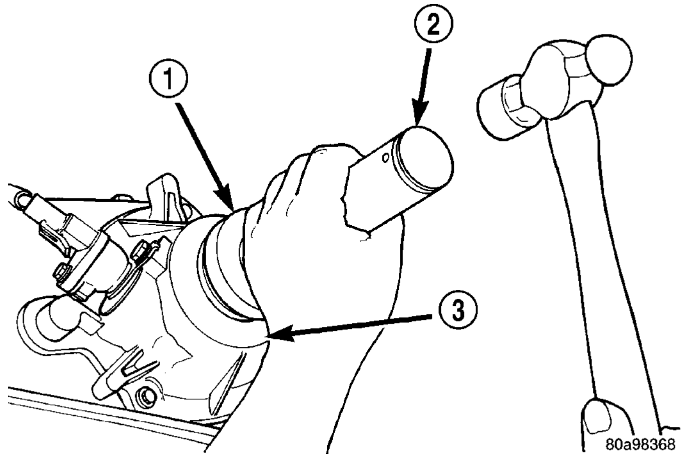


Fig. 79 Rear Seal Installation

1 - SPECIAL TOOL C-4076-B
2 - SPECIAL TOOL MD-998323
3 - TRANSFER CASE

(7) Install a new output shaft rear slinger with Installer 8408, if the vehicle is not equipped with an output shaft damper.

(8) If the vehicle is equipped with an output shaft damper, install the output shaft damper as follows:

(a) Position the damper weight on the output shaft. Start the damper onto the output shaft chamfer, being careful to keep the weight square to the output shaft. (Fig. 80)

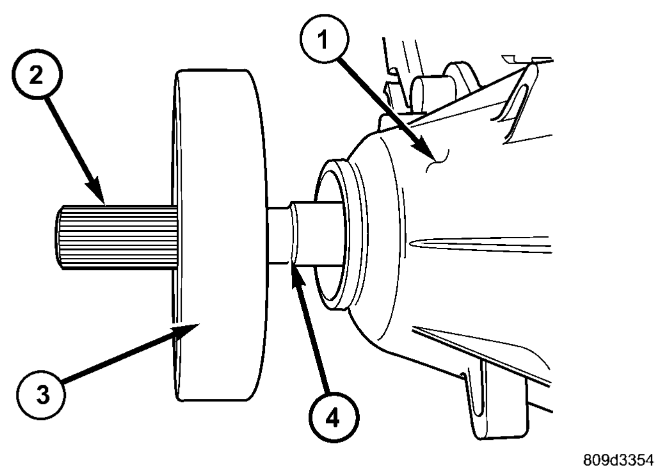


Fig. 80 Position Damper on Output Shaft

1 - Transfer Case
2 - Output Shaft
3 - Damper Weight
4 - Chamfer

TRANSFER CASE - NV231 (Continued)

(b) Position the driver portion of Installer 8422 (Fig. 81) onto the damper, making sure the legs of the damper are positioned through the slots of the damper.

(c) Thread the puller screw of Installer 8422 into the output shaft by hand only. Make sure the screw is fully threaded into the output shaft.

(d) Using a wrench to hold the pulling screw stationary (Fig. 82), turn the pulling screw nut until the driver legs contact the rear face of the transfer case rear retainer. When the legs contact the retainer, the damper is properly positioned on the output shaft.

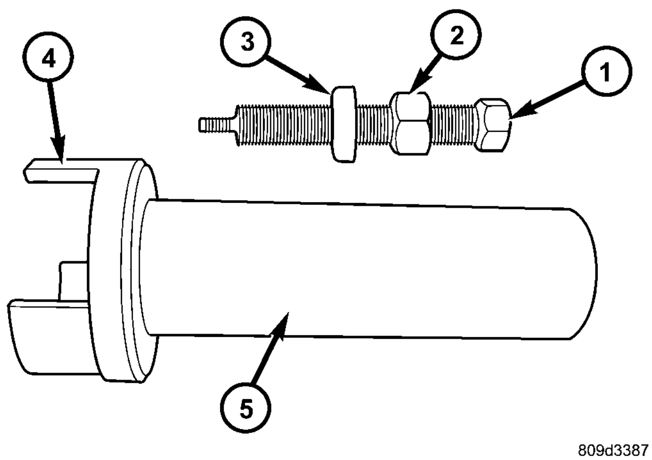


Fig. 81 Driver Installer 8422

1 - Pulling Screw
2 - Pulling Screw Nut
3 - Bearing
4 - Driver Legs
5 -Installer Driver

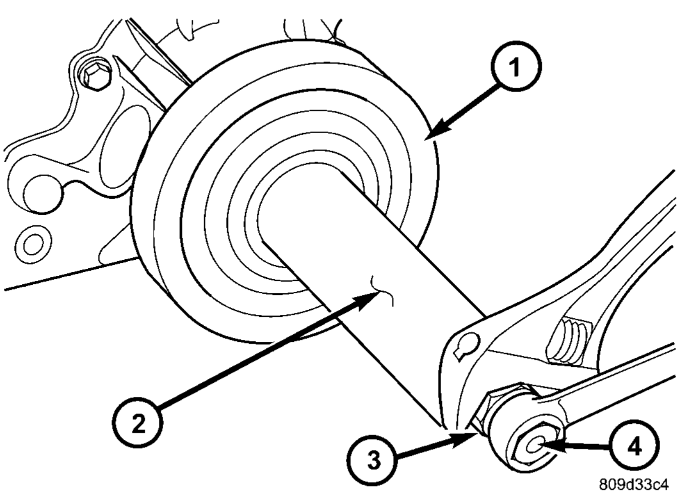


Fig. 82 Install Damper

1 - Damper
2 - Installer Driver
3 - Pulling Screw Nut
4 - Pulling Screw

(9) Install boot on output shaft slinger, or output shaft damper, and crimp retaining clamp with tool C-4975-A (Fig. 83).

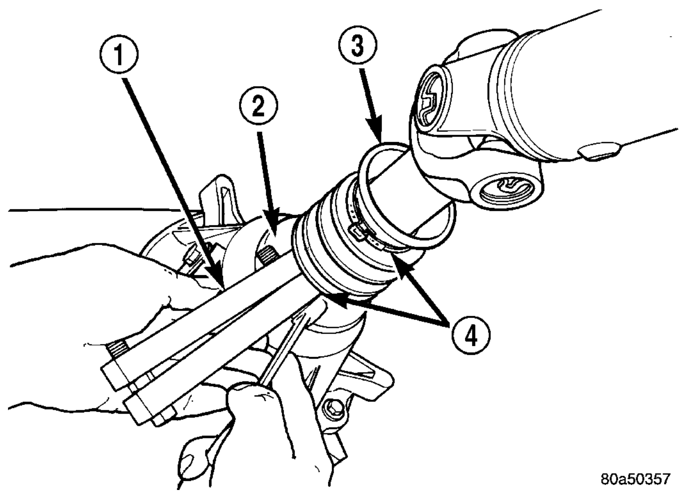


Fig. 83 Slinger Boot Installation - Typical

1 - SPECIAL TOOL C-4975–A
2 - SLINGER
3 - BOOT
4 - CLAMP

INSTALLATION

(1) Mount transfer case on a transmission jack.

(2) Secure transfer case to jack with chains.

(3) Position transfer case under vehicle.

(4) Align transfer case and transmission shafts and install transfer case on transmission.

(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 2).

(6) Connect vehicle speed sensor wires, and vent hose.

(7) Connect indicator switch harness to transfer case switch, if necessary. Secure wire harness to clips on transfer case.

(8) Align and connect propeller shafts. Refer to Differential and Driveline for proper procedures and specifications.

(9) Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.

(10) Install rear crossmember, or skid plate. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(11) Remove transmission jack and support stand.

(12) Connect shift rod to transfer case range lever.

(13) Adjust transfer case shift linkage.

(14) Lower vehicle and verify transfer case shift operation.

TRANSFER CASE - NV231 (Continued)

SPECIFICATIONS

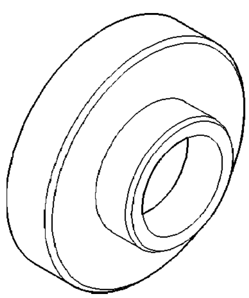
TRANSFER CASE - NV231

TORQUE

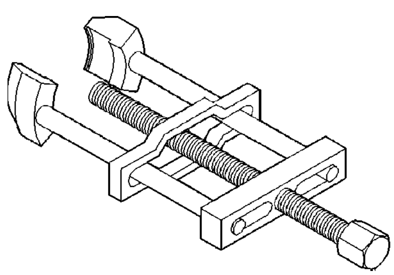
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-24	12-18	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Front Brg. Retainer	21	16	-
Bolt, Case Half	27-34	20-25	-
Nut, Front Yoke	122-176	90-130	-
Nut, Range Lever	27-34	20-25	-
Bolt, Rear Retainer	35-46	26-34	-
Nuts, Mounting	35-47	26-35	-
Switch, Indicator	20-34	15-25	-

SPECIAL TOOLS

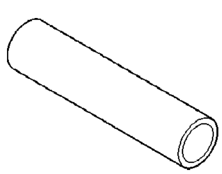
NV231



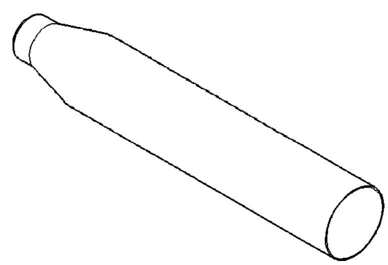
Installer - C-4076-B



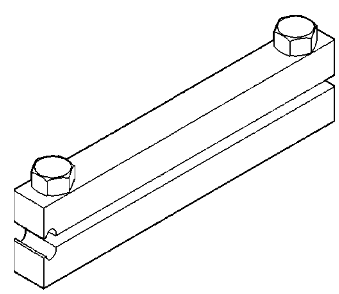
Puller, Slinger - MD-998056-A



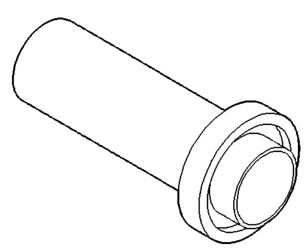
Installer - MD-998323



Protector, Seal - 8824

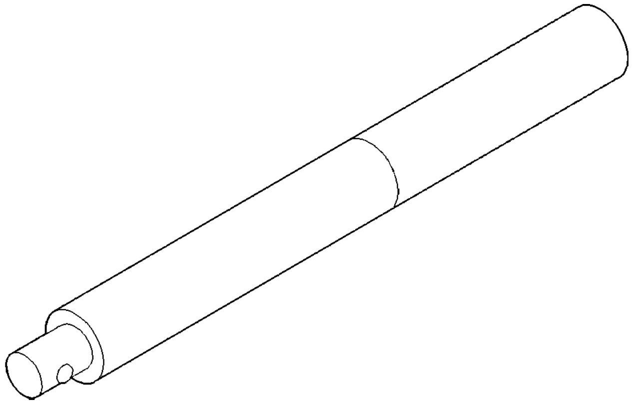


Installer, Boot Clamp - C-4975-A

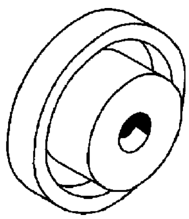


Installer, Seal - 8143-A

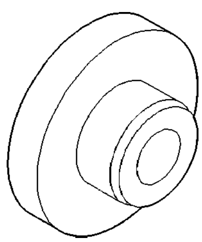
TRANSFER CASE - NV231 (Continued)



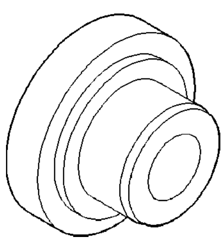
Handle, Universal - C-4171



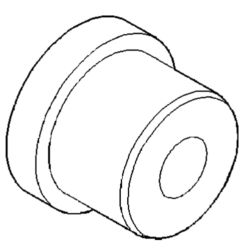
Installer, Seal - C-4210



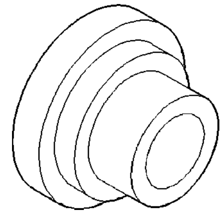
Installer, Bearing - 5052



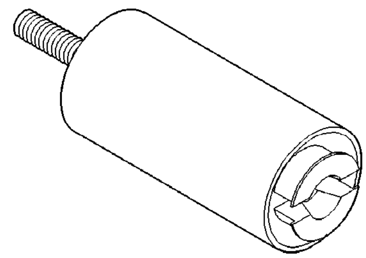
Installer, Bearing - 5065



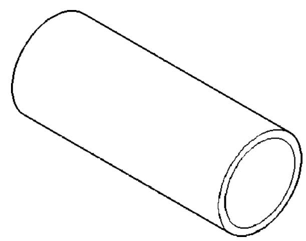
Installer, Bushing - 5066



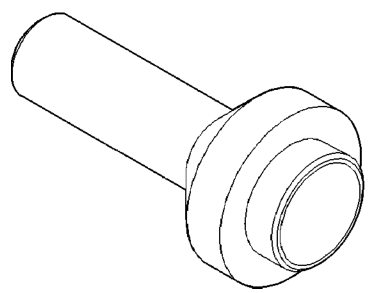
Installer, Bearing - 8128



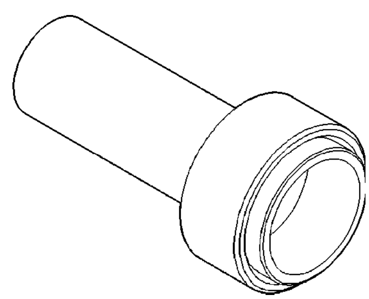
Remover - L-4454



Cup - 8148

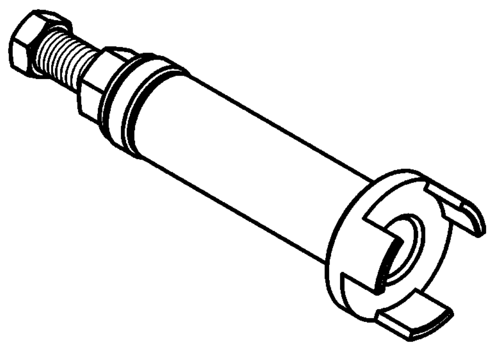


Installer, Seal - 7884

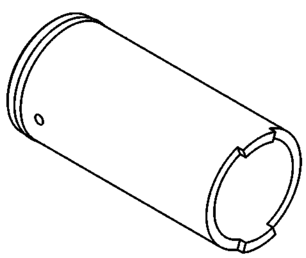


Installer, Pump Housing Seal - 7888

TRANSFER CASE - NV231 (Continued)



Installer, Transfer Case Damper Driver - 8422



Installer, Output Shaft Slinger - 8408

FLUID

STANDARD PROCEDURE - FLUID DRAIN AND FILL

The fill and drain plugs are both in the rear case (Fig. 84). Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

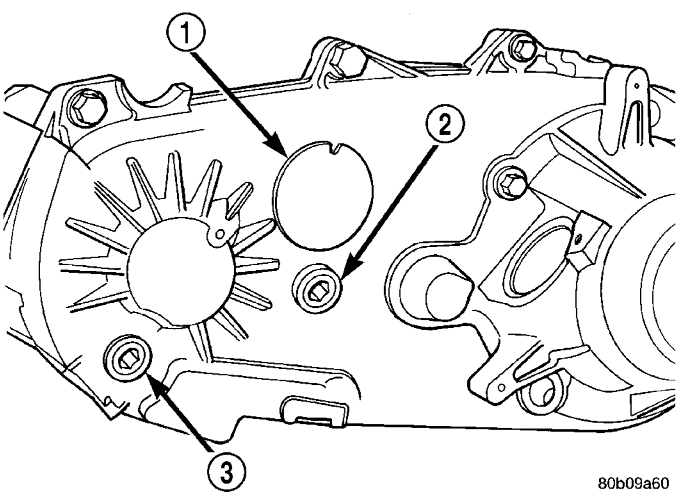


Fig. 84 Fill/Drain Plug And I.D. Tag Locations

1 - I.D. TAG
2 - FILL PLUG
3 - DRAIN PLUG

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.

(2) Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(3) Remove front output shaft yoke.

(4) Remove seal from front case with pry tool (Fig. 85).

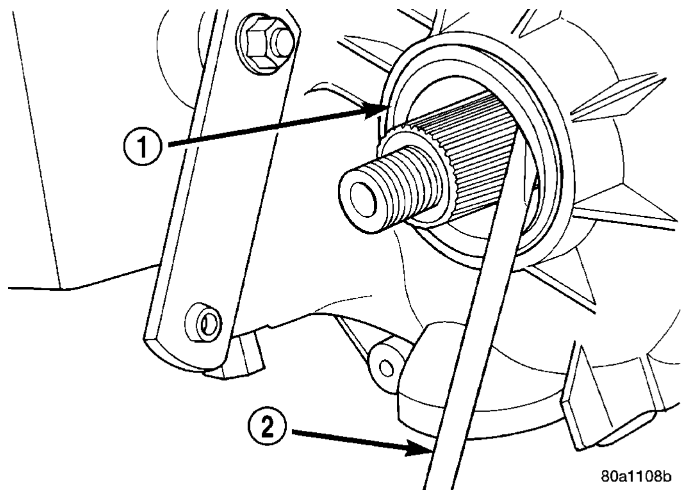


Fig. 85 Remove Front Output Shaft Seal - Typical

1 - OUTPUT SHAFT SEAL
2 - PRYBAR

FRONT OUTPUT SHAFT SEAL (Continued)

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 8143-A as follows:

(a) Place new seal on tool. Garter spring on seal goes toward interior of case.

(b) Start seal in bore with light taps from hammer (Fig. 86). Once seal is started, continue tapping seal into bore until installer tool seats against case.

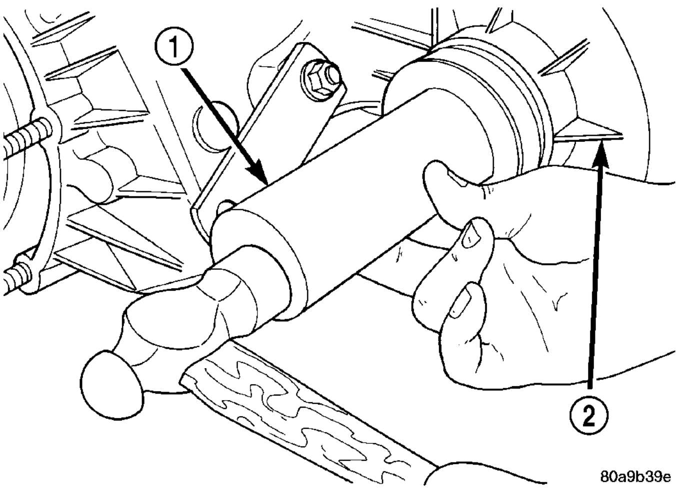


Fig. 86 Front Output Seal Installation - Typical

1 - INSTALLER 8143-A
2 - TRANSFER CASE

REAR OUTPUT SHAFT SEAL

REMOVAL

(1) Shift the transmission and transfer case into NEUTRAL.

(2) Raise and support vehicle.

(3) Mark a line across the pinion shaft and at each end of the propeller shaft for installation reference.

(4) Remove the U-joint strap bolts at the pinion shaft yoke.

(5) Pry open clamp holding the dust boot to propeller shaft yoke (Fig. 87).

(6) Slide the slip yoke off of the transmission/ transfer case output shaft and remove the propeller shaft.

(7) Spread band clamp which holds output shaft boot to the output shaft slinger, or output shaft damper, with a suitable awl, or equivalent.

NOTE: Vehicles built with a 4.0L engine and a manual transmission use a damper weight on the transfer case output shaft. Be sure to identify the transfer case before proceeding.

(8) Remove output shaft boot from slinger, or output shaft damper, and output shaft.

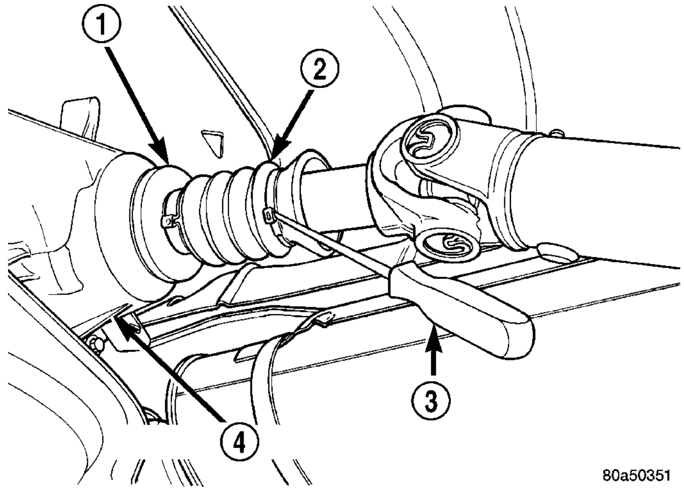


Fig. 87 Dust Boot Clamp

1 - SLINGER
2 - BOOT
3 - AWL
4 - TRANSFER CASE

(9) If the vehicle is not equipped with an output shaft damper, remove the output shaft rear slinger using Puller MD-998056-A (Fig. 88).

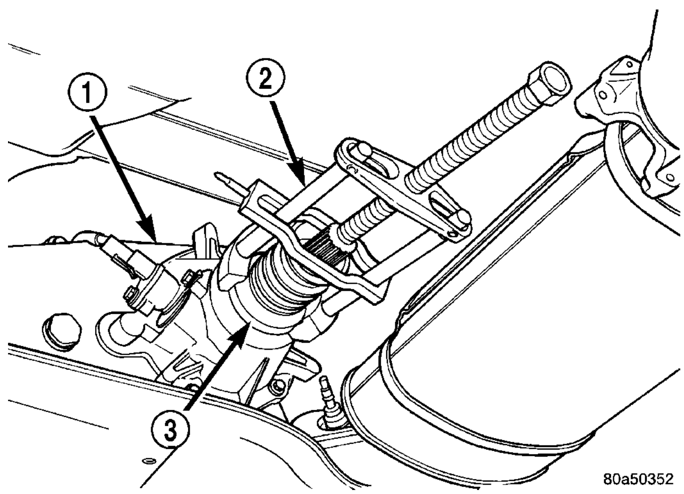


Fig. 88 Rear Slinger Removal

1 - TRANSFER CASE
2 - SPECIAL TOOL MD-998056-A
3 - SLINGER

(10) If the vehicle is equipped with an output shaft damper, use Screws 8421 and the puller yoke and forcing screw from a bolt-grip puller set, such as those used to remove steering wheels and harmonic balancers, to remove the transfer case output shaft damper.

REAR OUTPUT SHAFT SEAL (Continued)

(11) Use a suitable pry tool, or a slide hammer mounted screw, to remove the seal from the rear retainer (Fig. 89).

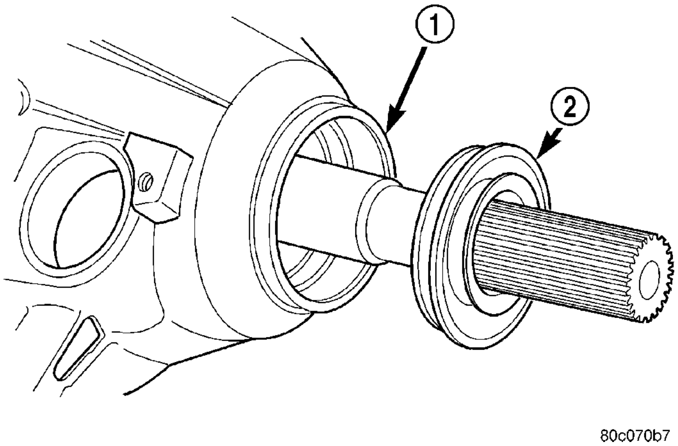


Fig. 89 Rear Output Shaft Seal

1 - REAR RETAINER
2 - OUTPUT SHAFT SEAL

INSTALLATION

(1) Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.

(2) Slide seal onto Seal Protector 6992 (Fig. 90). Slide seal protector and seal onto output shaft.

(3) Slide Installer C-4076-B onto seal protector with the recessed side of the tool toward the seal. Drive seal into rear bearing retainer with Installer C-4076-B and Handle MD-998323 (Fig. 91).

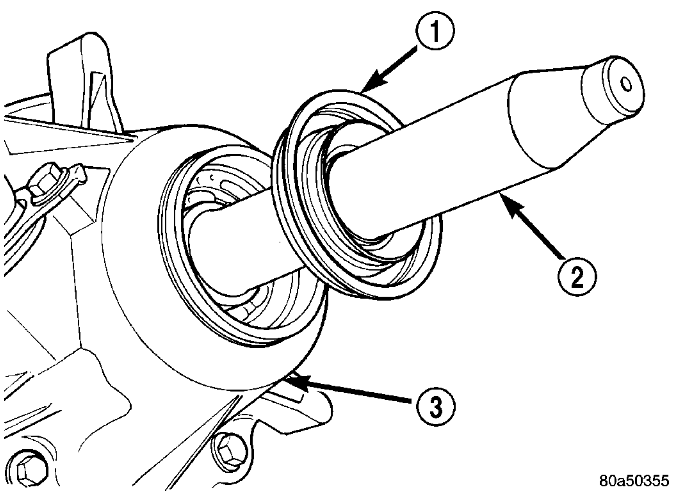


Fig. 90 Output Shaft Seal and Protector

1 - OUTPUT SHAFT SEAL
2 - SPECIAL TOOL 6992
3 - TRANSFER CASE

NOTE: Vehicles built with a 4.0L engine and a manual transmission use a damper weight on the transfer case output shaft. Be sure to identify the transfer case before proceeding.

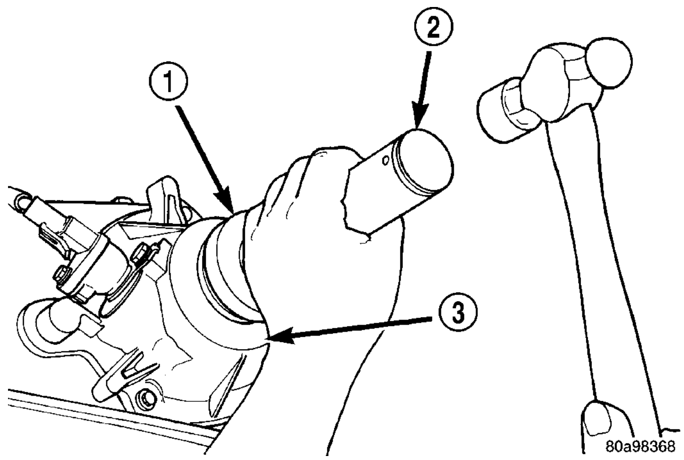


Fig. 91 Rear Seal Installation

1 - SPECIAL TOOL C-4076-B
2 - SPECIAL TOOL MD-998323
3 - TRANSFER CASE

(4) Install a new output shaft rear slinger with Installer 8408, if the vehicle is not equipped with an output shaft damper.

(5) If the vehicle is equipped with an output shaft damper, install the output shaft damper as follows:

(a) Position the damper weight on the output shaft. Start the damper onto the output shaft chamfer, being careful to keep the weight square to the output shaft. (Fig. 92)

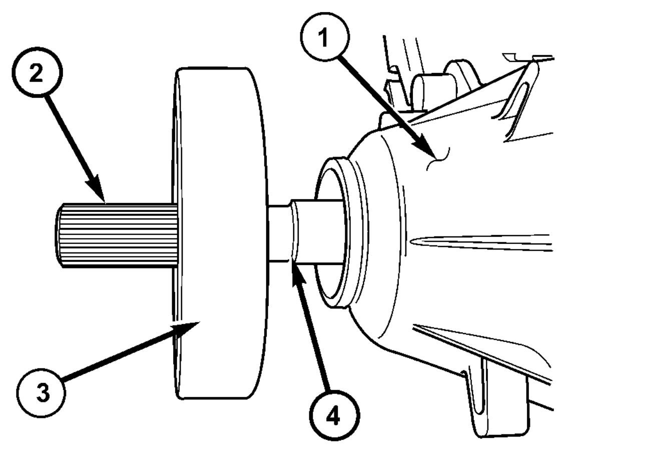


Fig. 92 Position Damper on Output Shaft

1 - Transfer Case
2 - Output Shaft
3 - Damper Weight
4 - Chamfer

REAR OUTPUT SHAFT SEAL (Continued)

(b) Position the driver portion of Installer 8422 (Fig. 93) onto the damper, making sure the legs of the damper are positioned through the slots of the damper.

(c) Thread the puller screw of Installer 8422 into the output shaft by hand only. Make sure the screw is fully threaded into the output shaft.

(d) Using a wrench to hold the pulling screw stationary (Fig. 94), turn the pulling screw nut until the driver legs contact the rear face of the transfer case rear retainer. When the legs contact the retainer, the damper is properly positioned on the output shaft.

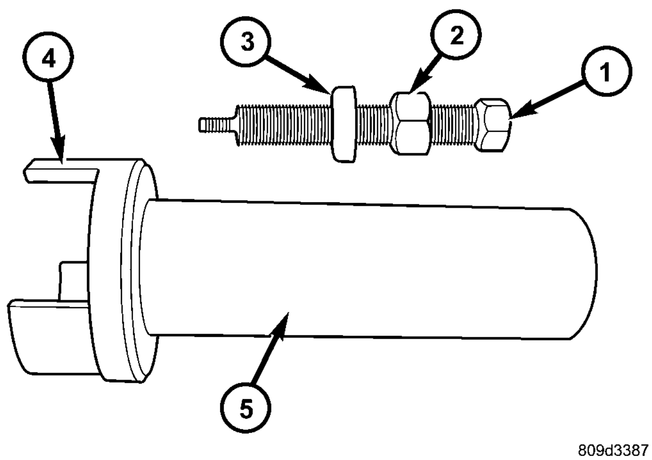


Fig. 93 Driver Installer 8422

1 - Pulling Screw
2 - Pulling Screw Nut
3 - Bearing
4 - Driver Legs
5 -Installer Driver

(6) Install boot on output shaft slinger, or output shaft damper, and crimp retaining clamp with tool C-4975-A (Fig. 95).

(7) Slide the slip yoke on the transmission/transfer case output shaft. Align installation reference marks at the axle yoke and install the propeller shaft.

(8) Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.).

(9) Crimp clamp with Clamp Tool C-4975A to hold dust boot to propeller shaft yoke.

(10) Remove support and lower the vehicle.

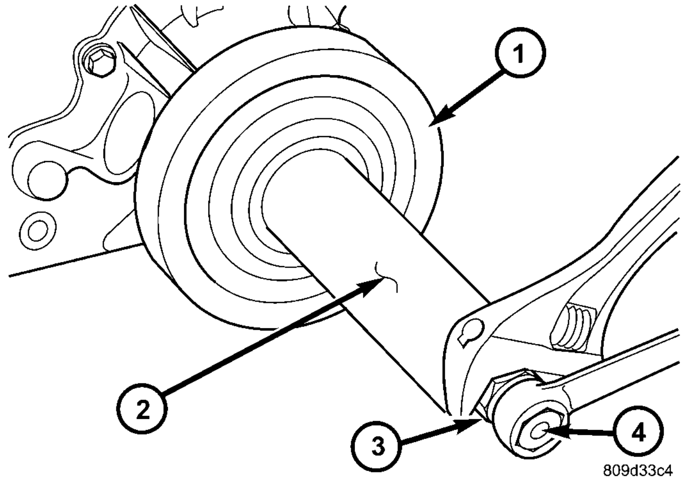


Fig. 94 Install Damper

1 - Damper
2 - Installer Driver
3 - Pulling Screw Nut
4 - Pulling Screw

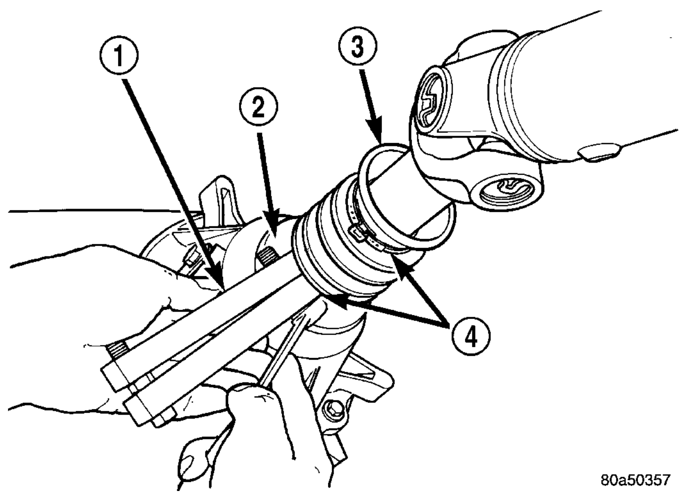


Fig. 95 Slinger Boot Installation - Typical

1 - SPECIAL TOOL C-4975–A
2 - SLINGER
3 - BOOT
4 - CLAMP

SHIFT LEVER

REMOVAL

(1) Shift transfer case into 4L.

(2) Raise vehicle.

(3) Loosen adjusting trunnion locknut and slide shift rod out of trunnion (Fig. 96). If rod lacks enough travel to come out of trunnion, push trunnion out of torque shaft.

(4) Lower vehicle.

(5) Remove console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(6) Remove screws attaching lever assembly to floorpan and remove assembly and shift rod (if left attached).

INSTALLATION

(1) If shift rod was not removed from lever assembly, work rod down through floorpan opening. Then position lever assembly on floorpan and install assembly attaching screws.

(2) Install console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

(3) Raise vehicle.

(4) Connect trunnion to torque shaft arm. Or, slide shift rod into trunnion on range lever. Be sure shift rod slides freely in trunnion.

(5) Verify that range lever is in 4L position. Then tighten trunnion lock bolt.

(6) Lower vehicle and check transfer case shift operation.

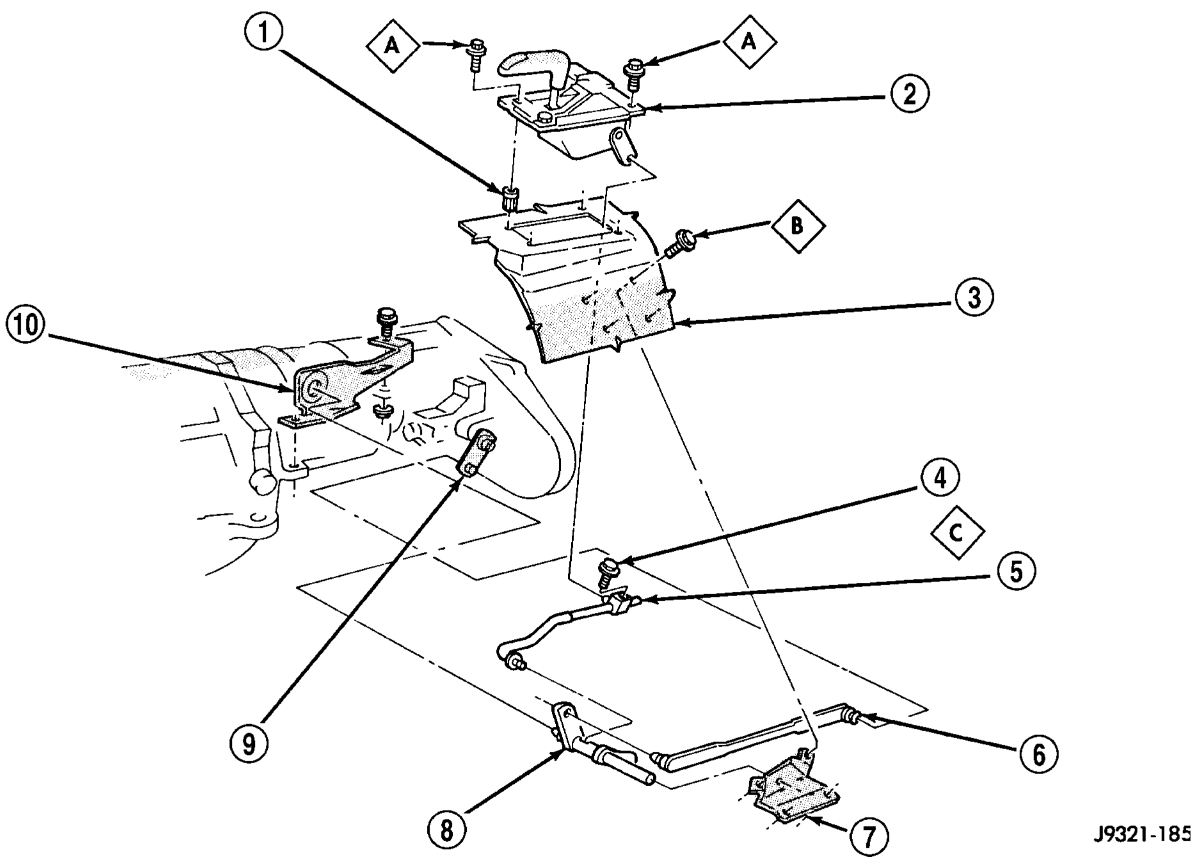


Fig. 96 Shift Linkage

1 - Rivnut (4)
2 - Shift Lever Assembly
3 - Floorpan
4 - Trunnion Lock Bolt
5 - Selector Rod and Trunnion
6 - Shift Lever Rod
7 - Torque Shaft Frame Bracket
8 - Torque Shaft
9 - Transfer Case Shift Lever
10 - Torque Shaft Transfer Case Bracket
A - 3-4 N·m (27-35 in. lbs.)
B - 11-14 N·m (97-123 in. lbs.)
C - 8-14 N·m (72-120 in. lbs.)

SHIFT LEVER (Continued)

ADJUSTMENTS - SHIFT LINKAGE

(1) Shift transfer case into 4L position.
(2) Raise vehicle.
(3) Loosen lock bolt on adjusting trunnion (Fig. 97).
(4) Be sure linkage rod slides freely in trunnion. Clean rod and apply spray lube if necessary.
(5) Verify that transfer case range lever is fully engaged in 4L position.
(6) Tighten adjusting trunnion lock bolt.
(7) Lower vehicle.

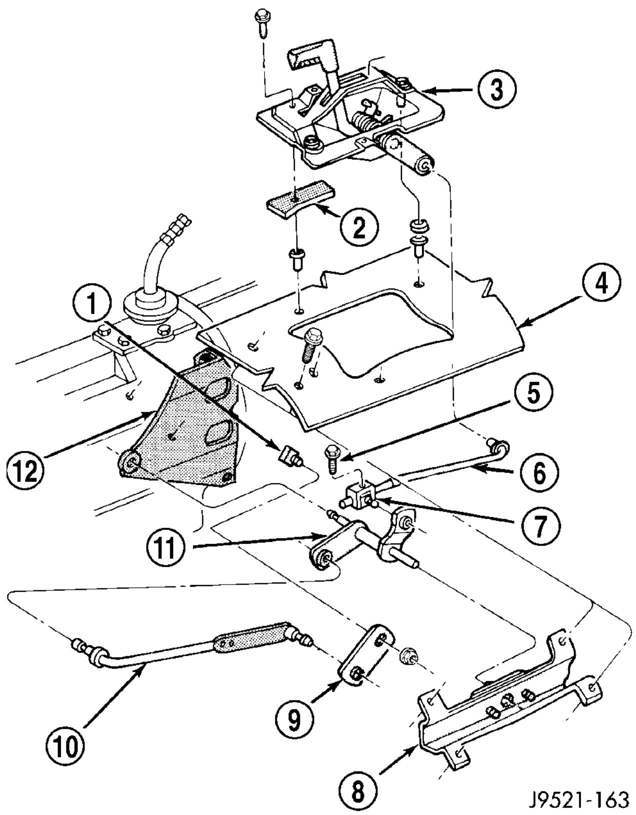


Fig. 97 Shift Linkage

1 - TRANSFER CASE SHIFT LEVER SHAFT
2 - SEAL
3 - TRANSFER CASE SHIFT LEVER ASSEMBLY
4 - FLOORPAN
5 - TRUNNION LOCK BOLT
6 - SHIFT ROD
7 - ADJUSTING TRUNNION
8 - TORQUE SHAFT BRACKET
9 - RANGE LEVER
10 - TORQUE SHAFT ROD
11 - TORQUE SHAFT
12 - LINKAGE BRACKET

SPEEDOMETER DRIVE ADAPTER

REMOVAL

(1) Raise vehicle.
(2) Disconnect wires from vehicle speed sensor.
(3) Remove adapter clamp and screw (Fig. 98).
(4) Remove speed sensor and speedometer adapter as an assembly.
(5) Remove speed sensor retaining screw and remove sensor from adapter.
(6) Remove speedometer pinion from adapter. Replace pinion if chipped, cracked, or worn.
(7) Inspect sensor and adapter O-rings (Fig. 98). Remove and discard O-rings if worn or damaged.
(8) Inspect terminal pins in speed sensor. Clean pins with Mopar® electrical spray cleaner if dirty or oxidized. Replace sensor if faulty, or if pins are loose, severely corroded, or damaged.

INSTALLATION

(1) Thoroughly clean adapter flange and adapter mounting surface in housing. Surfaces must be clean for proper adapter alignment and speedometer operation.
(2) Install new O-rings on speed sensor and speedometer adapter (Fig. 98), if necessary.
(3) Lubricate sensor and adapter O-rings with transmission fluid.
(4) Install vehicle speed sensor in speedometer adapter. Tighten sensor attaching screw to 2-3 N·m (15-27 in. lbs.) torque.
(5) Install speedometer pinion in adapter.
(6) Count number of teeth on speedometer pinion. Do this before installing assembly in housing. Then lubricate pinion teeth with transmission fluid.
(7) Note index numbers on adapter body (Fig. 99). These numbers will correspond to number of teeth on pinion.
(8) Install speedometer assembly in housing.
(9) Rotate adapter until required range numbers are at 6 o-clock position. Be sure range index numbers correspond to number of teeth on pinion gear.

SPEEDOMETER DRIVE ADAPTER (Continued)

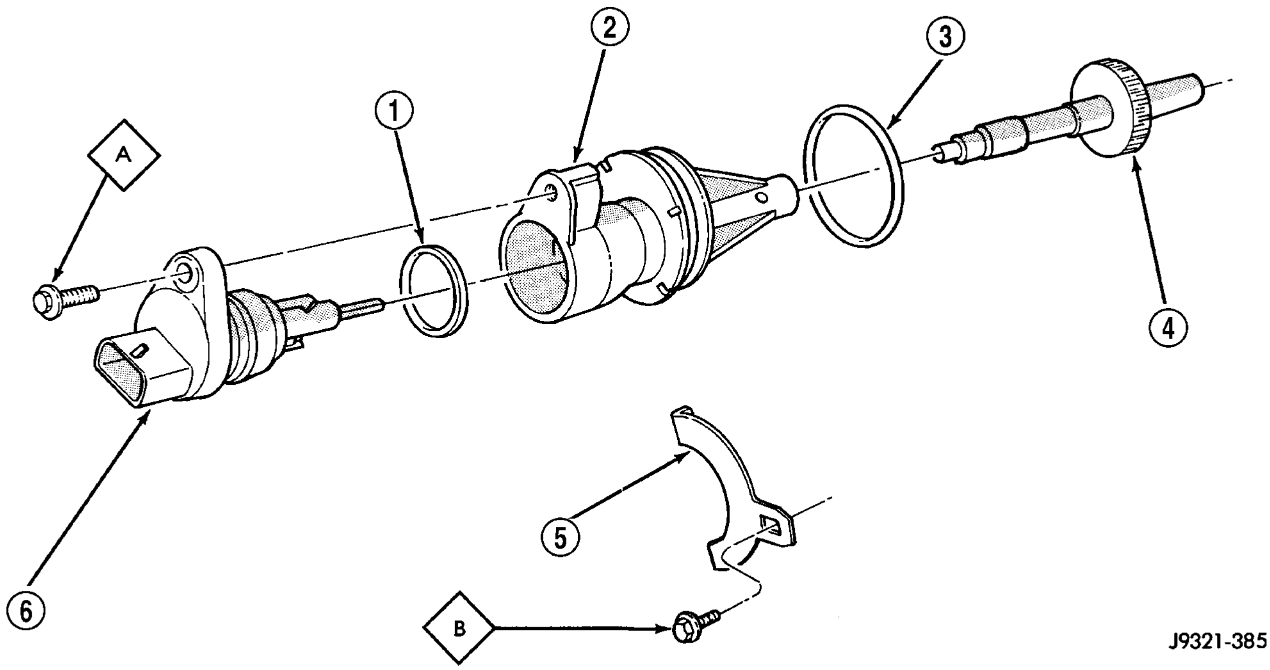


Fig. 98 Speedometer

1 - Sensor O-ring
2 - Speedometer Adapter
3 - Adapter O-ring
4 - Speedometer Pinion
5 - Adapter Clamp
6 - Vehicle Speed Sensor
A - 2-3 N·m (15-27 in. lbs.)
B - 10-12 N·m (90-110 in. lbs.)

(10) Install speedometer adapter clamp and retaining screw. Tighten clamp screw to 10-12 N·m (90-110 in. lbs.) torque.

(11) Connect wires to vehicle speed sensor.

(12) Lower vehicle and top off transmission fluid level if necessary.

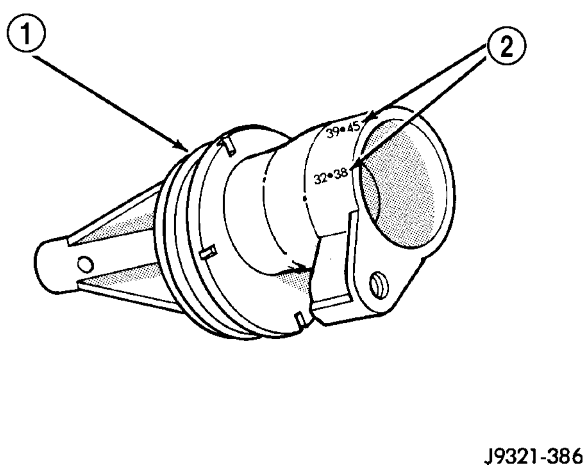


Fig. 99 Location Of Index Numbers On Speedometer Adapter

1 - SPEEDOMETER ADAPTER
2 - INDEX NUMBER LOCATION

VEHICLE SPEED SENSOR

DESCRIPTION

The 3-wire Vehicle Speed Sensor (VSS) is located on the speedometer pinion gear adapter. If equipped with 4WD, this adapter is located on the extension housing of the transfer case (drivers side). If equipped with 2WD, this adapter is located on the left side of the transmission extension housing.

OPERATION

The VSS is a 3-circuit (3–wire), magnetic, hall-effect sensor.

The 3 circuits are:

• A 5-volt power supply from the Powertrain Control Module (PCM).

• A ground is provided for the sensor though a low-noise sensor return circuit in the PCM.

• An input to the PCM is used to determine vehicle speed and distance traveled.

The speed sensor generates 8 pulses per sensor revolution. These signals, in conjunction with a closed throttle signal from the throttle position sensor, indicate a closed throttle deceleration to the PCM. When the vehicle is stopped at idle, a closed throttle signal is received by the PCM (but a speed sensor signal is not received).

VEHICLE SPEED SENSOR (Continued)

Under deceleration conditions, the PCM adjusts the Idle Air Control (IAC) motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

REMOVAL

The Vehicle Speed Sensor (VSS) is located on the speedometer pinion gear adapter. If equipped with 4WD, this adapter is located on the transfer case extension (left side) (Fig. 100). If equipped with 2WD, this adapter is located on the extension housing of the transmission (left side).

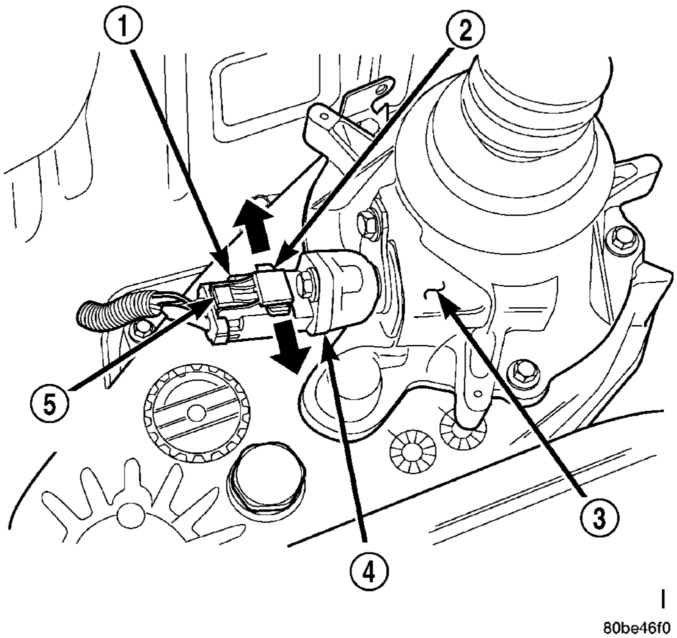


Fig. 100 VSS Location

1 - SENSOR ELECTRICAL CONNECTOR
2 - SLIDE TAB
3 - 4WD TRANSFER CASE EXTENSION
4 - VEHICLE SPEED SENSOR
5 - RELEASE LOCK

(1) Raise and support vehicle.

(2) Disconnect electrical connector from sensor by pushing slide tab (Fig. 100). After slide tab has been positioned, push in on secondary release lock (Fig. 100) on side of connector and pull connector from sensor.

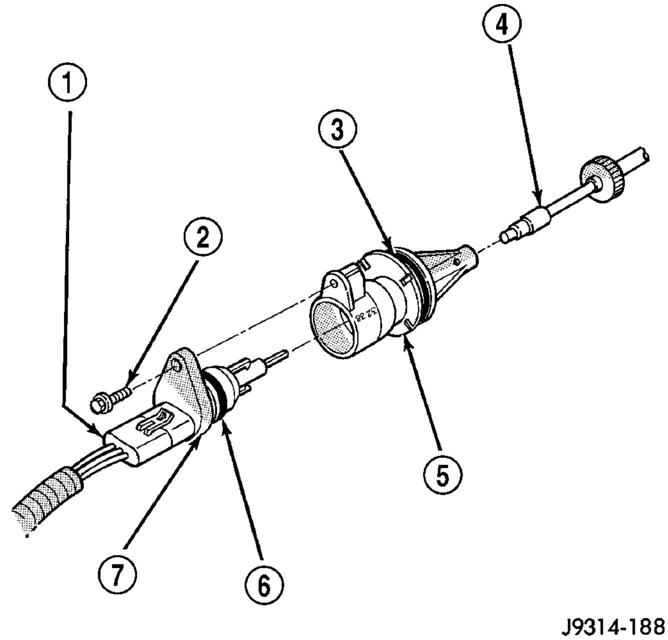


Fig. 101 VSS Removal/Installation

1 - ELECTRICAL CONNECTOR
2 - SENSOR MOUNTING BOLT
3 - O-RING
4 - SPEEDOMETER PINION GEAR
5 - SPEEDOMETER PINION GEAR ADAPTER
6 - O-RING
7 - VEHICLE SPEED SENSOR

(3) Remove sensor mounting bolt (Fig. 101).

(4) Remove sensor (pull straight out) from speedometer pinion gear adapter (Fig. 101). Do not remove gear adapter from transmission.

INSTALLATION

(1) Clean inside of speedometer pinion gear adapter before installing speed sensor.

(2) Install sensor into speedometer gear adapter and install mounting bolt. Before tightening bolt, verify speed sensor is fully seated (mounted flush) to speedometer pinion gear adapter.

(3) Tighten sensor mounting bolt to 2.2 N·m (20 in. lbs.) torque.

(4) Connect electrical connector to sensor.

TRANSFER CASE - NV241

TABLE OF CONTENTS

TRANSFER CASE - NV241

DESCRIPTION

The NV241 transfer case (Fig. 1) is a part-time transfer case with a low-range gear system. It provides three operating ranges plus a NEUTRAL position. The low range position provides a gear reduction ratio of 4.0:1 for increased low speed torque capability.

The gear cases, retainer and extension are all of aluminum. Drive sprockets and an interconnecting drive chain are used to transmit engine torque to the front/rear propeller shafts. The mainshaft, input gear and front output shaft are supported by ball and needle bearings.

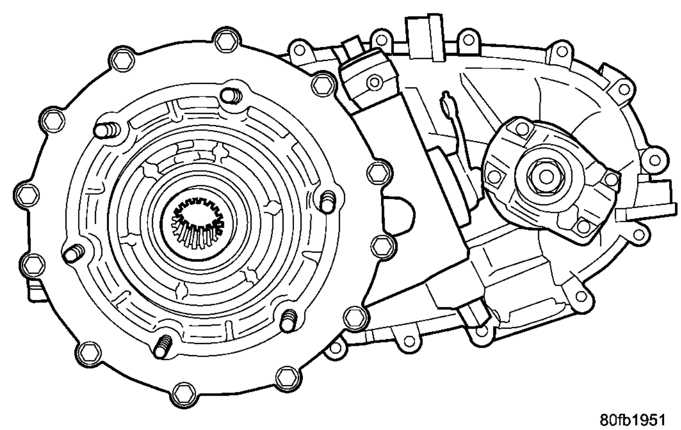


Fig. 1 NV241 - Front View

TRANSFER CASE - NV241 (Continued)

IDENTIFICATION

An identification tag (Fig. 2) is attached to the rear case of every transfer case. The tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

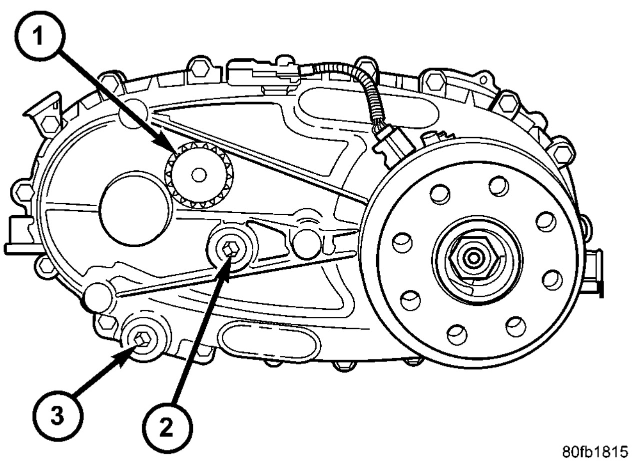


Fig. 2 Transfer Case Identification Tag and Fill/Drain Plugs

1 - IDENTIFICATION TAG
2 - FILL PLUG
3 - DRAIN PLUG

OPERATION

OPERATING RANGES

Transfer case operating ranges are:

- 2H (2-wheel drive)
- 4H (4-wheel drive)
- 4LO (4-wheel drive low range

The 2H range is for use on any road surface at any time.

The 4H and 4LO ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is covered by ice and snow.

The low range reduction gear system is operative in 4LO range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 4.0:1.

SHIFT MECHANISM

The transfer case is operated by an adjustable floor mounted shift linkage. The transfer case shift lever is directly attached to the shift sector. The sector operates the range and mode forks within the transfer case.

A straight line shift pattern is used with a NEUTRAL detent. Lever range positions are imprinted in the shift knob.

SHIFTING

The vehicle must have the transmission placed in NEUTRAL, or the clutch depressed in the case of a manual transmission, and be moving less than 2-3 MPH when shifting into the 4L operating range.

DIAGNOSIS AND TESTING - TRANSFER CASE

Before beginning repair on a suspected transfer case malfunction, check all other driveline components beforehand.

The actual cause of a problem may be related to such items as: front hubs, axles, propeller shafts, wheels and tires, transmission, or clutch instead. If all other driveline components are in good condition and operating properly, refer to the Diagnosis Chart for further information.

TRANSFER CASE - NV241 (Continued)

DIAGNOSIS CHART

Condition	Possible Cause	Correction
Transfer Case difficult to shift or will not shift into desired range.	1) Vehicle speed too great to permit shifting.	1) Stop vehicle and shift into desired range. Or, reduce speed to below 3-4 km/h (2-3 mph) before attempting the shift.
	2) If vehicle was operated for an extended period in 4H on a dry paved surface, the driveline torque load may be causing a bind.	2) Stop vehicle and shift the transmission into neutral. Shift the transfer case to 2H and operate vehicle in 2H on dry paved surfaces.
	3) Transfer case external shift linkage binding.	3) Lubricate, repair, or replace linkage bushings, or tighten loose components as necessary.
	4) Insufficient or incorrect lubricant.	4) Drain and refill to edge of fill hole with Mopar® ATF +4, type 9602, Automatic Transmission fluid.
	5) Internal components binding, worn, or damaged.	5) Disassemble the transfer case and replace worn or damaged components as necessary.
Transfer Case noisy in all operating ranges.	1) Insufficient or incorrect lubricant.	1) Drain and refill to edge of fill hole with Mopar® ATF +4, type 9602, Automatic Transmission fluid.
Noisy in, or jumps out of, four wheel drive low range.	1) Transfer case not completely engaged in 4L position.	1) With the transmission in NEUTRAL, or the clutch depressed in the case of a manual transmission and the vehicle moving under 3-4 km/h (2-3 mph), shift the transfer case to NEUTRAL and then shift into the 4L position.
	2) Shift linkage out of adjustment.	2) Adjust linkage.
	3) Shift linkage loose or binding.	3) Tighten, lubricate, or repair linkage as necessary.
	4) Range fork damaged, inserts worn, or fork is binding on the shift rail.	4) Disassemble unit and repair as necessary.
	5) Low range gear worn or damaged.	5) Disassemble unit and repair as necessary.
Lubricant leaking from output shaft seal or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Vent closed or restricted.	2) Clear or replace vent as necessary.
	3) Output shaft seals damaged or installed incorrectly.	3) Replace seal as necessary. Check to ensure that another component, the propeller shaft slip yoke for example, is not causing damage to seal.
Abnormal tire wear.	1) Extended operation on hard, dry surfaces in the 4H position.	1) Operate vehicle in the 2H position on hard, dry surfaces.

TRANSFER CASE - NV241 (Continued)

REMOVAL

(1) Raise and support vehicle.

(2) Remove skid plate, if equipped. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - REMOVAL)

(3) Position drain oil container under transfer case.

(4) Remove transfer case drain plug and drain lubricant into container.

(5) Disconnect vent hose and vacuum harness at transfer case switch.

(6) Disconnect shift rod from grommet in transfer case shift lever, or from floor shift arm whichever provides easy access. Use channel lock style pliers to press rod out of lever grommet.

(7) Support transmission with jack stand.

(8) Remove rear crossmember.

(9) Mark front and rear propeller shafts for assembly reference.

(10) Remove front and rear propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(11) Support transfer case with suitable jack. Secure transfer case to jack with safety chains.

(12) Remove nuts attaching transfer case to transmission.

(13) Move transfer case assembly rearward until free of transmission output shaft.

(14) Lower jack and move transfer case from under vehicle.

DISASSEMBLY

Position transfer case in a shallow drain pan. Remove drain plug and drain any remaining lubricant remaining in case.

REAR EXTENSION, RETAINER, AND REAR CASE

(1) Install bolts into two threaded holes in the rear propeller shaft companion flange 180° apart (Fig. 3).

(2) Place the Holder 6719 (Fig. 3) over the two bolts and use the Holder to remove the rear companion flange nut.

(3) Remove the rear companion flange from the output shaft.

NOTE: The companion flange is a taper fit onto the output shaft. It may be necessary to use Puller 8992 to remove the companion flange.

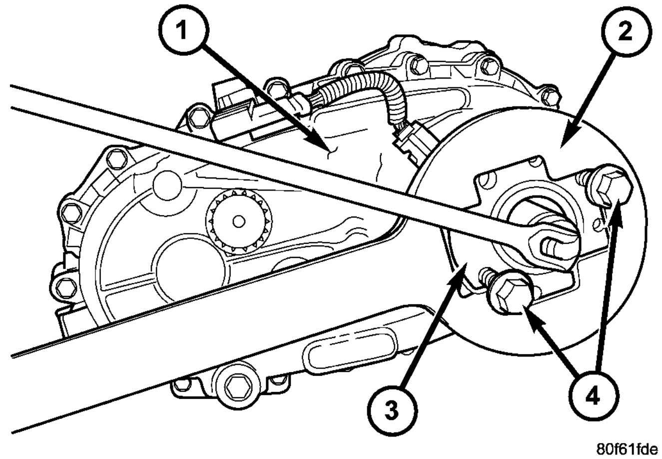


Fig. 3 Rear Companion Flange Nut Removal

1 - TRANSFER CASE
2 - HOLDER 6719
3 - COMPANION FLANGE
4 - BOLTS

(4) There is a seal slinger located on the rear of the companion flange that can be replaced if necessary. Use a suitable cold chisel to strike the slinger hub parallel to the centerline in several spots to expand the slinger hub. A new slinger can be driven onto the flange hub using a suitable pipe tool.

(5) Remove the speedometer sensor bolt (Fig. 4).

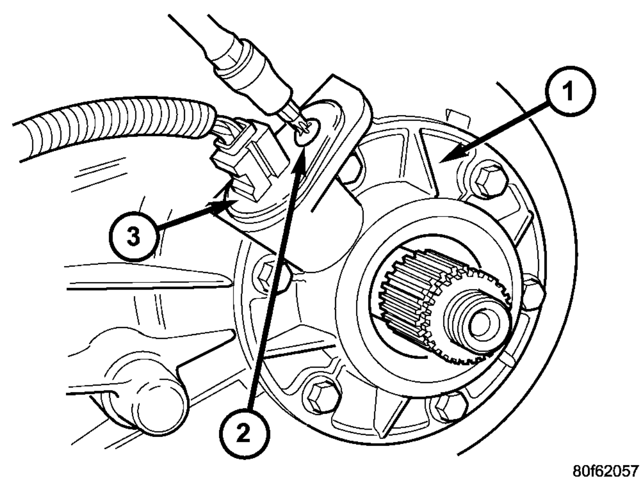


Fig. 4 Speedometer Sensor Bolt Removal

1 - EXTENSION HOUSING
2 - BOLT
3 - SPEEDOMETER SENSOR

TRANSFER CASE - NV241 (Continued)

(6) Remove the speedometer sensor (Fig. 5) from the extension housing.

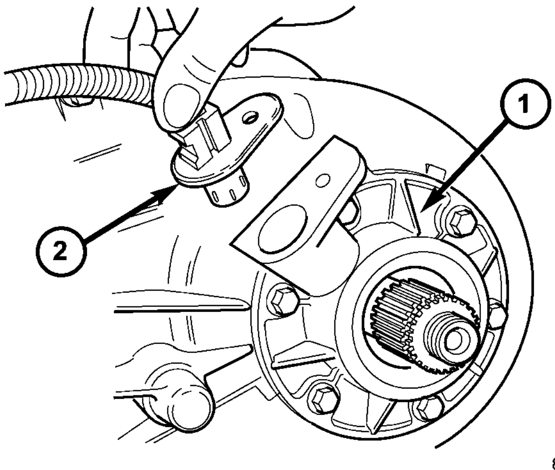


Fig. 5 Speedometer Sensor Removal

1 - EXTENSION HOUSING
2 - SPEEDOMETER SENSOR

(7) Remove rear extension bolts (Fig. 6).

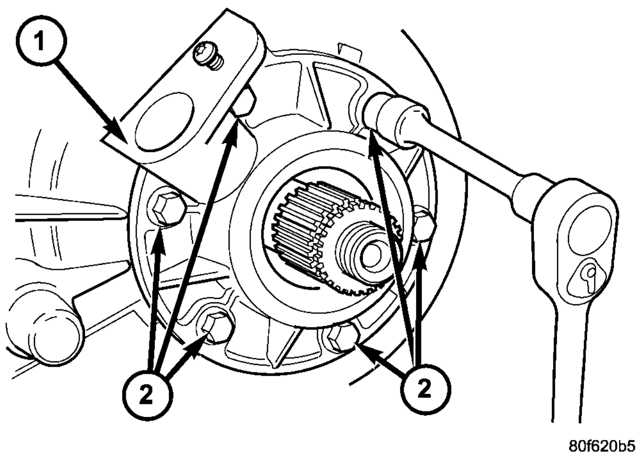


Fig. 6 Rear Extension Bolt Removal

1 - EXTENSION HOUSING
2 - BOLTS

(8) Remove rear extension housing (Fig. 7). Tap extension once or twice with a plastic mallet to break sealer bead and loosen it.

(9) Remove the speedometer sensor tone wheel (Fig. 8) from the output shaft.

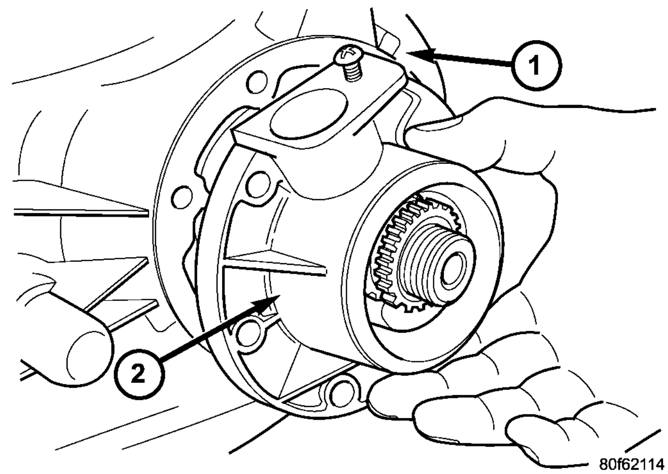


Fig. 7 Rear Extension Removal

1 - TRANSFER CASE
2 - EXTENSION HOUSING

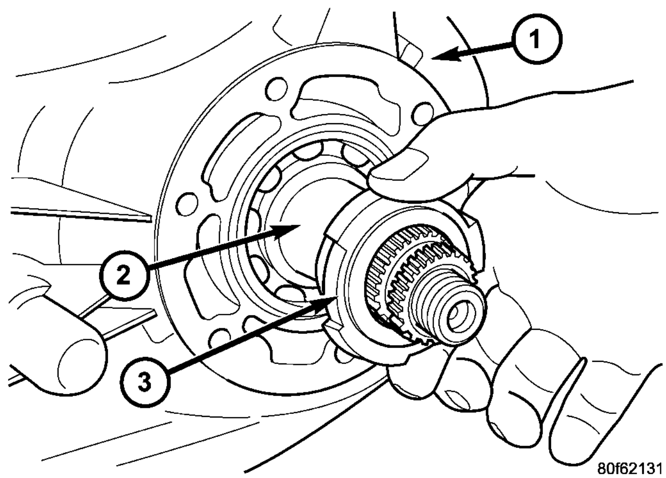


Fig. 8 Speedometer Sensor Tone Wheel Removal

1 - TRANSFER CASE
2 - OUPUT SHAFT
3 - SENSOR TONE WHEEL

TRANSFER CASE - NV241 (Continued)

(10) Remove the tone wheel dowel pin (Fig. 9) from the output shaft.

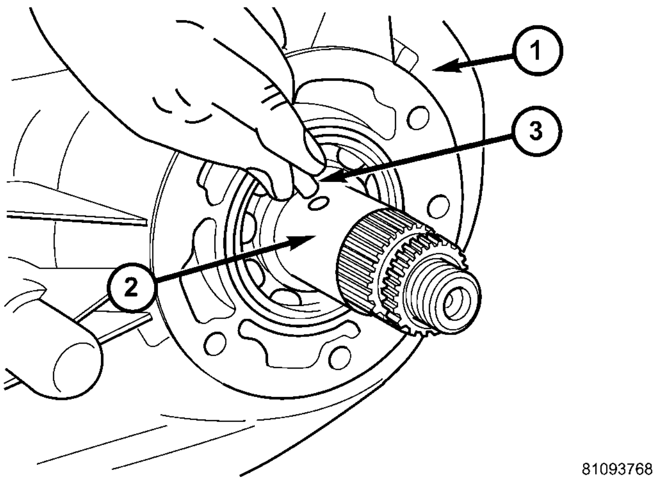


Fig. 9 Output Shaft Dowel Pin

1 - TRANSFER CASE
2 - OUPUT SHAFT
3 - DOWEL PIN

YOKE AND SHIFT LEVER

(1) Shift transfer case into a 4WD mode.

(2) Use Holder 6958 to secure the yoke and remove the yoke nut (Fig. 10). Discard nut after removal. It is not reusable.

(3) Remove the yoke (Fig. 11) from the front output shaft.

NOTE: The yoke is a taper fit onto the output shaft. It may be necessary to use a puller such as C-452 to remove the yoke.

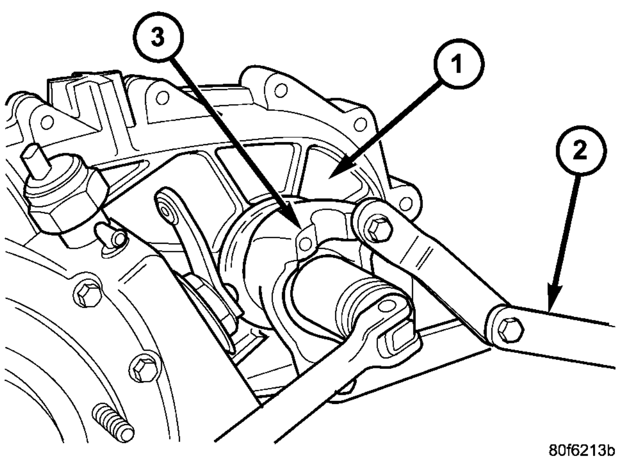


Fig. 10 Front Yoke Nut Removal

1 - TRANSFER CASE
2 - HOLDER 6958
3 - FRONT YOKE

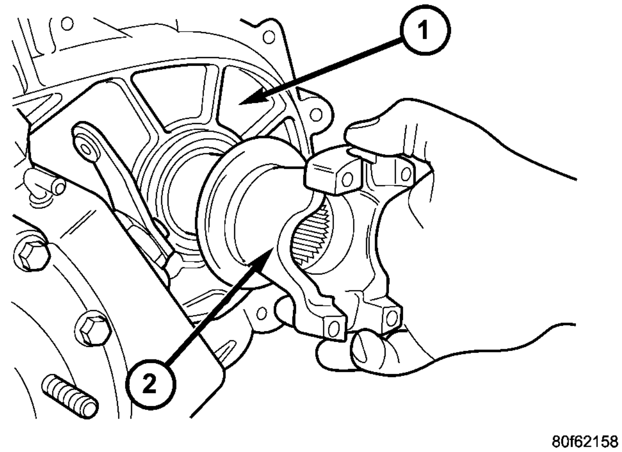


Fig. 11 Front Yoke Removal

1 - TRANSFER CASE
2 - FRONT YOKE

(4) There is a seal slinger located on the rear of the yoke that can be replaced if necessary. Use a suitable cold chisel to strike the slinger hub parallel to the centerline in several spots to expand the slinger hub. A new slinger can be driven onto the yoke hub using a suitable pipe tool.

(5) Remove yoke rubber seal from front output shaft.

(6) Remove bolt (Fig. 12) that retains the shift lever to sector shaft.

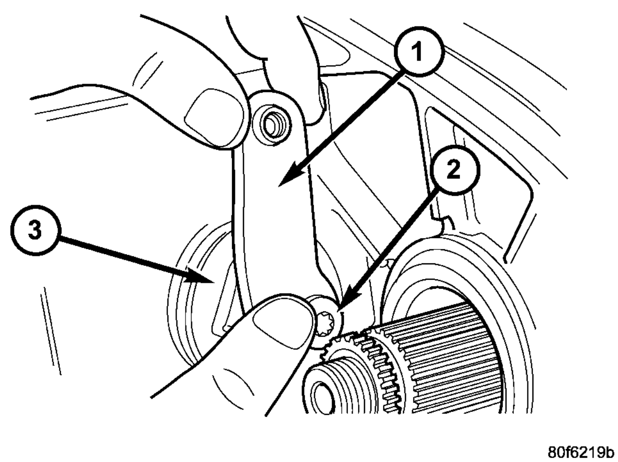


Fig. 12 Shift Lever Bolt Removal

1 - SHIFT LEVER
2 - BOLT
3 - SECTOR SUPPORT

TRANSFER CASE - NV241 (Continued)

(7) Remove the shift lever (Fig. 13) from the shift sector.

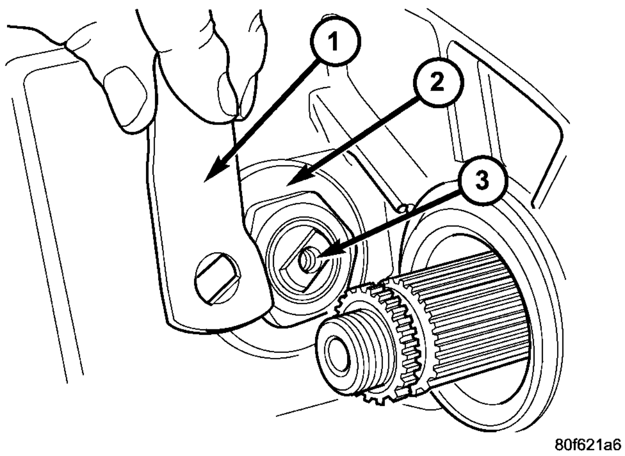


Fig. 13 Shift Lever Removal

1 - SHIFT LEVER
2 - SECTOR SUPPORT
3 - SHIFT SECTOR

(8) Remove the detent plug (Fig. 14).

(9) Remove the detent plug (Fig. 15), spring, and plunger from the transfer case.

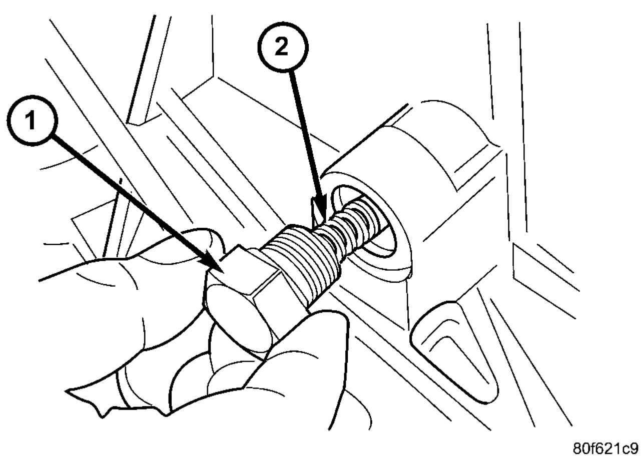


Fig. 14 Detent Plug Removal

1 - DETENT PLUG
2 - SPRING

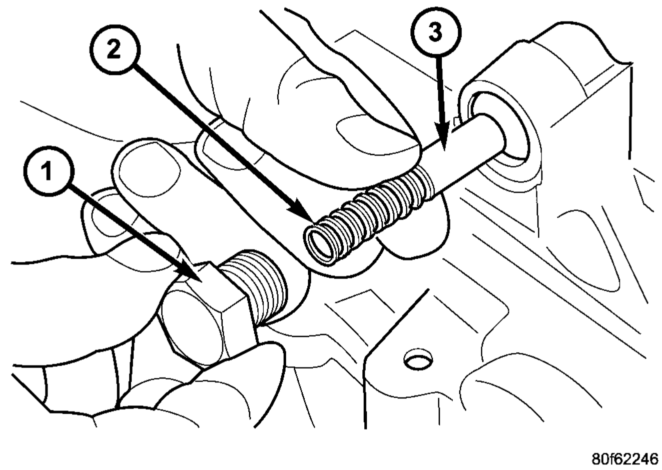


Fig. 15 Detent Plug, Spring, and Plunger Removal

1 - DETENT PLUG
2 - SPRING
3 - PLUNGER

(10) Remove the transfer case position sensor (Fig. 16).

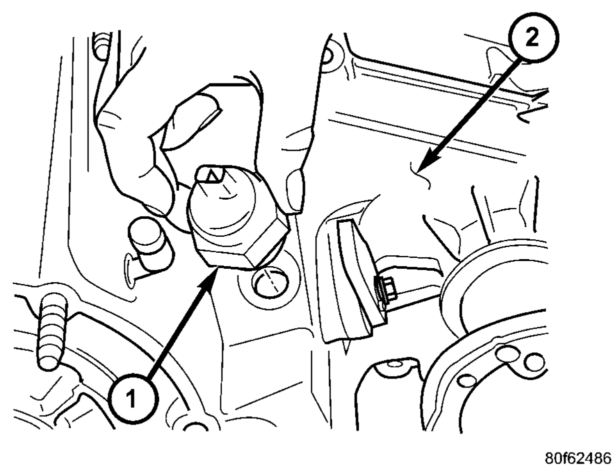


Fig. 16 Remove Transfer Case Position Sensor

1 - TRANSFER CASE POSITION SENSOR
2 - TRANSFER CASE

TRANSFER CASE - NV241 (Continued)

(11) Remove the shift sector support (Fig. 17).

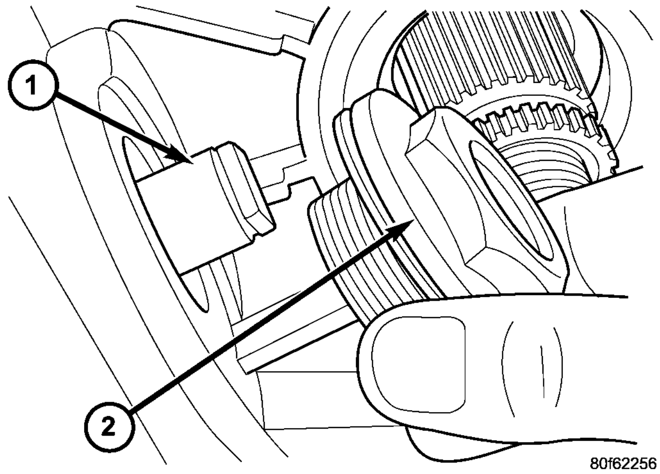


Fig. 17 Shift Sector Support Removal

1 - SHIFT SECTOR SHAFT
2 - SECTOR SUPPORT

MAINSHAFT, FRONT OUTPUT SHAFT, AND DRIVE CHAIN

(1) Note position of bolts that attach rear case to front case. Some bolts are unique. Mark position of these bolts with paint or scriber.

(2) Remove rear case-to-front case bolts (Fig. 18).

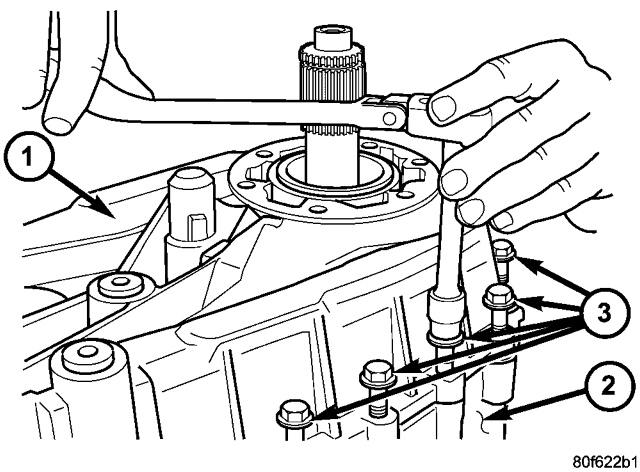


Fig. 18 Case Half Bolt Removal

1 - REAR CASE HALF
2 - FRONT CASE HALF
3 - BOLTS

(3) Loosen rear case with pry tool to break sealer bead.

(4) Unseat rear case from alignment dowels (Fig. 19).

(5) Remove rear case and oil pump assembly from front case (Fig. 20).

CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft bearing inner race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump, the rear case and oil pump assembly MUST be replaced.

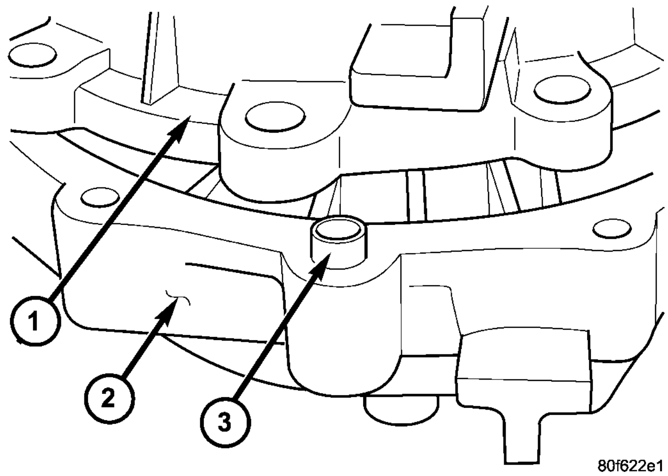


Fig. 19 Case Alignment Dowel

1 - REAR CASE HALF
2 - FRONT CASE HALF
3 - ALIGNMENT DOWEL

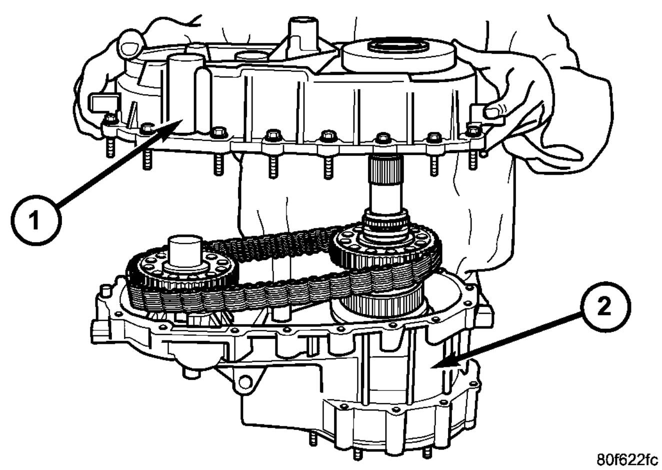


Fig. 20 Rear Case Half Removal

1 - REAR CASE HALF
2 - FRONT CASE HALF

TRANSFER CASE - NV241 (Continued)

(6) Remove shift rail cups and spring (Fig. 21).

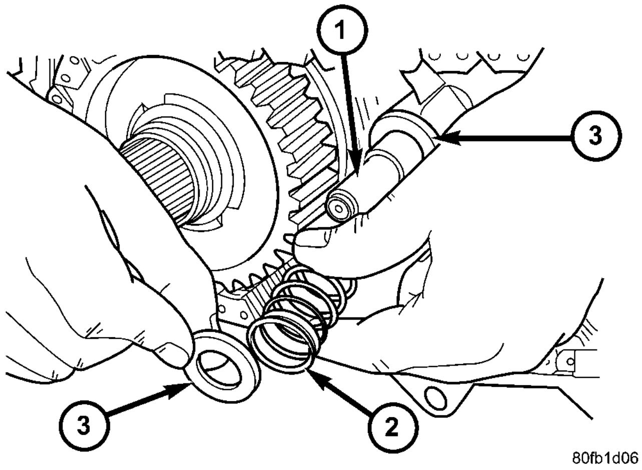


Fig. 21 Shift Rail Cup And Spring Removal

1 - SHIFT RAIL
2 - SPRING
3 - CUPS (2)

(7) Remove front drive sprocket retaining ring (Fig. 22).

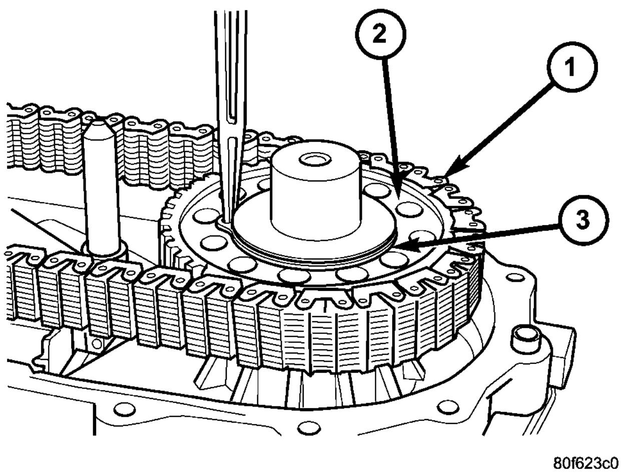


Fig. 22 Front Drive Sprocket Snap-Ring Removal

1 - DRIVE CHAIN
2 - FRONT DRIVE SPROCKET
3 - SNAP-RING

(8) Remove mainshaft, front sprocket, and chain as an assembly (Fig. 23).

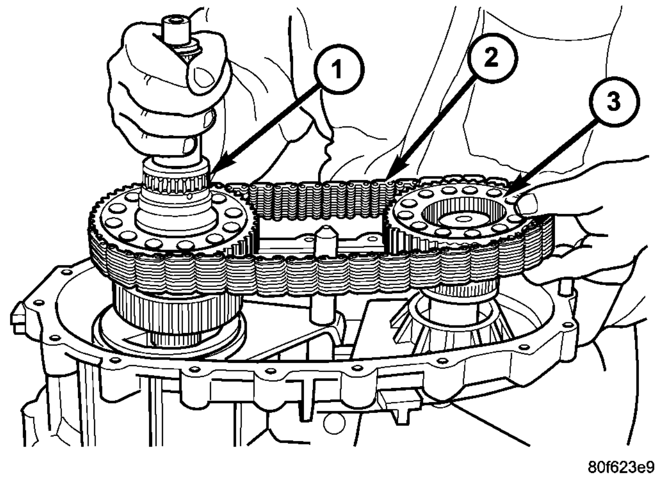


Fig. 23 Remove Mainshaft, Drive Chain, and Front Sprocket

1 - MAINSHAFT
2 - DRIVE CHAIN
3 - DRIVE SPROCKET

SHIFT FORKS

(1) Remove front output shaft from bearing in case (Fig. 24).

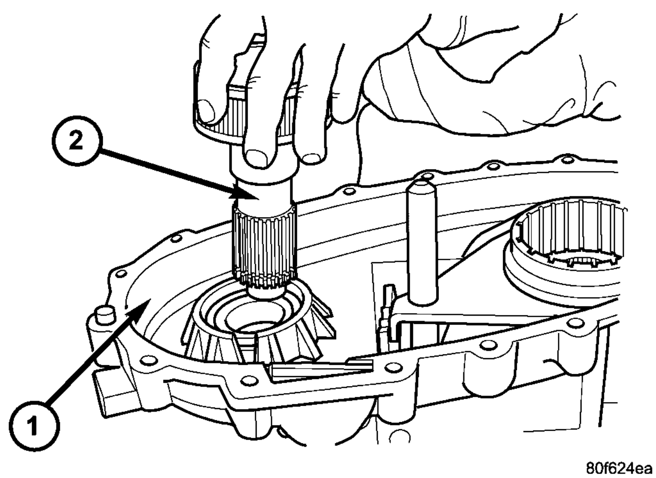


Fig. 24 Front Output Shaft Removal

1 - FRONT CASE HALF
2 - FRONT OUTPUT SHAFT

TRANSFER CASE - NV241 (Continued)

(2) Remove the shift rail (Fig. 25) from the shift forks.

(3) Remove mode fork, mode sleeve (Fig. 26). Note which way sleeve fits in fork (long side of sleeve goes to front).

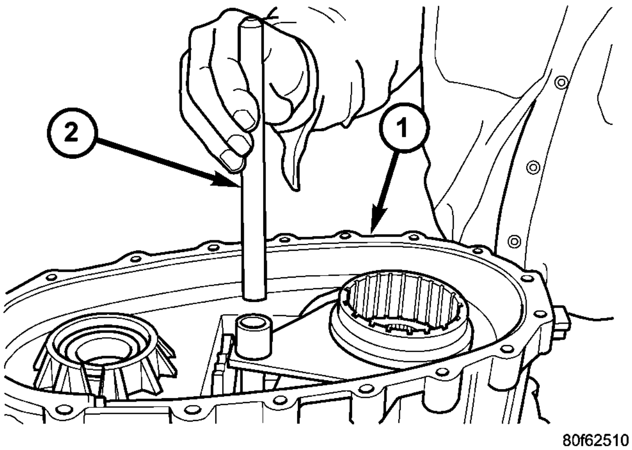


Fig. 25 Shift Fork Rail Removal

1 - FRONT CASE HALF
2 - SHIFT RAIL

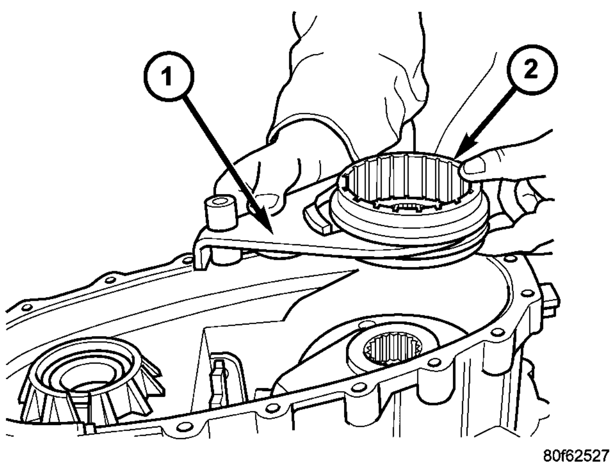


Fig. 26 Mode Fork and Sleeve Removal

1 - MODE FORK
2 - MODE SLEEVE

(4) Remove range fork and hub as an assembly (Fig. 27). Note fork position for installation reference.

(5) Remove shift sector (Fig. 28).

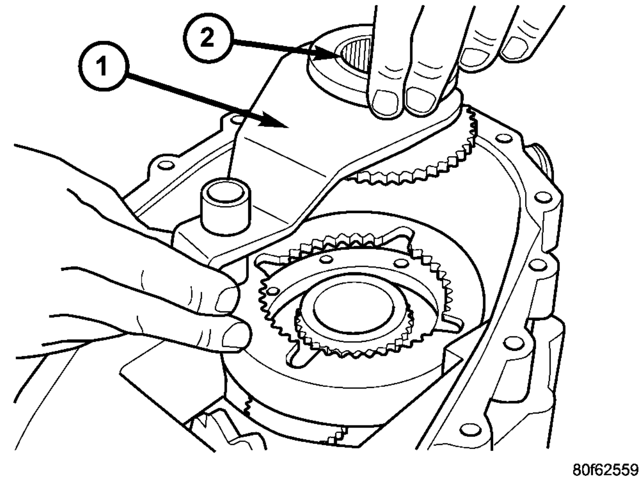


Fig. 27 Range Fork and Hub Removal

1 - RANGE FORK
2 - RANGE HUB

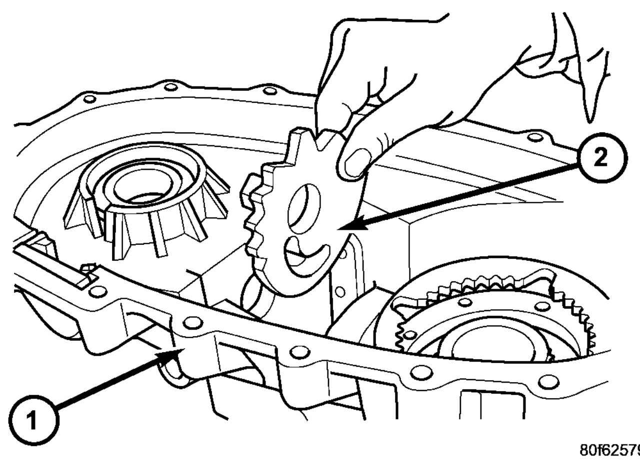


Fig. 28 Shift Sector Removal

1 - FRONT CASE HALF
2 - SHIFT SECTOR

TRANSFER CASE - NV241 (Continued)

MAINSHAFT

(1) Remove the snap-ring that secures the chain drive sprocket onto mainshaft (Fig. 29). Use standard (instead of parallel jaw) snap-ring pliers to remove this snap-ring.

(2) Remove drive sprocket (Fig. 30).

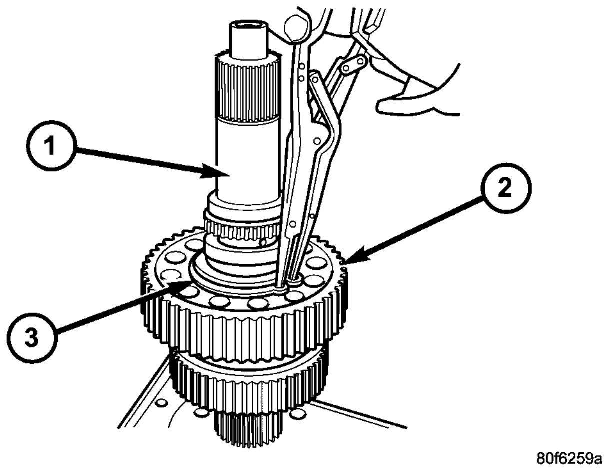


Fig. 29 Mainshaft Drive Sprocket Snap-Ring Removal

1 - MAINSHAFT
2 - DRIVE SPROCKET
3 - SNAP-RING

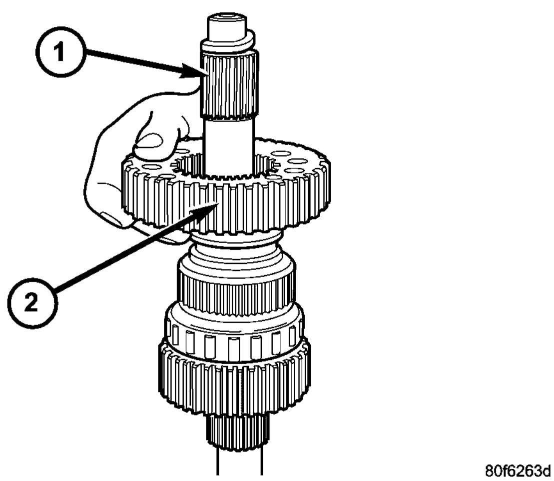


Fig. 30 Mainshaft Drive Sprocket Removal

1 - MAINSHAFT
2 - DRIVE SPROCKET

(3) Remove the sliding clutch gear (Fig. 31) from the mainshaft.

(4) Rotate the mainshaft 180° and remove the mode hub snap-ring (Fig. 32).

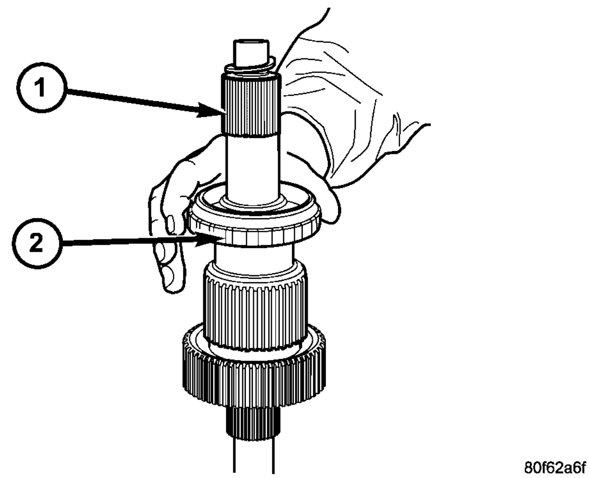


Fig. 31 Sliding Clutch Gear Removal

1 - MAINSHAFT
2 - SLIDING CLUTCH GEAR

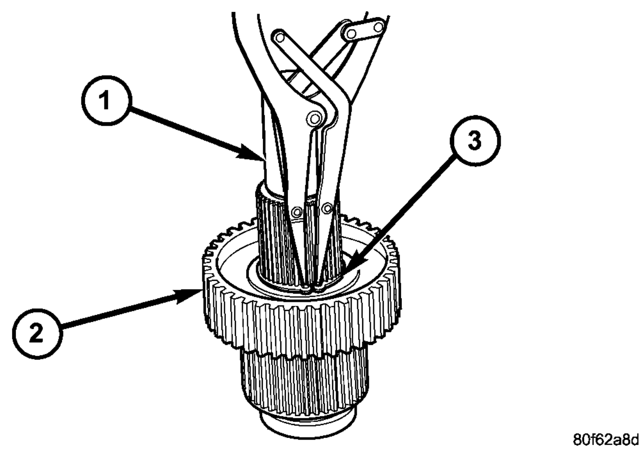


Fig. 32 Mode Hub Snap-Ring Removal

1 - MAINSHAFT
2 - MODE HUB
3 - SNAP-RING

TRANSFER CASE - NV241 (Continued)

(5) Remove the mode hub (Fig. 33) from the mainshaft.

(6) Remove the drive sprocket drive hub (Fig. 34) from the mainshaft.

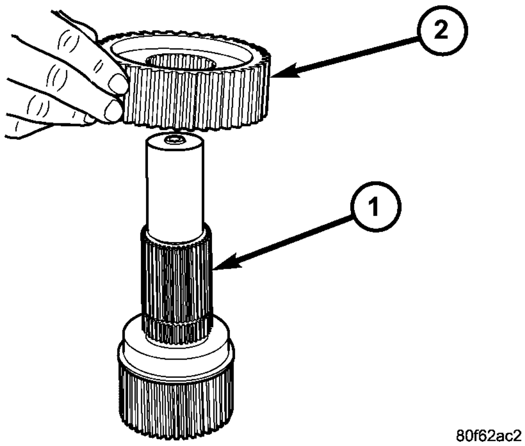


Fig. 33 Mode Hub Removal

1 - MAINSHAFT
2 - MODE HUB

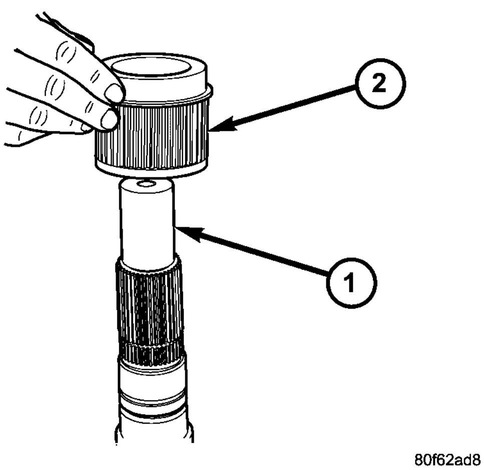


Fig. 34 Drive Sprocket Drive Hub Removal

1 - MAINSHAFT
2 - DRIVE SPROCKET DRIVE HUB

INPUT AND PLANETARY GEAR

(1) Remove front input retainer attaching bolts (Fig. 35).

(2) Remove the input gear seal with a suitable screw and slide hammer.

(3) Remove the input gear snap-ring (Fig. 36) from the input retainer.

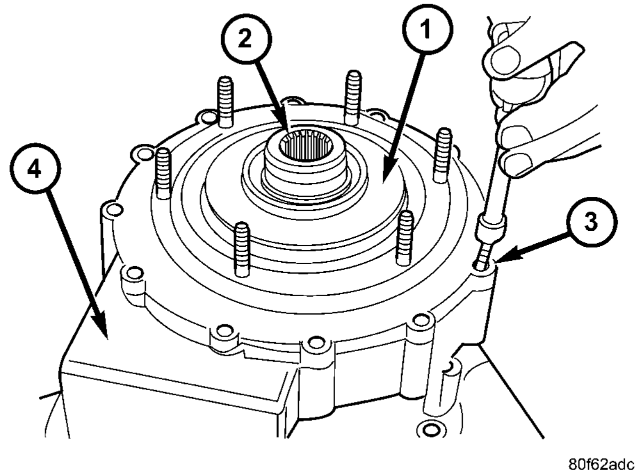


Fig. 35 Front Input Retainer Bolt Removal

1 - INPUT RETAINER
2 - INPUT GEAR
3 - BOLT
4 - FRONT CASE HALF

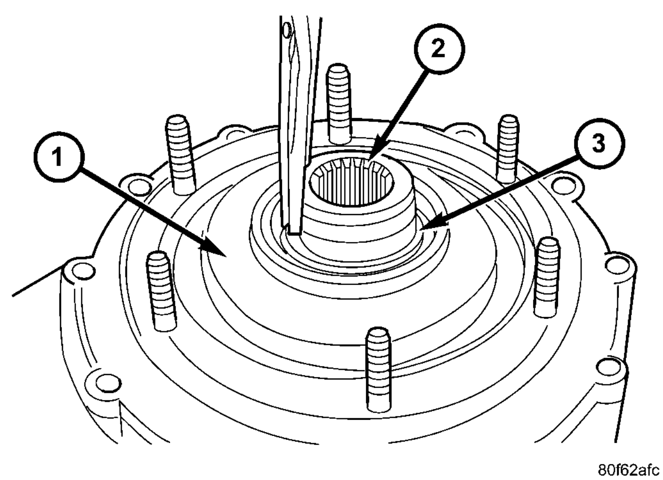


Fig. 36 Input Gear Snap-Ring Removal

1 - INPUT RETAINER
2 - INPUT GEAR
3 - SNAP-RING

TRANSFER CASE - NV241 (Continued)

(4) Remove the input gear (Fig. 37) from the input gear bearing with suitable hammer.

(5) Remove front input retainer (Fig. 38).

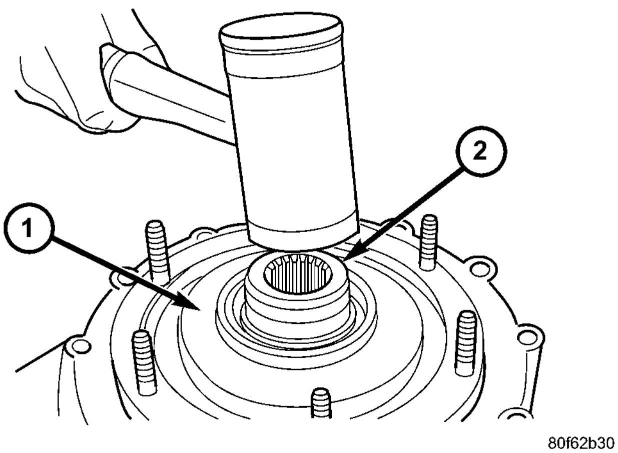


Fig. 37 Input Gear Removal

1 - INPUT RETAINER
2 - INPUT GEAR

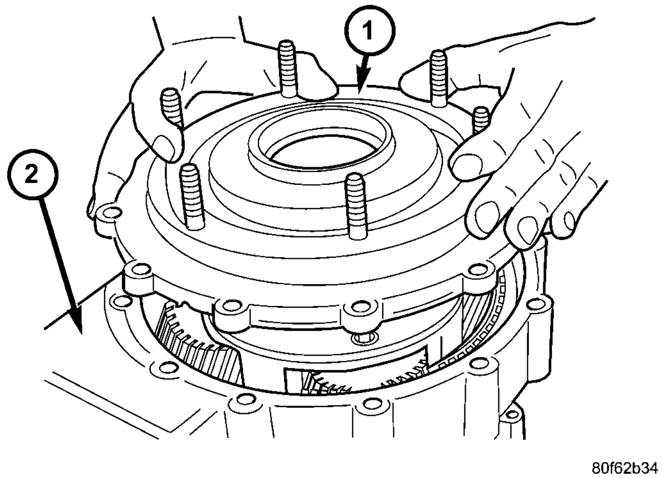


Fig. 38 Front Input Retainer Removal

1 - INPUT RETAINER
2 - FRONT CASE HALF

(6) Remove the low range planetary plastic spacer (Fig. 39) from the planetary carrier or back side of the input retainer.

(7) Remove the low range planetary gear set (Fig. 40) from the front case half.

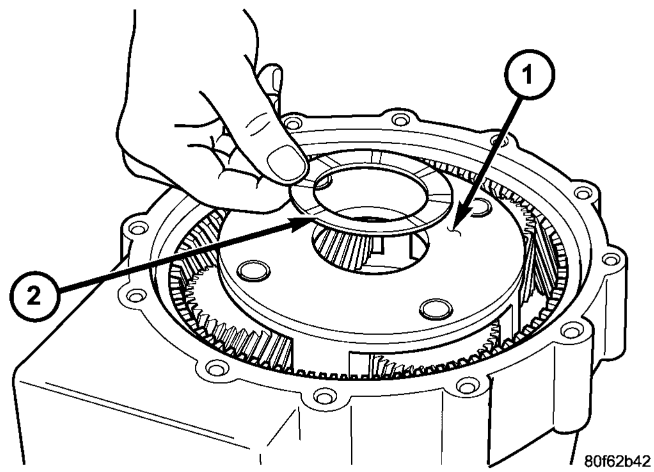


Fig. 39 Low Range Planetary Plastic Spacer

1 - LOW RANGE PLANETARY
2 - PLASTIC SPACER

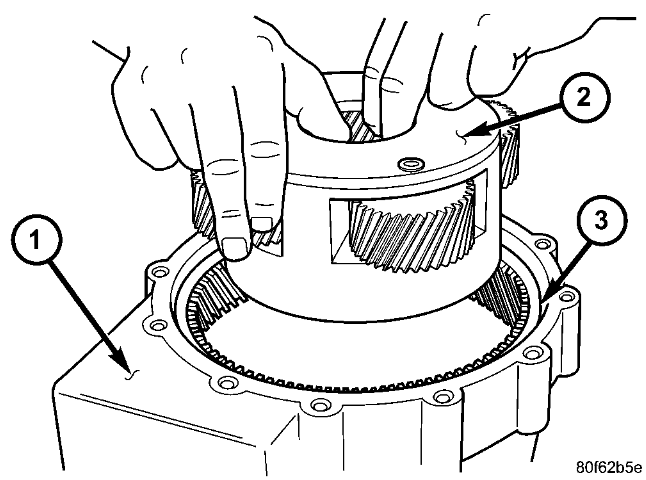


Fig. 40 Low Range Planetary Removal

1 - FRONT CASE HALF
2 - LOW RANGE PLANETARY
3 - ANNULUS GEAR

TRANSFER CASE - NV241 (Continued)

(8) Remove the annulus gear (Fig. 41) from the front case half.

(9) Support the input retainer on Cup 8148 as shown (Fig. 42).

(10) While using suitable snap-ring pliers to spread the input gear bearing snap-ring (Fig. 43), press downward on the retainer to remove the bearing.

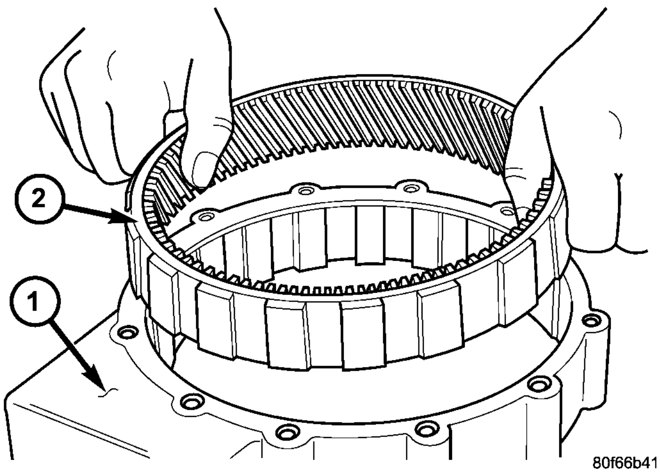


Fig. 41 Remove Annulus Gear

1 - FRONT CASE HALF
2 - ANNULUS GEAR

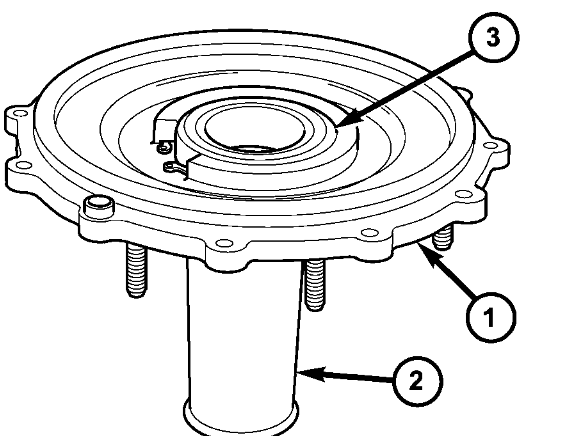


Fig. 42 Support Input Gear Bearing For Removal

1 - INPUT RETAINER
2 - CUP 8148
3 - INPUT GEAR BEARING

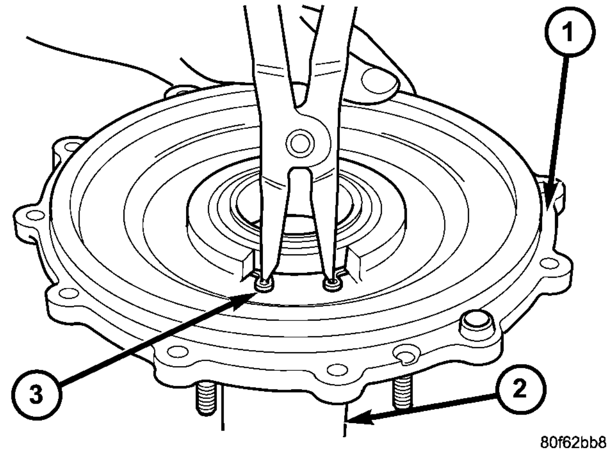


Fig. 43 Input Gear Bearing Removal

1 - INPUT RETAINER
2 - CUP 8148
3 - INPUT GEAR BEARING

(11) Remove the front output shaft bearing with Handle C-4171 and Installer 8239 (Fig. 44).

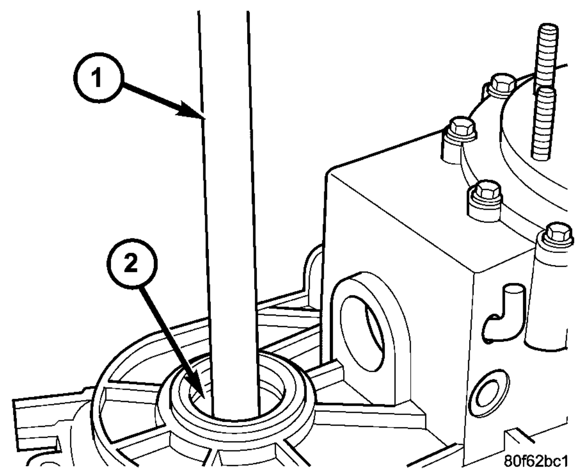


Fig. 44 Front Output Bearing Removal

1 - HANDLE C-4171
2 - INSTALLER 8239

TRANSFER CASE - NV241 (Continued)

(12) Remove the rear output shaft bearing with Handle C-4171 and Installer 8239 (Fig. 45).

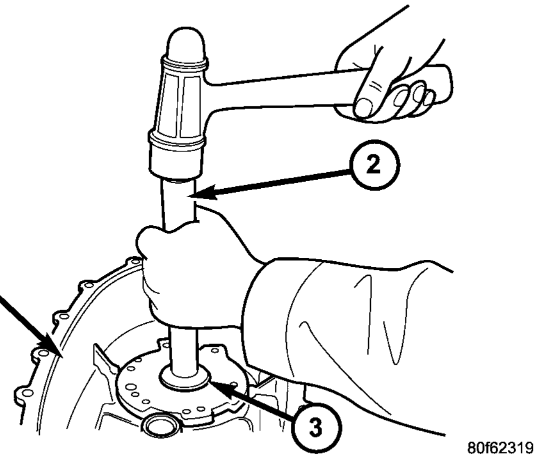


Fig. 45 Rear Output Bearing Removal

1 - REAR CASE HALF
2 - HANDLE C-4171
3 - INSTALLER 8239

CLEANING

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M™ all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

INSPECTION

MAINSHAFT/SPROCKET/HUB

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone, however, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320-400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear. Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300-400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged. Inspect the plastic washer on the inside, bottom of the planetary carrier. The washer is trapped by the pinion gears and the complete planetary will need to be replaced if the washer is worn or damaged.

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail. Minor nicks on the shift rail can be smoothed with 320-400 grit emery cloth.

Inspect the shift fork wear pads. The mode and range fork pads are serviceable and can be replaced if necessary.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

DRIVE CHAIN

Examine the drive chain and shaft bearings. replace the chain if stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear can be serviced separately.

FRONT-REAR CASES

Inspect the cases for wear and damage. Replace the input retainer seal, do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil™ stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any evidence of debris or damage exists. Do not disassemble the pump from the rear case half as individual parts are not available and it will not be possible to reassemble the pump cover to the rear case half. The pump is only available as part of the rear case half assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

ASSEMBLY

BEARINGS AND SEALS

(1) Position the input gear bearing in the input retainer bearing bore. Spread the snap-ring captured in the retainer with suitable snap-ring pliers and press the bearing into place. Verify that the snap-ring has engaged the groove in the bearing.

(2) Start front output shaft bearing in case (Fig. 46). Then seat bearing with Handle C-4171 and Installer 6953.

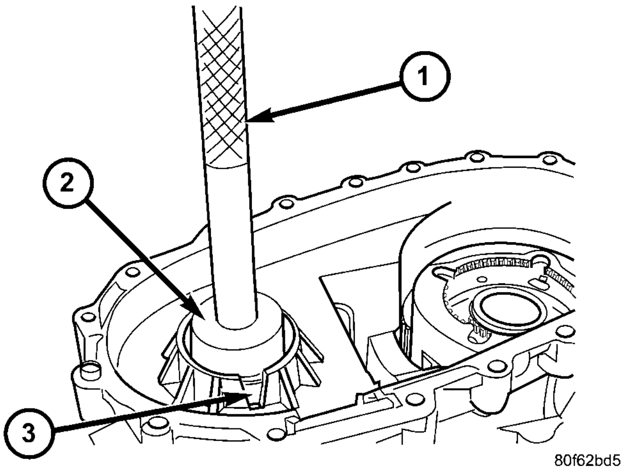


Fig. 46 Front Output Shaft Bearing Installation

1 - HANDLE C-4171
2 - INSTALLER 6953
3 - BEARING

(3) Install the front output shaft bearing retaining ring.

(4) Install the rear output shaft bearing into the rear case half with Installer 6953 and Handle C-4171 (Fig. 47).

(5) Remove the input gear pilot bearing using Puller Jaws 8240 and Cup 8148.

(6) Remove the input gear cup plug (Fig. 48) with a suitable drift and hammer inserted from the front of the input gear.

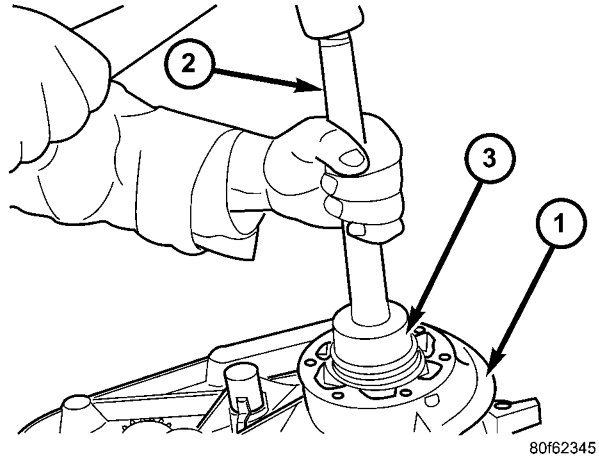


Fig. 47 Rear Output Bearing Installation

1 - REAR CASE HALF
2 - HANDLE C-4171
3 - INSTALLER 6953

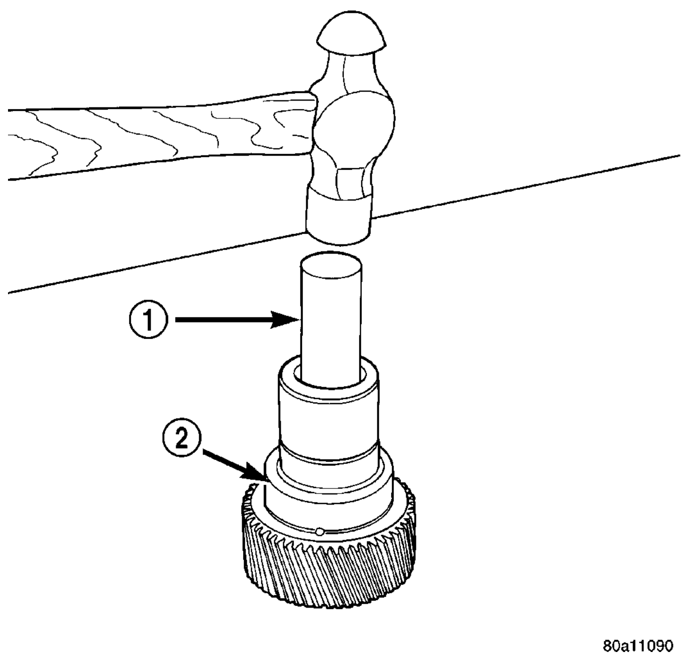


Fig. 48 Remove Input Gear Cup Plug

1 - DRIFT
2 - INPUT GEAR

TRANSFER CASE - NV241 (Continued)

(7) Install a new input gear cup plug with Installer 9045 and Handle C-4171.

(8) Install new input gear pilot bearing with Installer 9047 and Handle C-4171.

(9) Remove the front output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 49).

(10) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 50). The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 51).

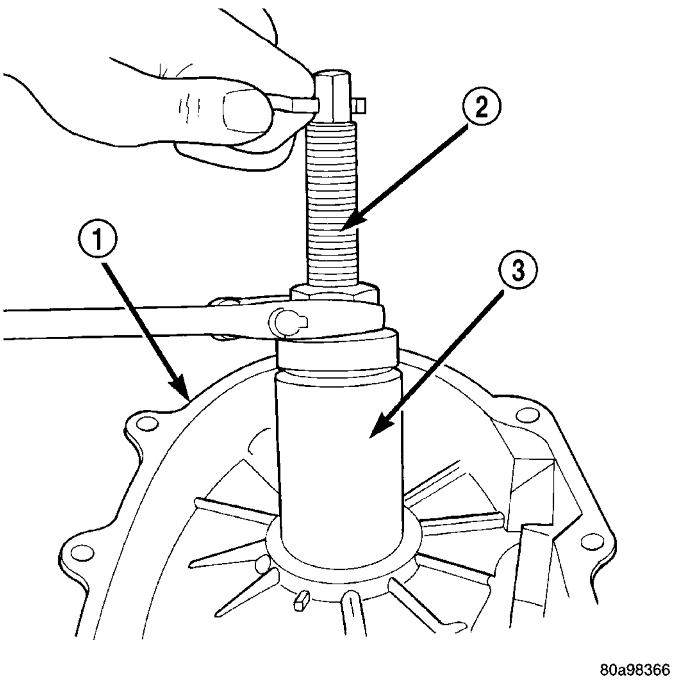


Fig. 49 Front Output Shaft Rear Bearing Removal

1 - REAR CASE
2 - SPECIAL TOOL L-4454-1 AND L-4454-3
3 - SPECIAL TOOL 8148

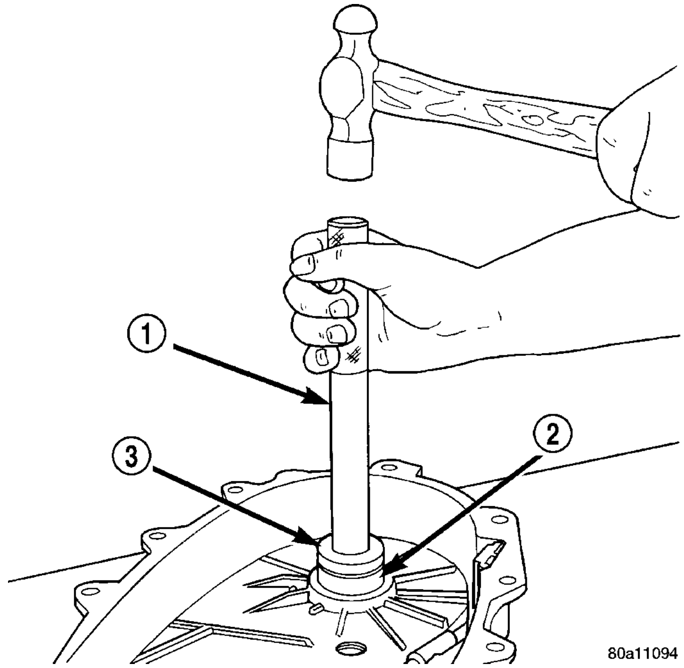


Fig. 50 Output Shaft Rear Bearing Installation

1 - HANDLE C-4171
2 - OUTPUT SHAFT INNER BEARING
3 - INSTALLER 5066

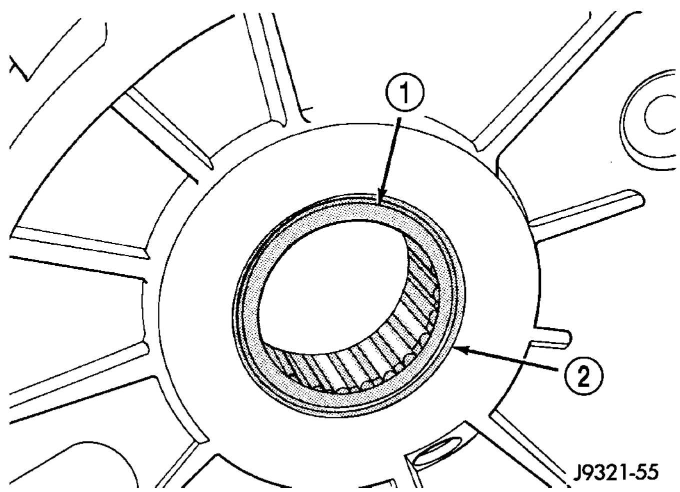


Fig. 51 Output Shaft Rear Bearing Installation Depth

1 - BEARING (SEATED) AT LOWER EDGE OF CHAMFER
2 - CHAMFER

INPUT AND PLANETARY GEAR

(1) Install the annulus gear (Fig. 52) into the front case half.

(2) Align and install low range planetary assembly into the front case half (Fig. 53). Be sure low range planetary pinions are engaged in annulus gear.

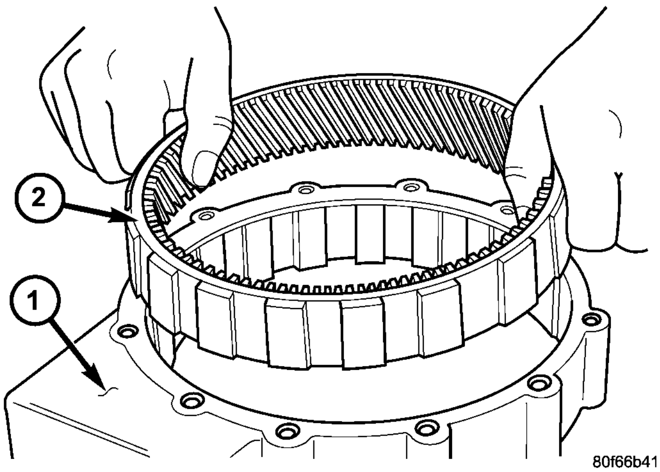


Fig. 52 Install Annulus Gear

1 - FRONT CASE HALF
2 - ANNULUS GEAR

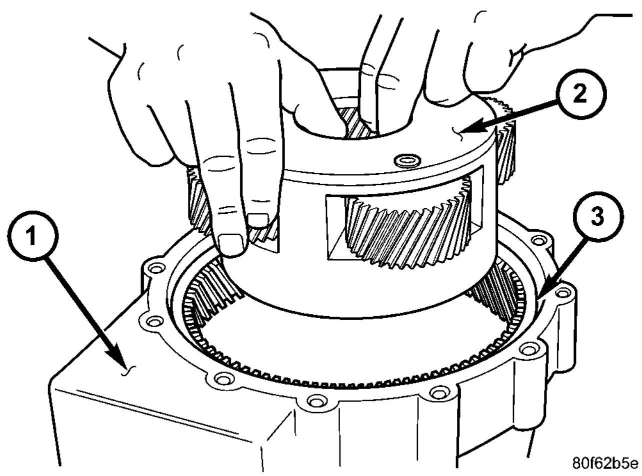


Fig. 53 Low Range Planetary Installation

1 - FRONT CASE HALF
2 - LOW RANGE PLANETARY
3 - ANNULUS GEAR

(3) Install the low range planetary plastic spacer (Fig. 54) onto the low range planetary carrier.

(4) Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.

(5) Apply a 3 mm (1/8 in.) bead of Mopar® Gasket Maker, or equivalent silicone adhesive, to sealing surface of retainer.

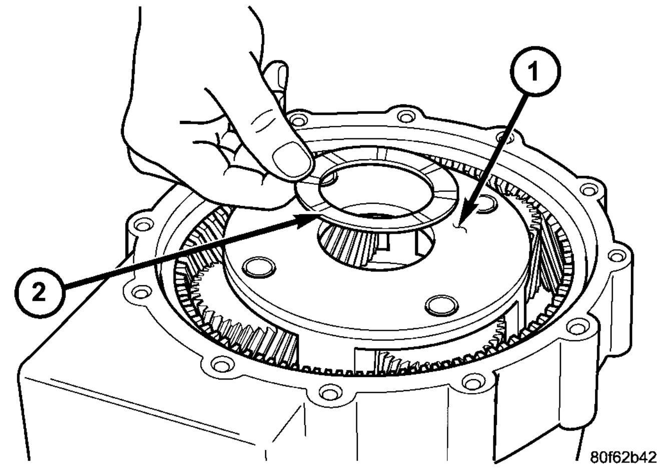


Fig. 54 Low Range Planetary Plastic Spacer

1 - LOW RANGE PLANETARY
2 - PLASTIC SPACER

(6) Install the front input retainer (Fig. 55) onto the front case half.

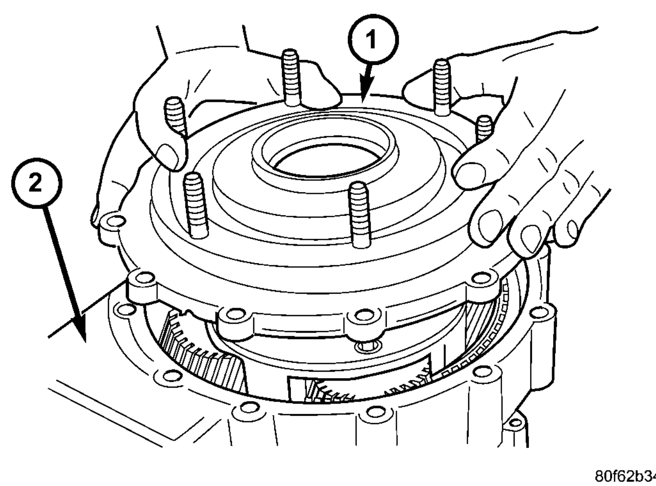


Fig. 55 Front Input Retainer Installation

1 - INPUT RETAINER
2 - FRONT CASE HALF

TRANSFER CASE - NV241 (Continued)

(7) Install bolts to hold retainer to transfer case (Fig. 56). Tighten to 21 N·m (16 ft. lbs.) of torque.

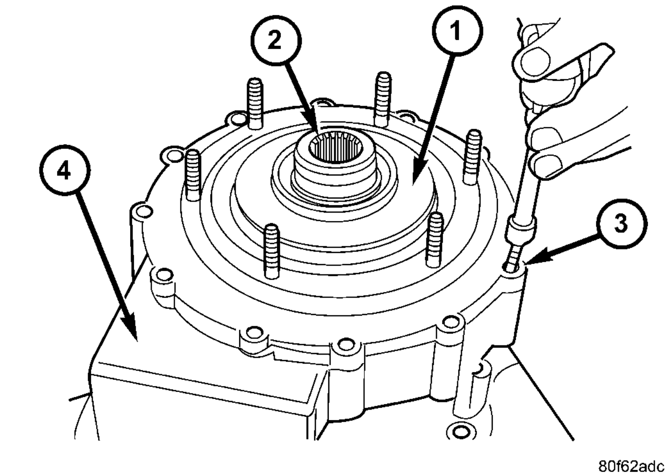


Fig. 56 Front Input Retainer Bolt Installation

1 - INPUT RETAINER
2 - INPUT GEAR
3 - BOLT
4 - FRONT CASE HALF

(8) Install the input gear to the low range planetary assembly and the input gear bearing.

(9) Install the input gear retaining snap-ring (Fig. 57) onto the input gear.

(10) Install new oil seal in front input retainer with Installer 8841 and Handle C-4171 (Fig. 58).

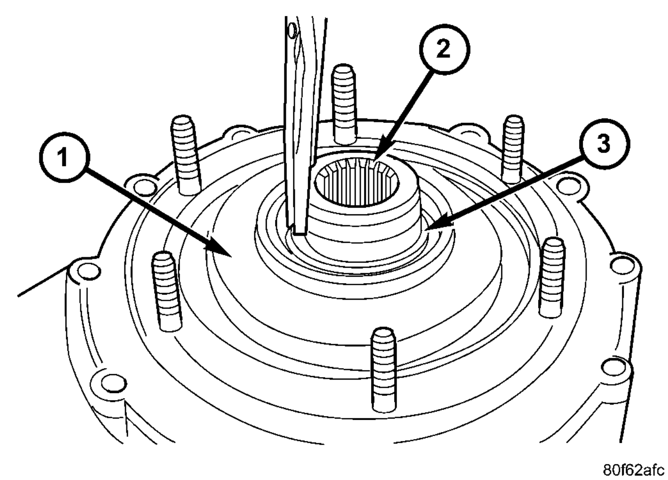


Fig. 57 Input Gear Snap-Ring Installation

1 - INPUT RETAINER
2 - INPUT GEAR
3 - SNAP-RING

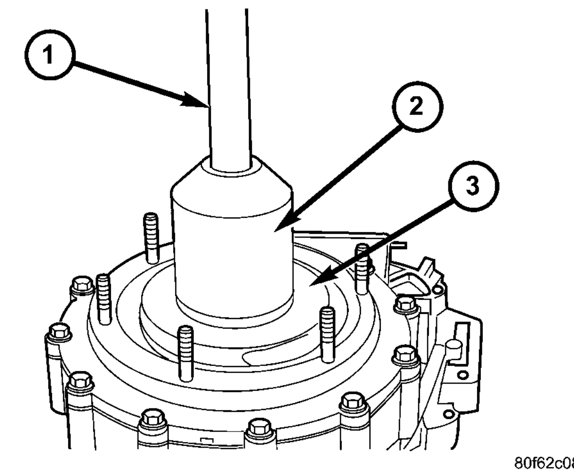


Fig. 58 Input Gear Seal Installation

1 - HANDLE C-4171
2 - INSTALLER 8841
3 - INPUT RETAINER

SHIFT FORKS AND MAINSHAFT

(1) Lubricate mainshaft splines with recommended transmission fluid.

(2) Install the drive sprocket drive hub onto the mainshaft (Fig. 59). Verify that the long shoulder is towards the front of the mainshaft.

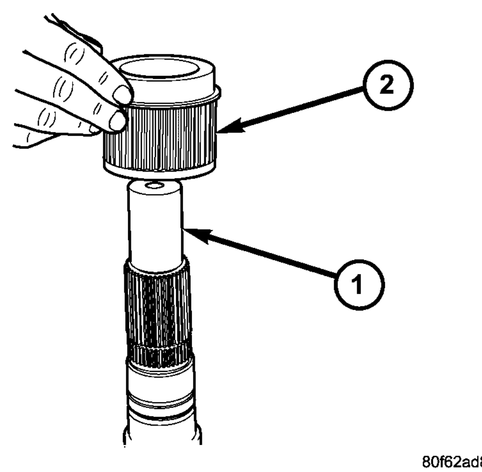


Fig. 59 Drive Sprocket Drive Hub Installation

1 - MAINSHAFT
2 - DRIVE SPROCKET DRIVE HUB

TRANSFER CASE - NV241 (Continued)

(3) Install the mode hub (Fig. 60) onto the mainshaft.

(4) Install the mode hub snap-ring (Fig. 61) onto the mainshaft.

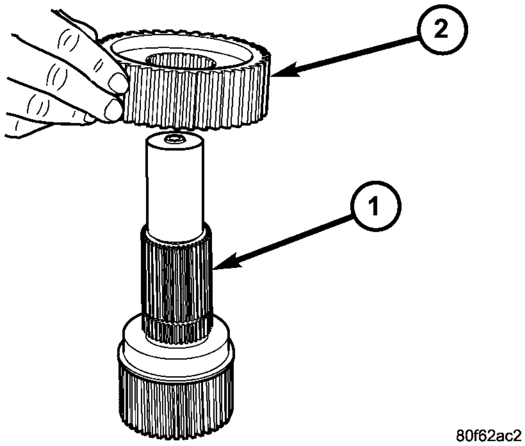


Fig. 60 Mode Hub Installation

1 - MAINSHAFT
2 - MODE HUB

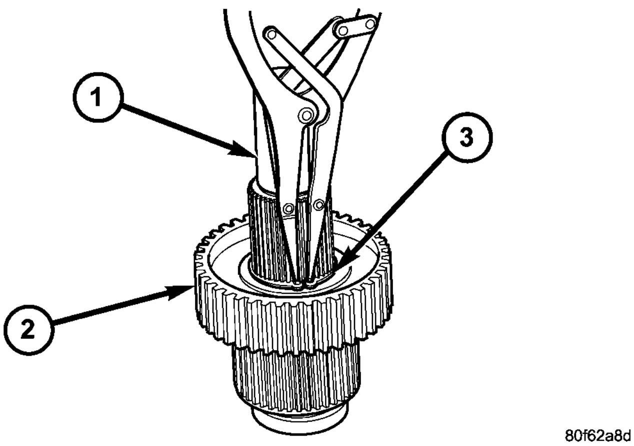


Fig. 61 Mode Hub Snap-Ring Installation

1 - MAINSHAFT
2 - MODE HUB
3 - SNAP-RING

(5) Rotate the mainshaft 180° and install the sliding clutch gear (Fig. 62) onto the drive sprocket drive hub.

(6) Install the mainshaft drive sprocket (Fig. 63) onto the drive hub.

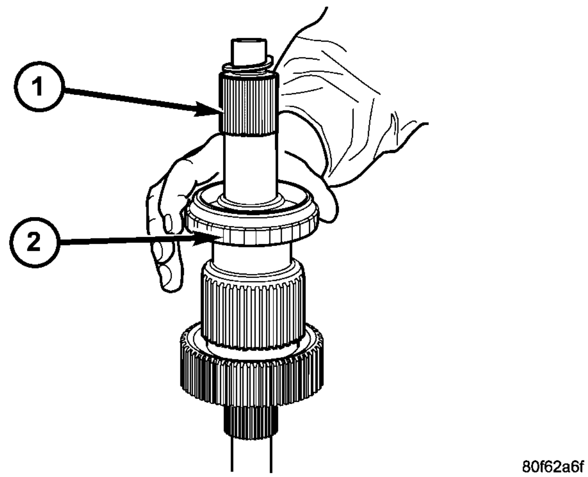


Fig. 62 Sliding Clutch Gear Installation

1 - MAINSHAFT
2 - SLIDING CLUTCH GEAR

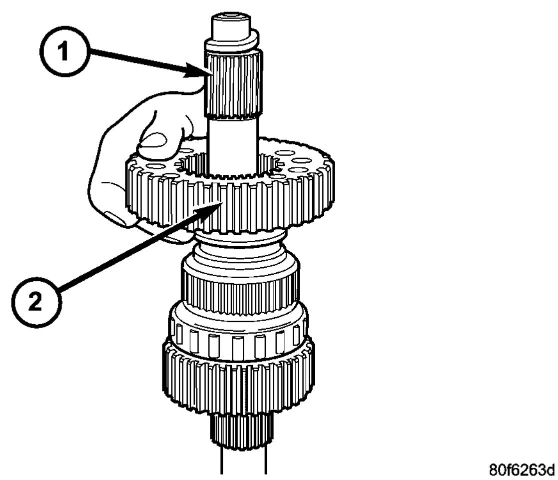


Fig. 63 Mainshaft Drive Sprocket Installation

1 - MAINSHAFT
2 - DRIVE SPROCKET

TRANSFER CASE - NV241 (Continued)

(7) Install the mainshaft drive sprocket retaining ring (Fig. 64) onto the drive hub.

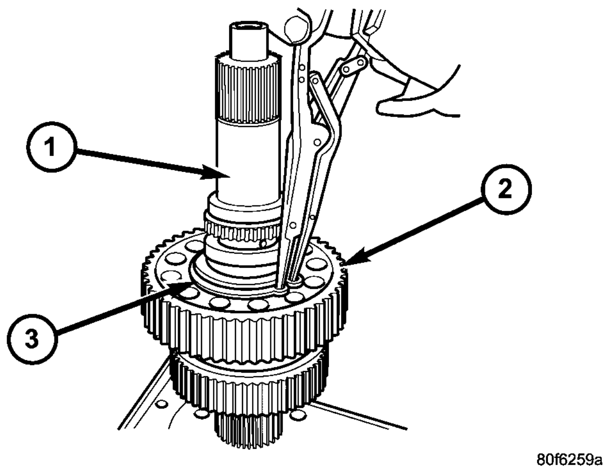


Fig. 64 Mainshaft Drive Sprocket Snap-Ring Installation

1 - MAINSHAFT
2 - DRIVE SPROCKET
3 - SNAP-RING

(8) Support front case on wood blocks so case interior is facing up. Place blocks between mounting studs on forward surface of case.

(9) Lubricate mainshaft components with transmission fluid.

(10) Lubricate sector shaft with transmission fluid and install shift sector in case (Fig. 65). Position slot in sector so it will be aligned with shift fork pin when shift forks are installed.

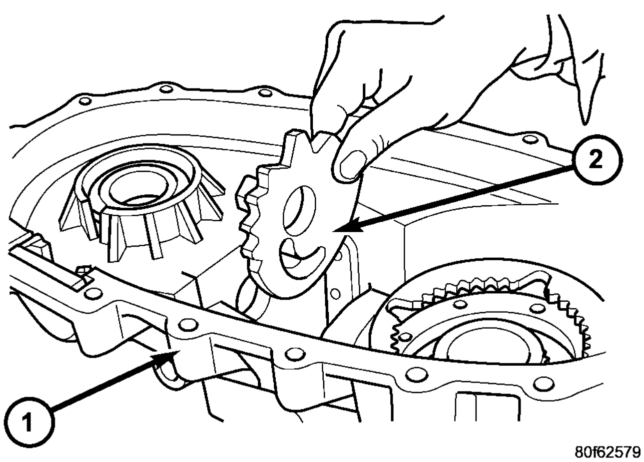


Fig. 65 Shift Sector Installation

1 - FRONT CASE HALF
2 - SHIFT SECTOR

(11) Assemble and install range fork and hub (Fig. 66). Be sure hub is properly seated in low range gear and engaged to the input gear.

(12) Align and insert range fork pin in shift sector slot.

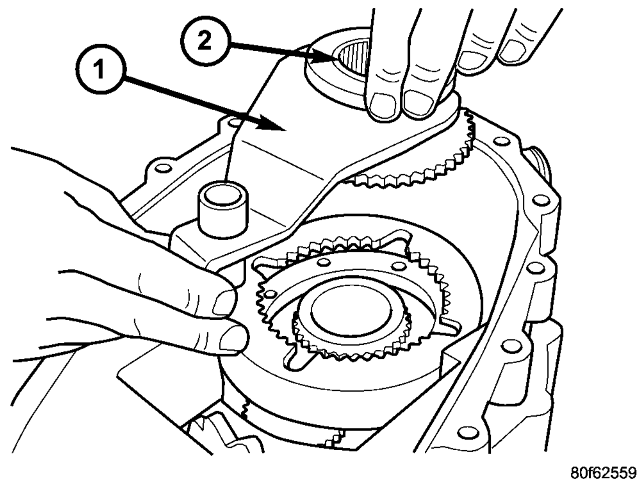


Fig. 66 Range Fork and Hub Installation

1 - RANGE FORK
2 - RANGE HUB

(13) Install mode fork and mode sleeve (Fig. 67). Verify that the long side of the mode sleeve is towards the front of the transfer case.

(14) Install the shift rail (Fig. 68) through the shift forks and into the shift rail pocket in the front case half.

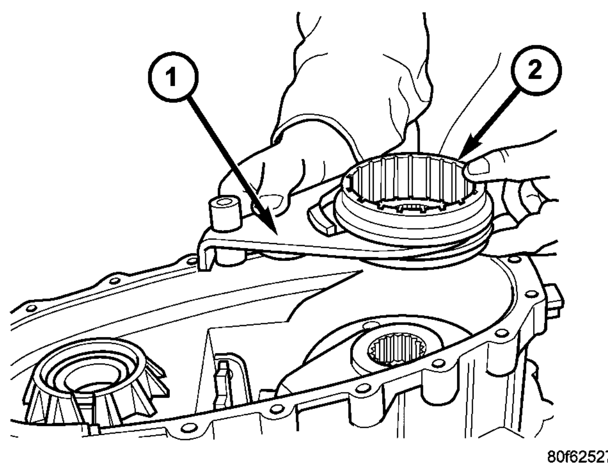


Fig. 67 Mode Fork and Sleeve Installation

1 - MODE FORK
2 - MODE SLEEVE

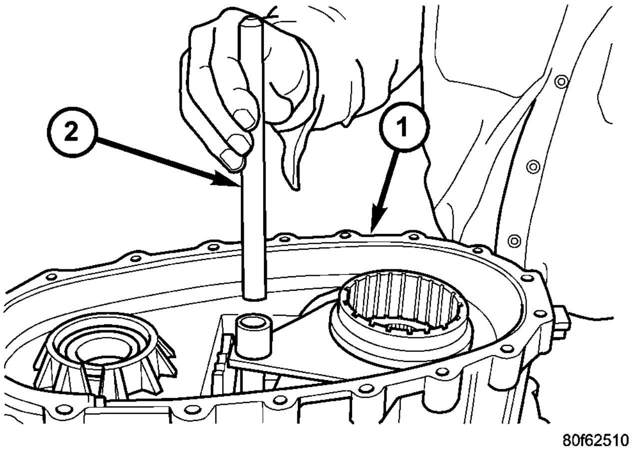


Fig. 68 Shift Fork Rail Installation

1 - FRONT CASE HALF
2 - SHIFT RAIL

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Install front output shaft into the font output shaft bearing (Fig. 69).

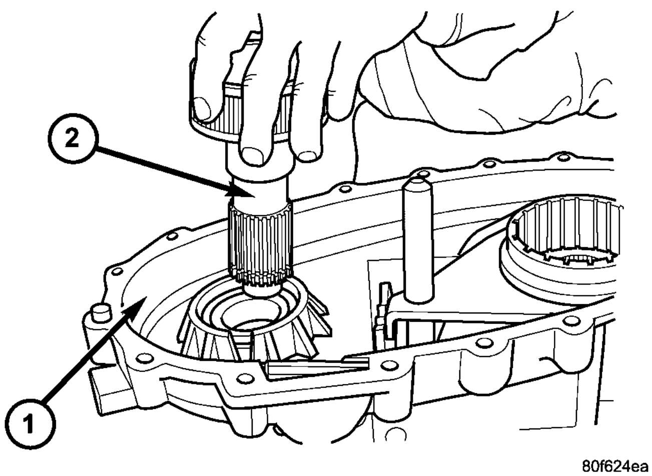


Fig. 69 Front Output Shaft Installation

1 - FRONT CASE HALF
2 - FRONT OUTPUT SHAFT

(2) Install the front output shaft snap-ring onto the front output shaft.

(3) Install new front output seal (Fig. 70) in front case with Installer 9041 and Handle C-4171.

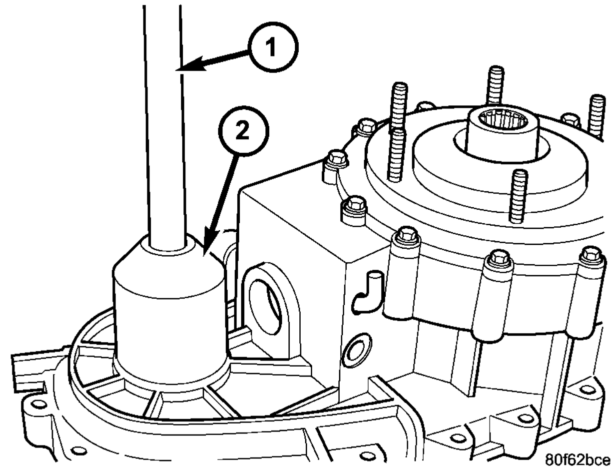


Fig. 70 Front Output Shaft Seal Installation

1 - HANDLE C-4171
2 - INSTALLER 9041

(4) Insert front sprocket in drive chain (Fig. 71).

(5) Install drive chain around mainshaft drive sprocket (Fig. 71). Then position front sprocket over front output shaft.

(6) Install the mainshaft into the range hub and mode sleeve and seat the front drive sprocket onto the front output shaft (Fig. 71).

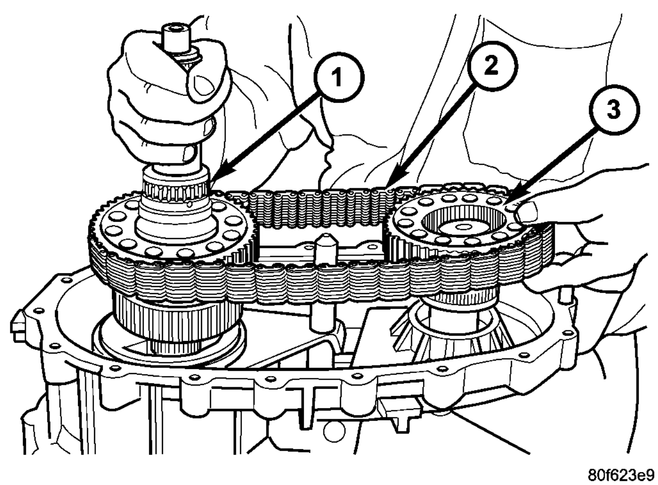


Fig. 71 Install Mainshaft, Drive Chain, and Front Sprocket

1 - MAINSHAFT
2 - DRIVE CHAIN
3 - DRIVE SPROCKET

TRANSFER CASE - NV241 (Continued)

(7) Install the front drive sprocket retaining ring (Fig. 72).

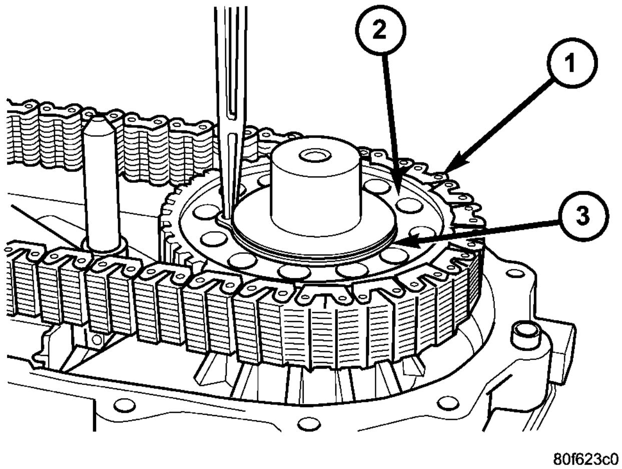


Fig. 72 Front Drive Sprocket Snap-Ring Installation

1 - DRIVE CHAIN
2 - FRONT DRIVE SPROCKET
3 - SNAP-RING

(8) Install spring and cups on shift rail (Fig. 73).

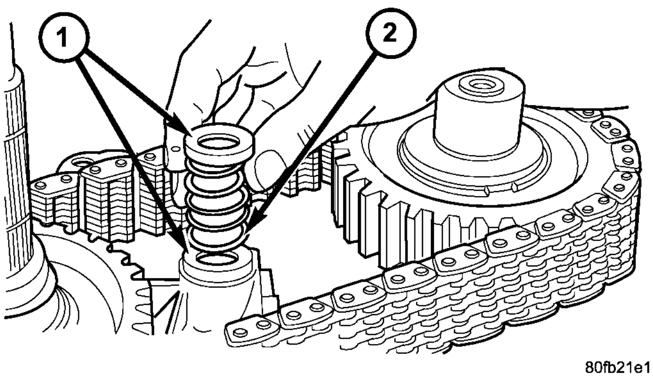


Fig. 73 Shift Rail Spring And Cups Installation

1 - CUPS (2)
2 - SPRING

(9) Insert magnet in front case pocket (Fig. 74).

OIL PUMP AND REAR CASE

CAUTION: Do not remove the bolts holding the oil pump cover to the rear case half. The oil pump cover is aligned to the rear output shaft inner bearing race and will become mis-aligned if the bolts are loosened. If the transfer case failure has generated any debris which may have become trapped in the oil pump. the rear case and oil pump assembly MUST be replaced.

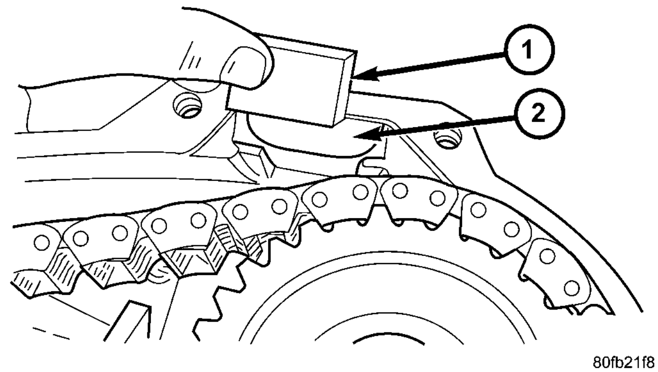


Fig. 74 Case Magnet Installation

1 - MAGNET
2 - CASE POCKET

Lubricate the oil pump components before installation. Prime the oil pickup tube by pouring a little oil into the tube before installation.

(1) Install new o-ring in pickup tube inlet of oil pump.

(2) Position oil pickup tube and filter in rear case. Be sure pickup filter is seated in case pocket and that pickup tube is aligned in case notches. Be sure hose that connects tube to filter is securely positioned.

(3) Install the transfer case position sensor (Fig. 75). Tighten the sensor to 20-34 N·m (16-25 ft.lbs.).

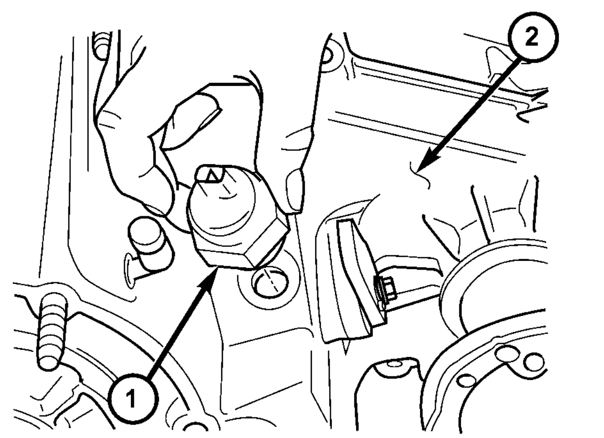


Fig. 75 Install Transfer Case Position Sensor

1 - TRANSFER CASE POSITION SENSOR
2 - TRANSFER CASE

TRANSFER CASE - NV241 (Continued)

(4) Install the shift sector support (Fig. 76). Tighten the sector support to 27-42 N·m (20-30 ft.lbs.).

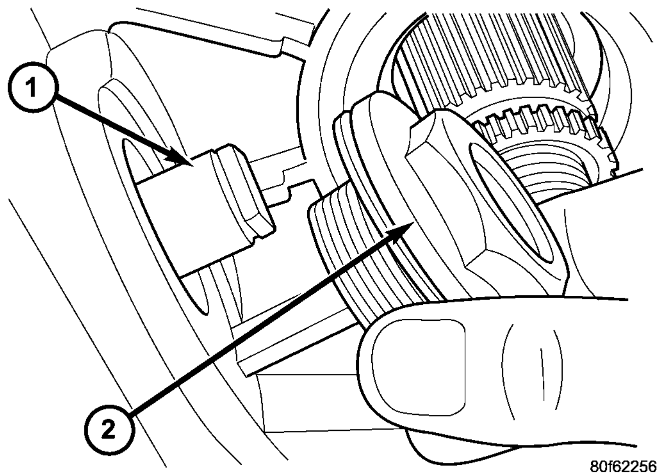


Fig. 76 Shift Sector Support Installation

1 - SHIFT SECTOR SHAFT
2 - SECTOR SUPPORT

(5) Install detent plunger and spring into the front case half. (Fig. 77).

(6) Install new o-ring on detent plug and install plug in front case (Fig. 77). Tighten plug to 16-25 N·m (12-18 ft. lbs.).

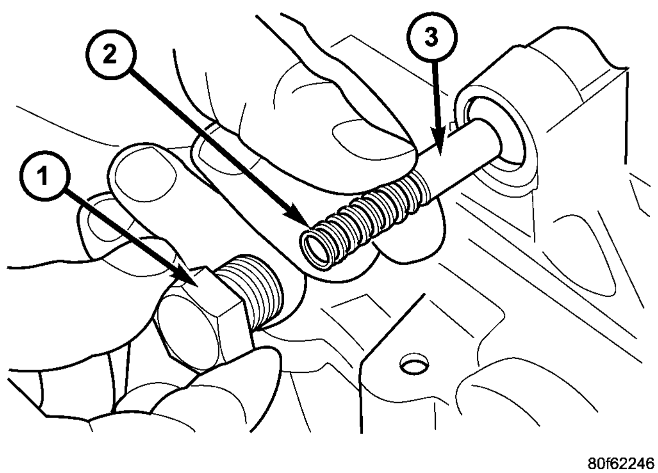


Fig. 77 Detent Plug, Spring, and Plunger Installation

1 - DETENT PLUG
2 - SPRING
3 - PLUNGER

(7) Install shift lever onto the sector shaft (Fig. 78).

(8) Install the shift lever bolt (Fig. 79). Tighten the bolt to 20-34 N·m (15-25 ft.lbs.)

(9) Shift the transfer case into a 4WD range. This will raise the mainshaft slightly and make installation of the rear case half much easier.

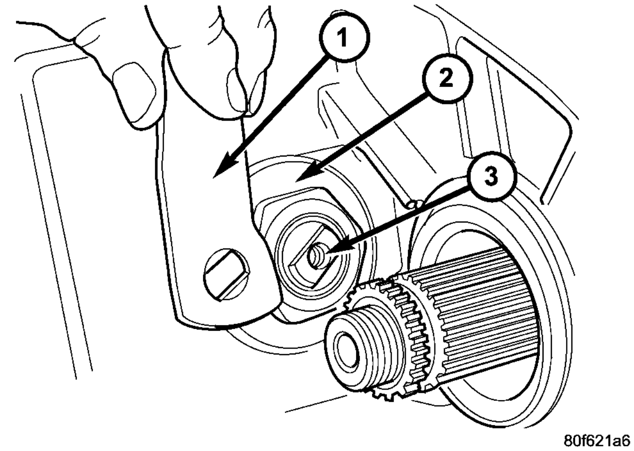


Fig. 78 Shift Lever Installation

1 - SHIFT LEVER
2 - SECTOR SUPPORT
3 - SHIFT SECTOR

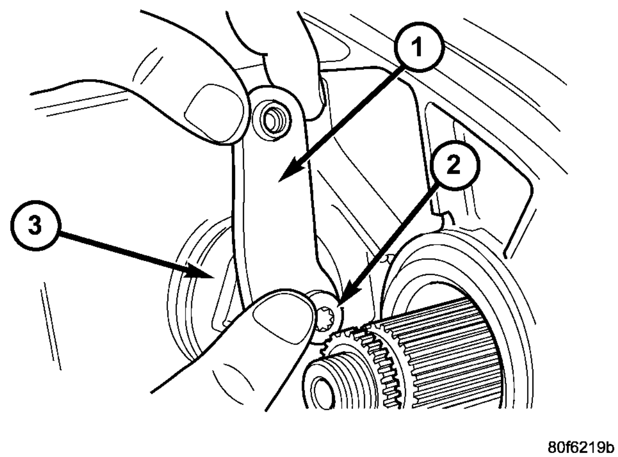


Fig. 79 Shift Lever Bolt Installation

1 - SHIFT LEVER
2 - BOLT
3 - SECTOR SUPPORT

(10) Verify that the transfer case alignment dowels are properly installed.

(11) Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of front case. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.

TRANSFER CASE - NV241 (Continued)

(12) Align oil pump with mainshaft and align shift rail with bore in rear case. Then install rear case and oil pump assembly (Fig. 80). Be sure oil pickup tube remains in position during case installation.

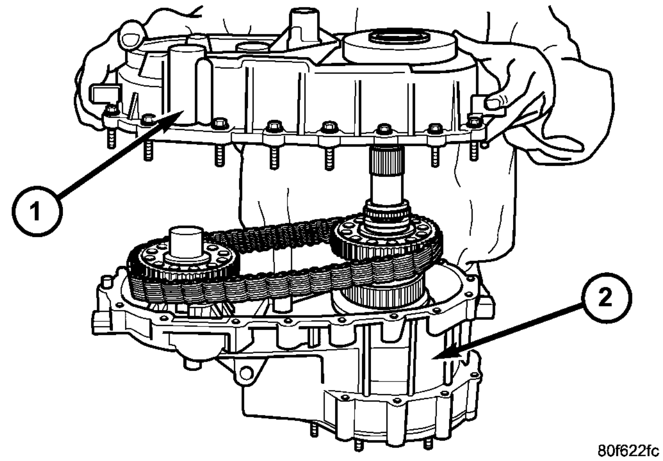


Fig. 80 Rear Case Half Installation

1 - REAR CASE HALF
2 - FRONT CASE HALF

(13) Install 4-5 rear case-to front case bolts to hold rear case in position. Tighten bolts snug but not to specified torque at this time.

CAUTION: Verify that shift rail, and case alignment dowels (Fig. 81) are seated before installing any bolts. Case could be cracked if shaft rail or dowels are misaligned.

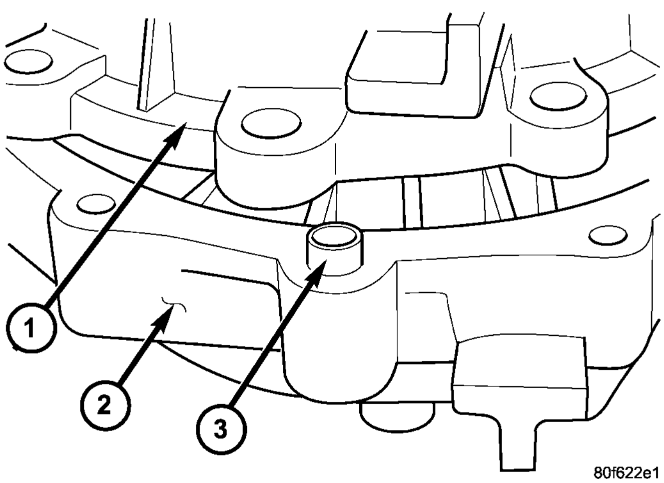


Fig. 81 Case Alignment Dowel

1 - REAR CASE HALF
2 - FRONT CASE HALF
3 - ALIGNMENT DOWEL

(14) Apply Loctite™ 242 to remainder of rear case-to-front case bolt threads and install bolts (Fig. 82). Tighten all bolts to 20-27 N·m (15-20 ft. lbs.).

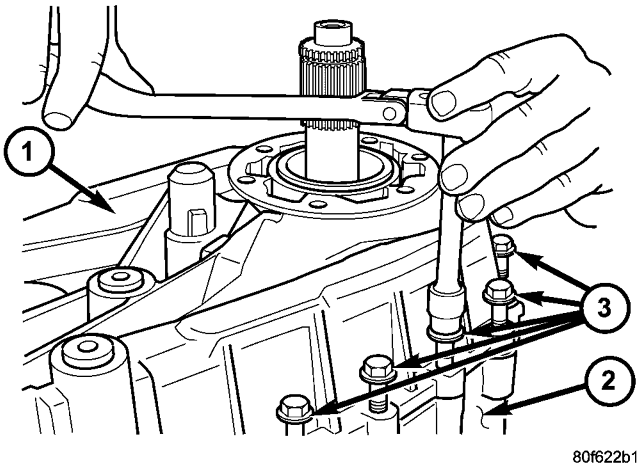


Fig. 82 Case Half Bolt Installation

1 - REAR CASE HALF
2 - FRONT CASE HALF
3 - BOLTS

YOKE

(1) Install yoke seal onto front shaft (Fig. 83).

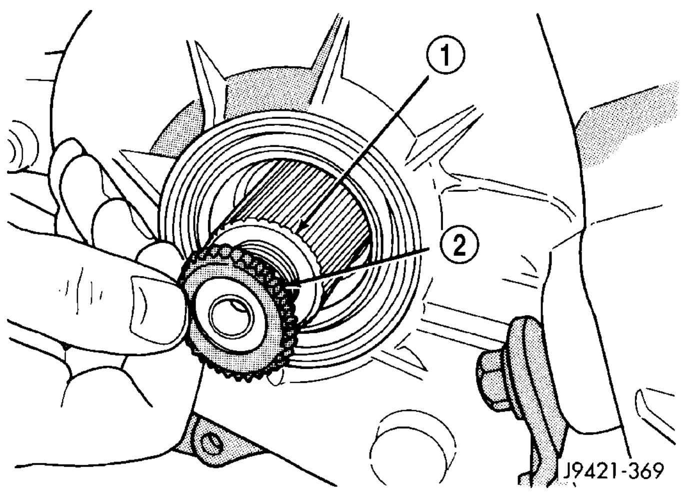


Fig. 83 Installing Flange Seal On Front Shaft

1 - FRONT OUTPUT SHAFT
2 - FLANGE SEAL

TRANSFER CASE - NV241 (Continued)

(2) Install yoke onto front shaft (Fig. 84). Then install and tighten a new yoke nut to 122-176 N·m (90-130 ft. lbs.) torque. Never re-use a yoke nut.

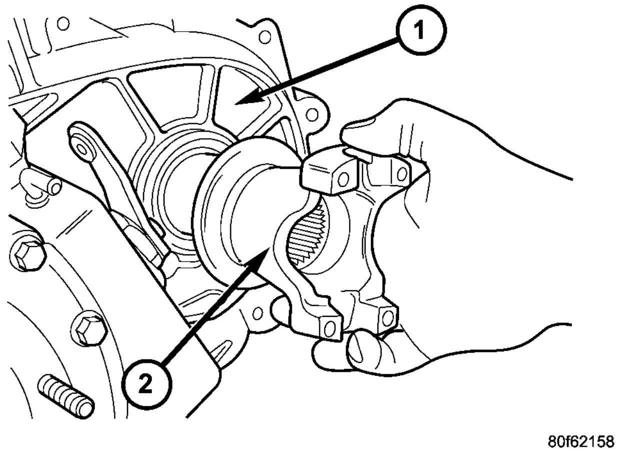


Fig. 84 Front Yoke Installation

1 - TRANSFER CASE
2 - FRONT YOKE

REAR EXTENSION

(1) Clean mating surfaces of transfer case housing and the rear retainer of any original gasket material.

(2) Apply bead of Mopar® Gasket Maker, or equivalent, to mating surface of rear case. Keep sealer bead width to maximum of 3/16 inch. Do not use excessive amount of sealer as excess will be displaced into case interior.

(3) Install the tone wheel dowel pin (Fig. 85) into the output shaft.

(4) Install the speedometer sensor tone wheel (Fig. 86) onto the output shaft with the notch in the tone wheel inner diameter toward the front of the transfer case. Make sure the notch fits over the dowel pin in the output shaft and the tone wheel is against the rear output shaft bearing inner race.

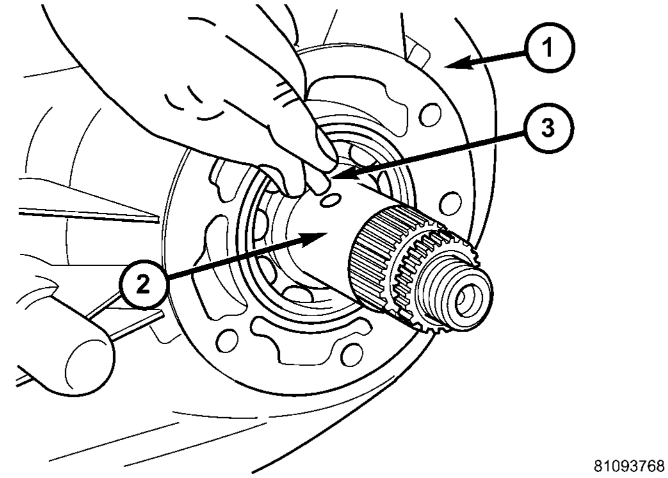


Fig. 85 Output Shaft Dowel Pin

1 - TRANSFER CASE
2 - OUPUT SHAFT
3 - DOWEL PIN

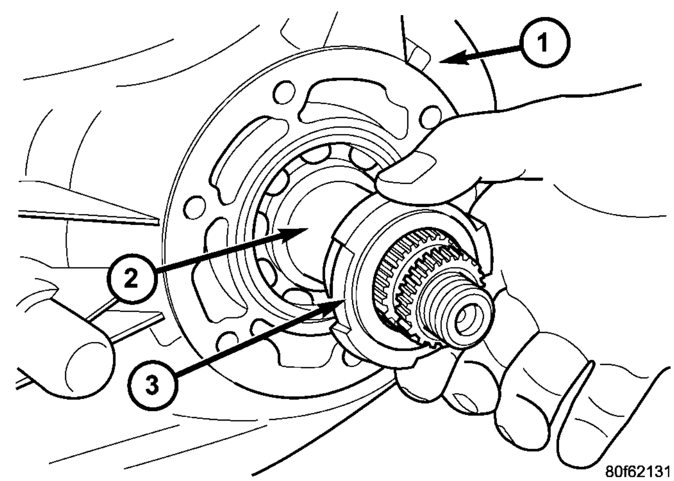


Fig. 86 Speedometer Sensor Tone Wheel Installation

1 - TRANSFER CASE
2 - OUPUT SHAFT
3 - SENSOR TONE WHEEL

TRANSFER CASE - NV241 (Continued)

(5) Align and install rear extension on rear case (Fig. 87).

(6) Apply Mopar® Silicone Sealer to threads of rear extension bolts. Then install extension bolts (Fig. 88). Tighten the extension bolts to 16-25 N·m (12-18 ft.lbs.).

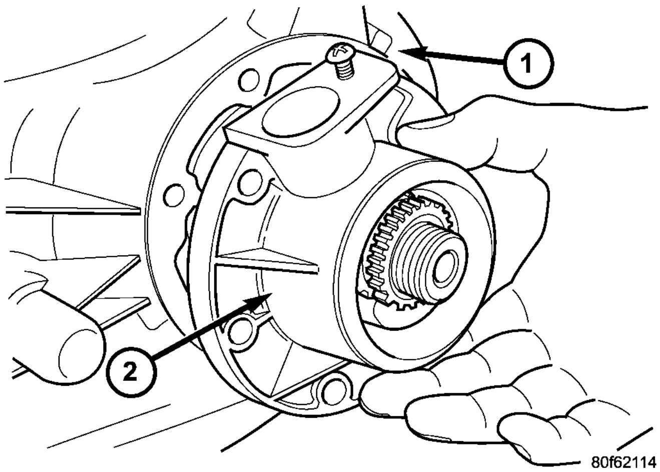


Fig. 87 Rear Extension Installation

1 - TRANSFER CASE
2 - EXTENSION HOUSING

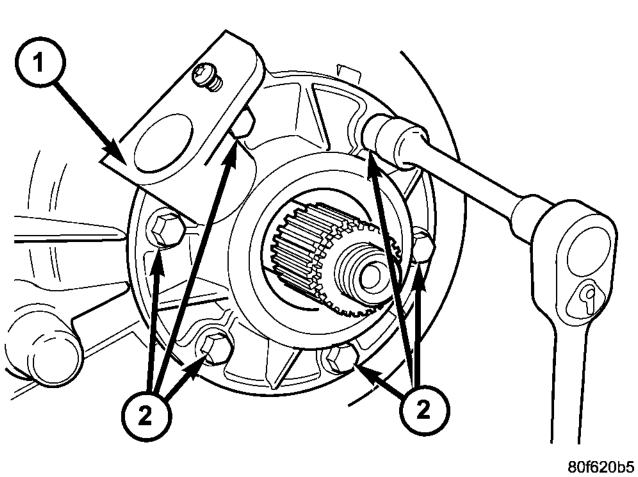


Fig. 88 Rear Extension Bolt Installation

1 - EXTENSION HOUSING
2 - BOLTS

(7) Install new seal in rear extension housing with Installer 9041 and Handle C-4171.

(8) Install the speedometer sensor (Fig. 89) into the extension housing.

(9) Install the speedometer sensor bolt (Fig. 90). Tighten the bolt to 11-16 N·m (8-12 ft.lbs.).

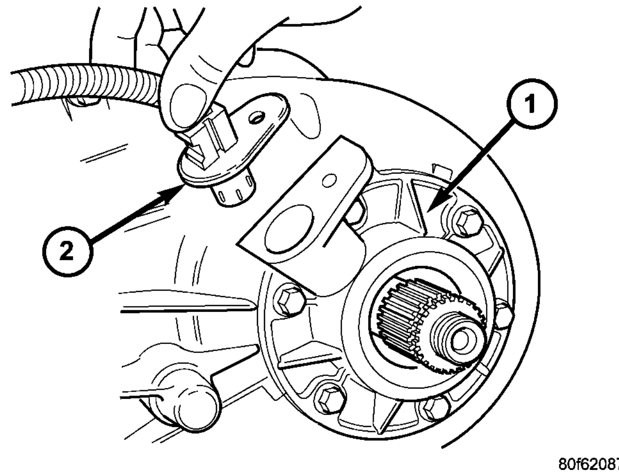


Fig. 89 Speedometer Sensor Installation

1 - EXTENSION HOUSING
2 - SPEEDOMETER SENSOR

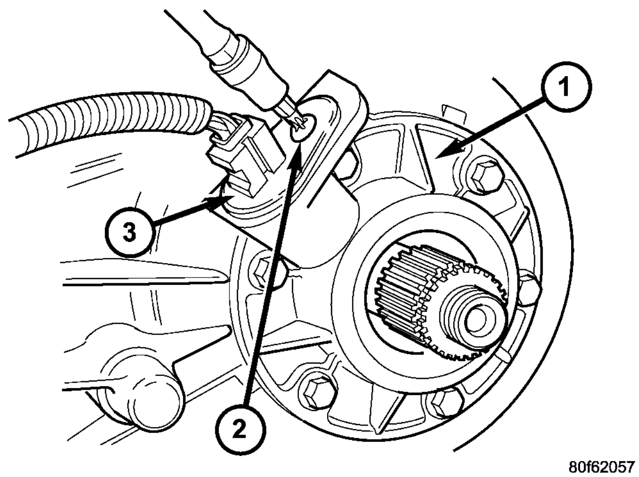


Fig. 90 Speedometer Sensor Bolt Installation

1 - EXTENSION HOUSING
2 - BOLT
3 - SPEEDOMETER SENSOR

TRANSFER CASE - NV241 (Continued)

(10) Install the rear companion flange onto the output shaft.

(11) Install bolts into two threaded holes in the rear propeller shaft companion flange 180° apart (Fig. 91).

(12) Place the Holder 6719 (Fig. 91) over the two bolts and use the Holder to install a new rear companion flange nut. Never re-use the companion flange nut once it has been installed. Tighten the companion flange nut to 122-176 N·m (90-130 ft.lbs.).

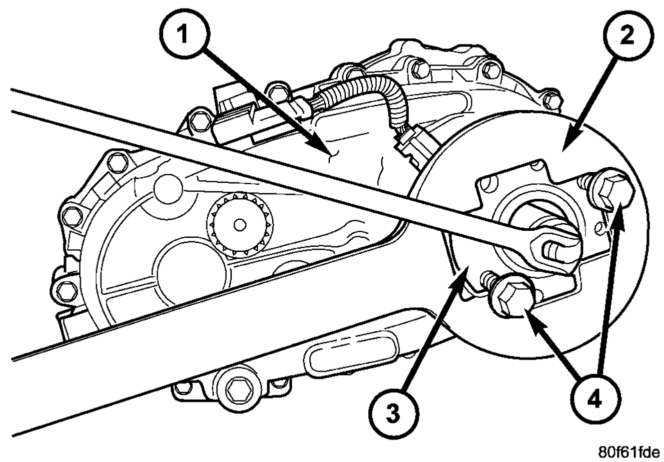


Fig. 91 Rear Companion Flange Nut Removal

1 - TRANSFER CASE
2 - HOLDER 6719
3 - COMPANION FLANGE
4 - BOLTS

INSTALLATION

(1) Align and seat transfer case on transmission. Be sure transfer case input gear splines are aligned with transmission output shaft. Align splines by rotating transfer case rear output shaft yoke if necessary. Do not install any transfer case attaching nuts until the transfer case is completely seated against the transmission.

(2) Install and tighten transfer case attaching nuts. Tighten nuts to 30-41 N·m (20-30 ft.lbs.).

(3) Install rear crossmember.

(4) Remove jack stand from under transmission.

(5) Align and connect propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(6) Connect vacuum harness and vent hose.

(7) Connect shift rod to transfer case lever or floor shift arm. Use channel lock style pliers to press rod back into lever grommet.

(8) Adjust shift linkage, if necessary.

(9) Fill transfer case with recommended transmission fluid and install fill plug.

(10) Install skid plate, if equipped. (Refer to 13 - FRAMES & BUMPERS/FRAME/TRANSFER CASE SKID PLATE - INSTALLATION)

(11) Lower vehicle

SPECIFICATIONS

TRANSFER CASE - NV241

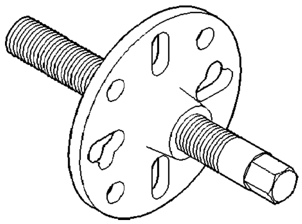
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Plug, Detent	16-25	12-18	-
Plug, Drain/Fill	20-34	15-25	-
Bolt, Rear Extension	16-24	12-18	-
Bolt, Front Input Retainer	21	16	-
Bolt, Case Half	20-27	15-20	-
Nut, Front Yoke	122-176	90-130	-
Nut, Rear Companion Flange	258-312	190-230	-
Bolt, Shift Lever	20-34	15-25	-
Nuts, Mounting	30-41	20-30	-
Bolts, U-Joint	19	17	-
Support, Sector	27-42	20-30	-
Sensor, Transfer Case Position	20-34	16-25	-
Bolt, Speed Sensor	11-16	8-12	-

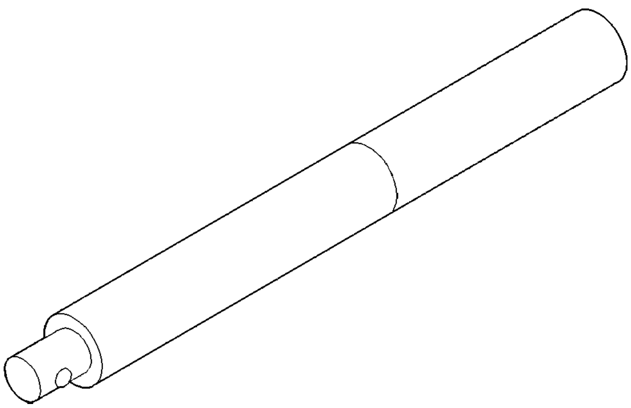
TRANSFER CASE - NV241 (Continued)

SPECIAL TOOLS

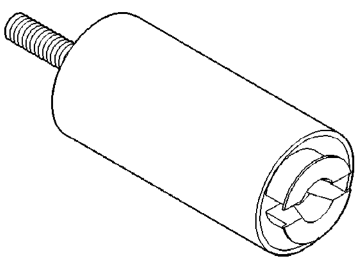
TRANSFER CASE - NV241



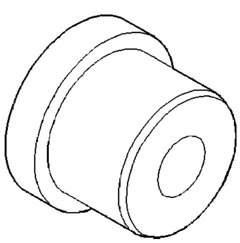
Puller - C-452



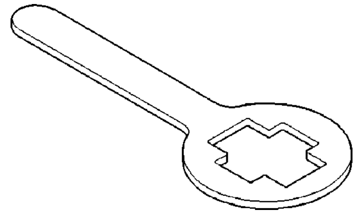
Handle, Universal - C-4171



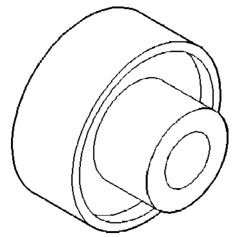
Remover - L-4454



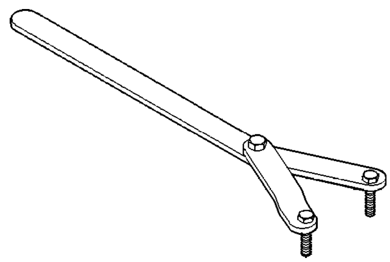
Installer, Bushing - 5066



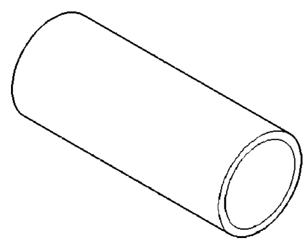
Holder, Yoke - 6719A



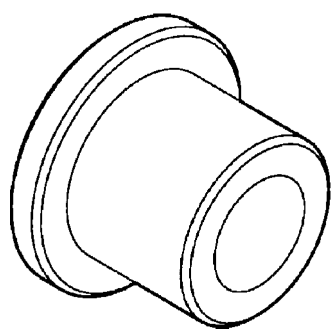
Installer, Bearing - 6953



Spanner Wrench - 6958

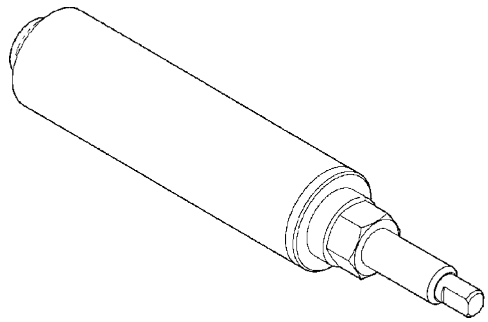


Cup - 8148

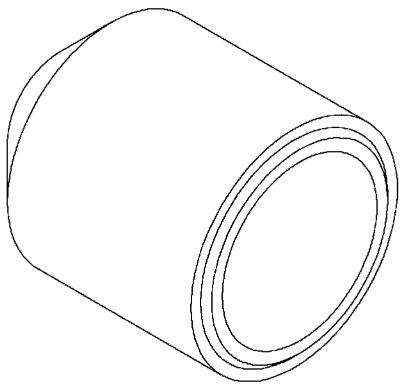


Installer, Bearing - 8239

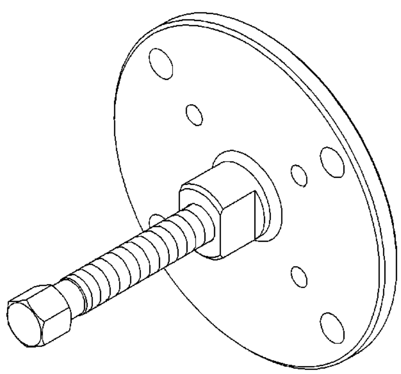
TRANSFER CASE - NV241 (Continued)



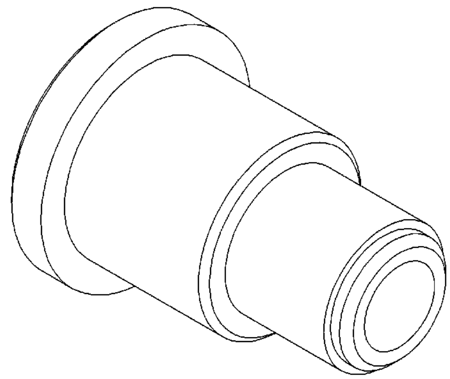
Remover - 8240



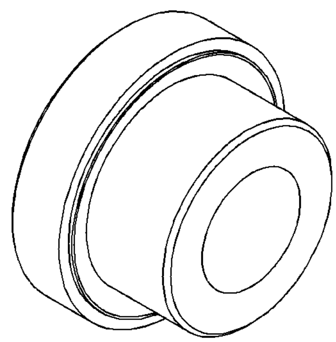
Installer, Seal - 8841



Flange Puller - 8992



Installer, Cup Seal - 9045



Installer, Bearing - 9047

REAR EXTENSION SEAL

REMOVAL

(1) Raise and support vehicle.

(2) Remove rear propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(3) Remove the rear companion flange from the output shaft.

(4) Using a suitable pry tool or slide-hammer mounted screw, remove the rear extension seal.

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.

(2) Using Installer 9041 and Handle C-4171, install seal in rear extension (Fig. 92).

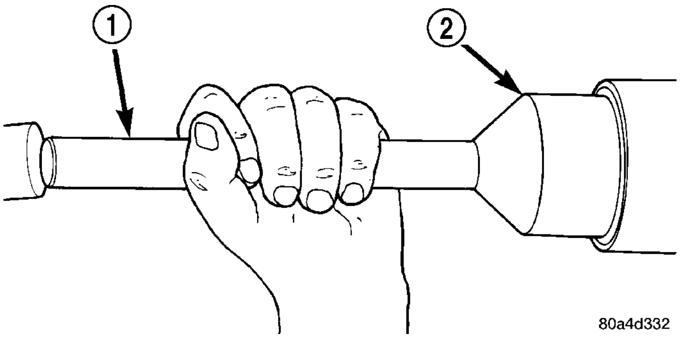


Fig. 92 Install Rear Extension Seal

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 9041

(3) Install the companion flange onto the output shaft.

(4) Install a new companion flange nut and tighten to 176-271 N·m (130-200 ft.lbs.).

(5) Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

(6) Verify proper transfer case fluid level.

(7) Lower vehicle.

FLUID

STANDARD PROCEDURE - FLUID DRAIN AND FILL

The fill and drain plugs are both in the rear case (Fig. 93). Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

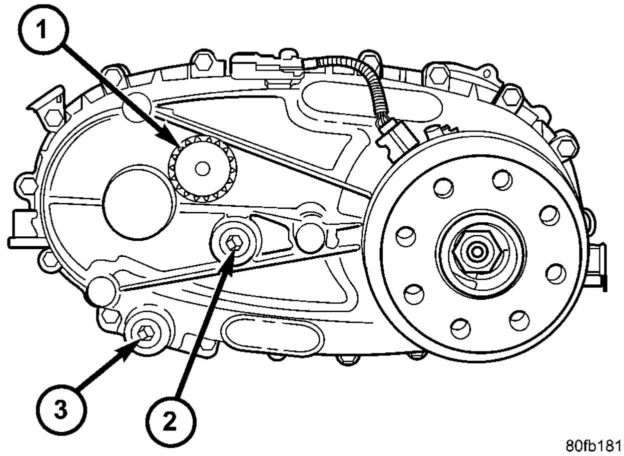


Fig. 93 Transfer Case Identification Tag and Fill/Drain Plugs

1 - IDENTIFICATION TAG
2 - FILL PLUG
3 - DRAIN PLUG

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Shift transfer case into NEUTRAL.

(2) Raise vehicle.

(3) Remove front propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)

(4) Using Spanner Wrench 6958, remove yoke nut (Fig. 94). Discard nut after removal. It is not reusable.

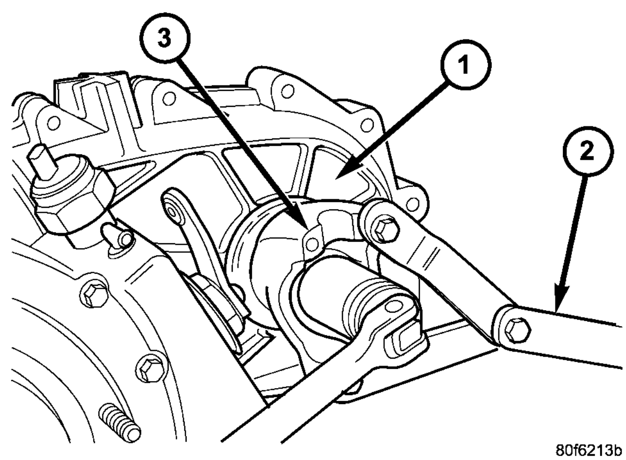


Fig. 94 Front Yoke Nut Removal

1 - TRANSFER CASE
2 - HOLDER 6958
3 - FRONT YOKE

FRONT OUTPUT SHAFT SEAL (Continued)

(5) Remove yoke from output shaft (Fig. 95). Use puller C-452 if flange can not be removed by hand.

(6) Remove yoke rubber seal from front output shaft (Fig. 96).

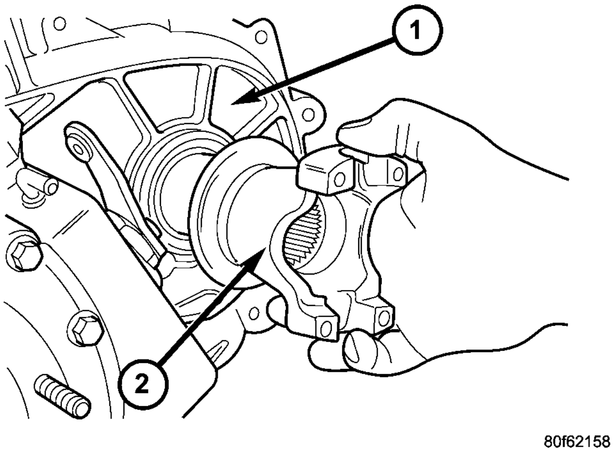


Fig. 95 Front Yoke Removal

1 - TRANSFER CASE
2 - FRONT YOKE

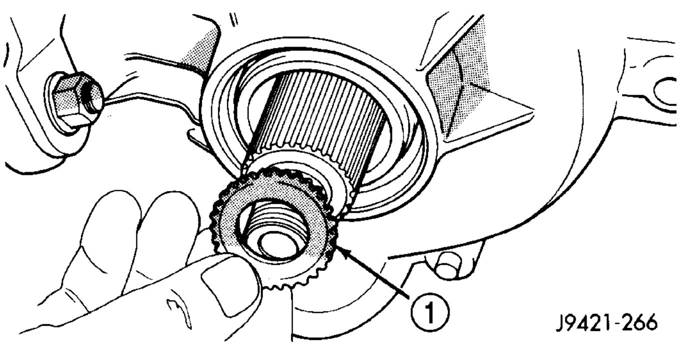


Fig. 96 Yoke Seal Removal

1 - FLANGE SEAL

(7) Remove front output shaft seal with suitable pry tool, or a slide hammer mounted screw.

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 9041 and Handle C-4171 (Fig. 97).

(2) Install yoke seal on front output shaft (Fig. 98).

(3) Install yoke on front output shaft (Fig. 99). Install a new yoke nut onto the front output shaft.

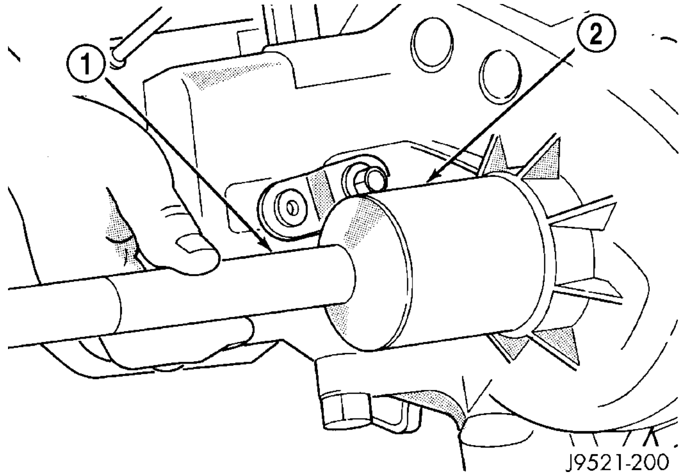


Fig. 97 Front Output Seal Installation - Typical

1 - SPECIAL TOOL C-4171
2 - SPECIAL TOOL 9041

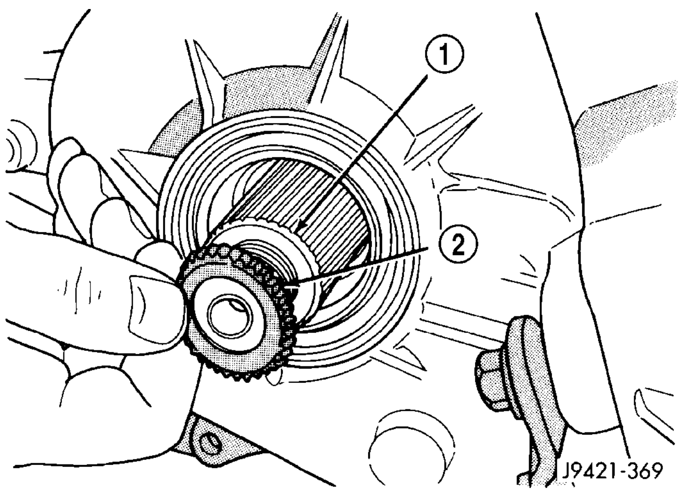


Fig. 98 Installing Flange Seal On Front Shaft

1 - FRONT OUTPUT SHAFT
2 - FLANGE SEAL

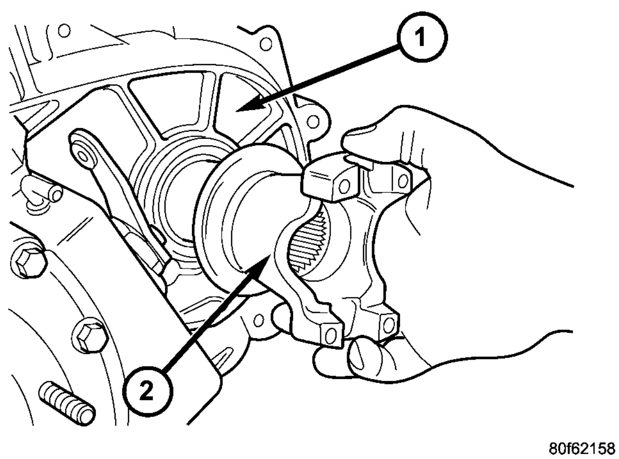


Fig. 99 Front Yoke Installation

1 - TRANSFER CASE
2 - FRONT YOKE

FRONT OUTPUT SHAFT SEAL (Continued)

(4) Using Spanner Wrench 6958 (Fig. 100), tighten the yoke nut to 176-271 N·m (130-200 ft. lbs.) torque.

(5) Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)

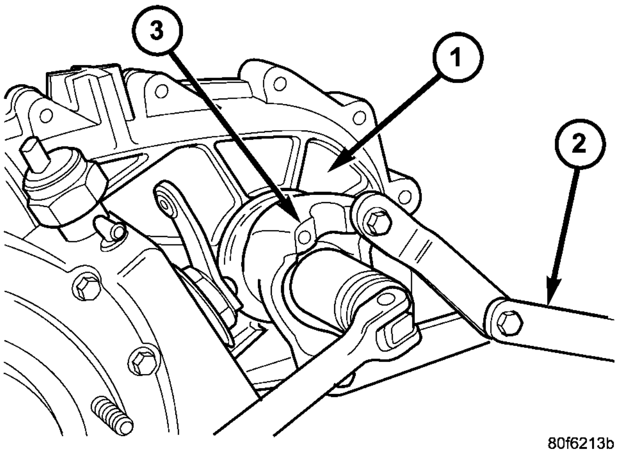


Fig. 100 Front Yoke Nut Installation

1 - TRANSFER CASE
2 - HOLDER 6958
3 - FRONT YOKE

POSITION SENSOR

DESCRIPTION

The transfer case position sensor is an electronic device whose output can be interpreted to indicate the transfer case's current operating mode. The sensor consists of a five position, resistive multiplexed circuit which returns a specific resistance value to the Powertrain Control Module (PCM) for each transfer case operating mode. The sensor is located on the top of the transfer case, just left of the transfer case centerline and rides against the sector plate roostercomb. The PCM supplies 5VDC (+/- 0.5V) to the sensor and monitors the return voltage to determine the sector plate, and therefore the transfer case, position.

OPERATION

During normal vehicle operation, the Powertrain Control Module (PCM) monitors the transfer case position sensor return voltage to determine the operating mode of the transfer case. Refer to the Operating Mode Versus Resistance table for the correct resistance for each position (Fig. 101).

OPERATING MODE VERSUS RESISTANCE

SENSOR POSITION	OPERATING MODE	SENSOR RESISTANCE (ohms)
1	2H	1124-1243
2	4H	650-719
3	NEUTRAL	389-431
4	4L	199-221
5	NOT USED	57-64

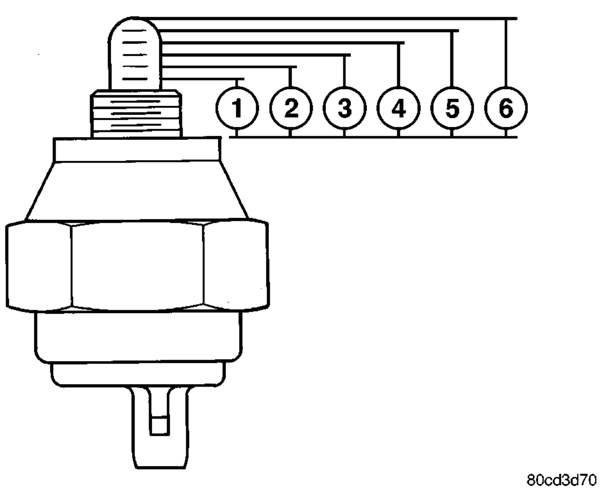


Fig. 101 Position Sensor Linear Movement

1 - POSITION 1 - 10mm ±0.5mm
2 - POSITION 2 - 12mm ±0.5mm
3 - POSITION 3 - 14mm ±0.5mm
4 - POSITION 4 - 16mm ±0.5mm
5 - POSITION 5 - 18mm ±0.5mm
6 - POSITION 6 - 20mm±0.5mm - FULL EXTENSION

REMOVAL

(1) Raise and support the vehicle.

(2) Disengage the transfer case position sensor connector from the position sensor.

(3) Remove the position sensor from the transfer case.

INSTALLATION

(1) Inspect the o-ring seal on the transfer case position sensor. Replace the o-ring if necessary.

(2) Install the transfer case position sensor into the transfer case. Torque the sensor to 20-34 N·m (15-25 ft.lbs.).

(3) Engage the transfer case position sensor connector to the position sensor.

(4) Lower vehicle.

(5) Verify proper sensor operation.

SHIFT LEVER

REMOVAL

(1) Shift transfer case into 4L.

(2) Raise vehicle.

(3) Loosen adjusting trunnion locknut and slide shift rod out of trunnion (Fig. 102). If rod lacks enough travel to come out of trunnion, push trunnion out of torque shaft.

(4) Lower vehicle.

(5) Remove console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - REMOVAL)

(6) Remove screws attaching lever assembly to floorpan and remove assembly and shift rod (if left attached).

INSTALLATION

(1) If shift rod was not removed from lever assembly, work rod down through floorpan opening. Then position lever assembly on floorpan and install assembly attaching screws.

(2) Install console. (Refer to 23 - BODY/INTERIOR/FLOOR CONSOLE - INSTALLATION)

(3) Raise vehicle.

(4) Connect trunnion to torque shaft arm. Or, slide shift rod into trunnion on range lever. Be sure shift rod slides freely in trunnion.

(5) Verify that range lever is in 4L position. Then tighten trunnion lock bolt.

(6) Lower vehicle and check transfer case shift operation.

ADJUSTMENTS - SHIFT LINKAGE

(1) Shift transfer case into 4L position.

(2) Raise vehicle.

(3) Loosen lock bolt on adjusting trunnion (Fig. 103).

(4) Be sure linkage rod slides freely in trunnion. Clean rod and apply spray lube if necessary.

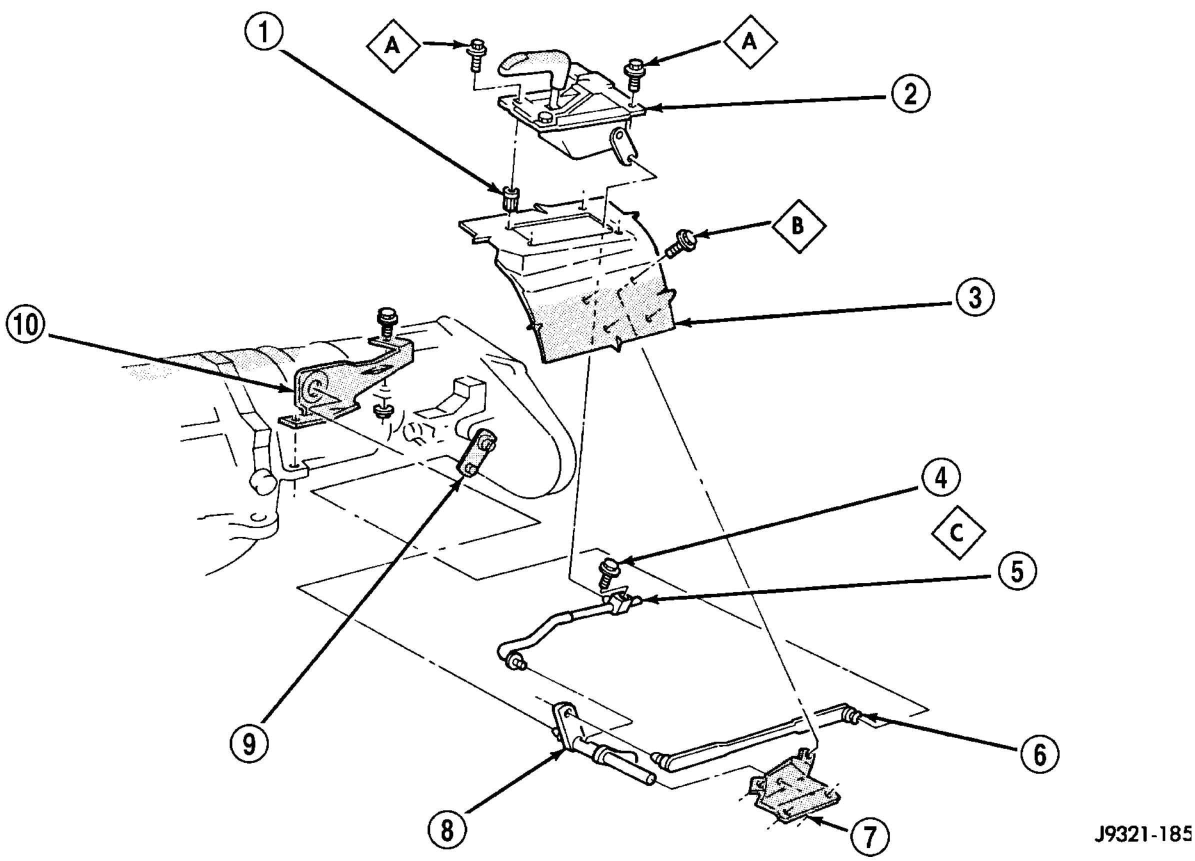


Fig. 102 Shift Linkage

1 - Rivnut (4)
2 - Shift Lever Assembly
3 - Floorpan
4 - Trunnion Lock Bolt
5 - Selector Rod and Trunnion
6 - Shift Lever Rod
7 - Torque Shaft Frame Bracket
8 - Torque Shaft
9 - Transfer Case Shift Lever
10 - Torque Shaft Transfer Case Bracket
A - 3-4 N·m (27-35 in. lbs.)
B - 11-14 N·m (97-123 in. lbs.)
C - 8-14 N·m (72-120 in. lbs.)

SHIFT LEVER (Continued)

(5) Verify that transfer case range lever is fully engaged in 4L position.

(6) Tighten adjusting trunnion lock bolt.

(7) Lower vehicle.

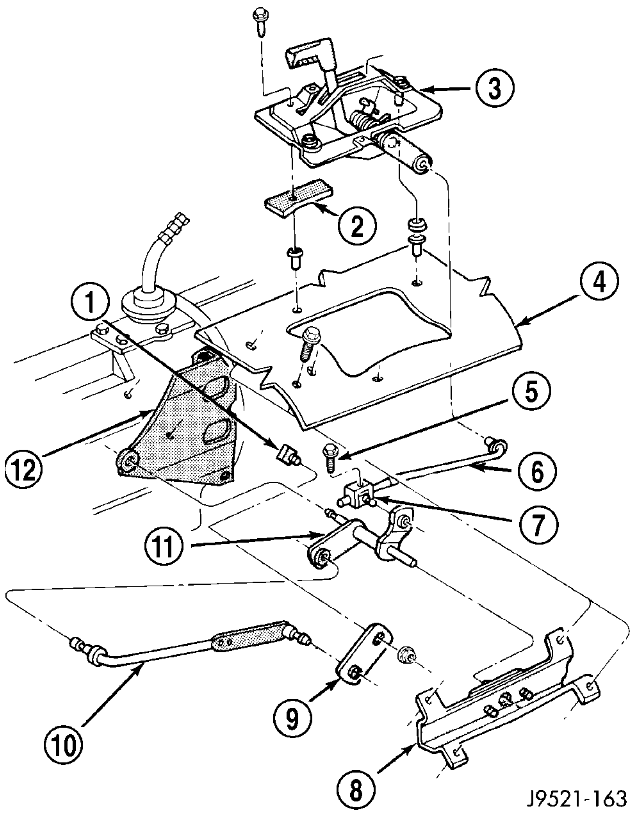


Fig. 103 Shift Linkage

1 - TRANSFER CASE SHIFT LEVER SHAFT
2 - SEAL
3 - TRANSFER CASE SHIFT LEVER ASSEMBLY
4 - FLOORPAN
5 - TRUNNION LOCK BOLT
6 - SHIFT ROD
7 - ADJUSTING TRUNNION
8 - TORQUE SHAFT BRACKET
9 - RANGE LEVER
10 - TORQUE SHAFT ROD
11 - TORQUE SHAFT
12 - LINKAGE BRACKET

VEHICLE SPEED SENSOR

DESCRIPTION

The 3-wire Vehicle Speed Sensor (VSS) (Fig. 104) is located in the transfer case rear extension.

OPERATION

The VSS is a 3-circuit (3–wire), magnetic, hall-effect sensor.

The 3 circuits are:

• A 5-volt power supply from the Powertrain Control Module (PCM).

• A ground is provided for the sensor though a low-noise sensor return circuit in the PCM.

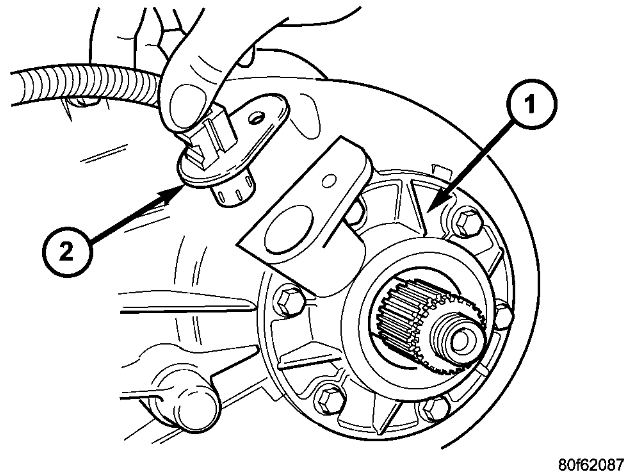


Fig. 104 Speedometer Sensor

1 - EXTENSION HOUSING
2 - SPEEDOMETER SENSOR

• An input to the PCM is used to determine vehicle speed and distance traveled.

The speed sensor generates 8 pulses per sensor revolution. These signals, in conjunction with a closed throttle signal from the throttle position sensor, indicate a closed throttle deceleration to the PCM. When the vehicle is stopped at idle, a closed throttle signal is received by the PCM (but a speed sensor signal is not received).

Under deceleration conditions, the PCM adjusts the Idle Air Control (IAC) motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the IAC motor to maintain a desired engine speed.

REMOVAL

The Vehicle Speed Sensor (VSS) is located in the transfer case rear extension.

(1) Raise and support vehicle.

(2) Disconnect electrical connector from sensor by pushing slide tab. After slide tab has been positioned, push in on secondary release lock on side of connector and pull connector from sensor.

(3) Remove sensor mounting bolt.

(4) Remove sensor (pull straight out) from rear extension.

INSTALLATION

(1) Install sensor into transfer case rear extension and install mounting bolt. Before tightening bolt, verify speed sensor is fully seated (mounted flush) to rear extension.

(2) Tighten sensor mounting bolt to 11-16 N·m (8-12 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

TIRES/WHEELS

TABLE OF CONTENTS

TIRES/WHEELS

DIAGNOSIS AND TESTING - TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 1).

Lateral runout is the **wobble** of the tire or wheel.

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

(1) Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

(2) Check wheel bearings and adjust if adjustable or replace if necessary.

(3) Check the wheel mounting surface.

(4) Relocate wheel on the mounting, two studs over from the original position.

(5) Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.

(6) Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

METHOD 2 (RELOCATE TIRE ON WHEEL)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

TIRES/WHEELS (Continued)

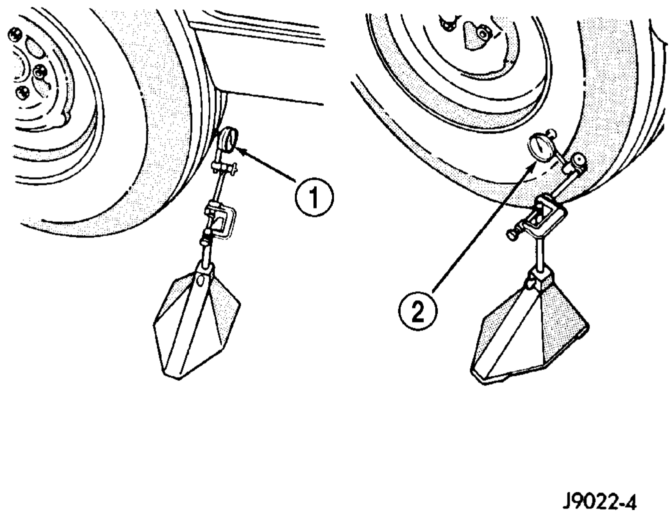


Fig. 1 Checking Tire/Wheel/Hub Runout

1 - RADIAL RUNOUT
2 - LATERAL RUNOUT

(1) Remove tire from wheel and mount wheel on service dynamic balance machine.

(2) Check wheel radial runout (Fig. 2) and lateral runout (Fig. 3).

- STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in. (average-maximum)
- ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in. (average-maximum)

(3) If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout or match mount, (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE).

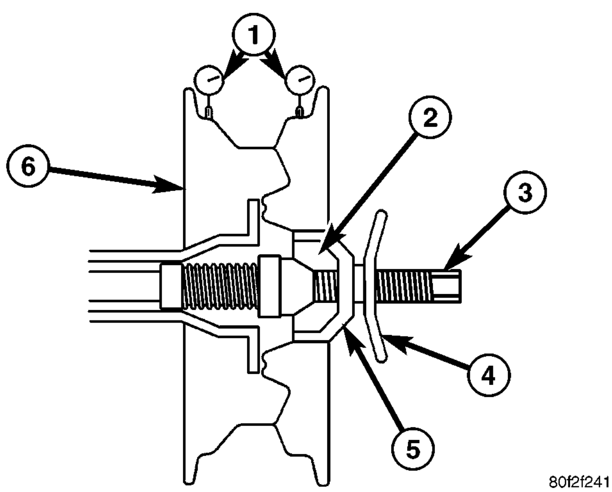


Fig. 2 RADIAL RUNOUT

1 - DIAL INDICATORS
2 - MOUNTING CONE
3 - SPINDLE SHAFT
4 - WING NUT
5 - PLASTIC CUP
6 - WHEEL

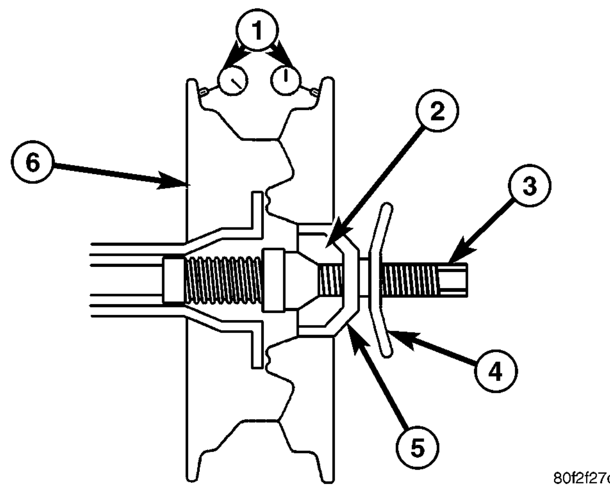


Fig. 3 LATERAL RUNOUT

1 - DIAL INDICATORS
2 - MOUNTING CONE
3 - SPINDLE SHAFT
4 - WING NUT
5 - PLASTIC CUP
6 - WHEEL

STANDARD PROCEDURE

STANDARD PROCEDURE - ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is (Fig. 4). Other rotation methods can be used, but they will not provide all the tire longevity benefits.

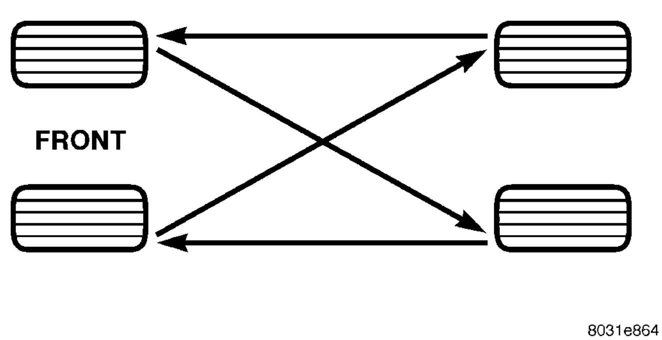


Fig. 4 Tire Rotation Pattern

TIRES/WHEELS (Continued)

STANDARD PROCEDURE - MATCH MOUNTING

Tires and wheels are currently match mounted at the factory. Match mounting is a technique used to reduce runout in the wheel/tire assembly. This means that the high spot of the tire is aligned with the low spot on the wheel rim. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Use a dial indicator to locate the high spot of the tire on the center tread rib (Fig. 5). Record the indicator reading and mark the high spot on the tire. Place a mark on the tire at the valve stem location (Fig. 6).

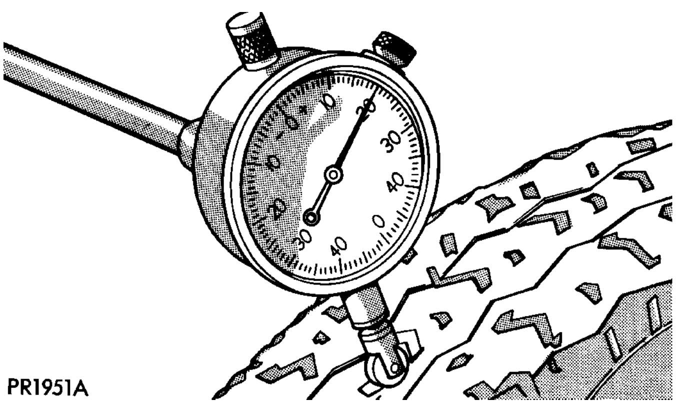


Fig. 5 Dial Indicator

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 7).

(3) Measure the total runout again and mark the tire to indicate the high spot.

(4) If runout is still excessive use the following procedures.

(a) If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.

(b) If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. (Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING).

(c) If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 8). This procedure will normally reduce the runout to an acceptable amount.

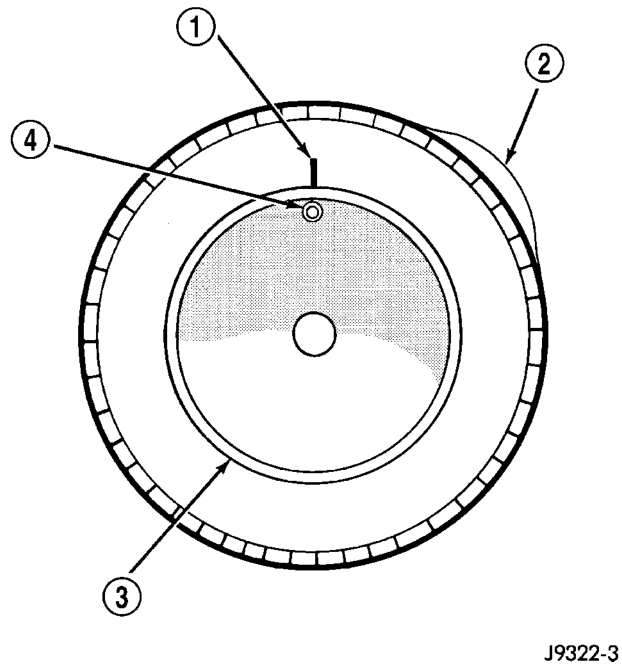


Fig. 6 First Measurement On Tire

1 - REFERENCE MARK
2 - 1ST MEASUREMENT
HIGH SPOT MARK TIRE AND RIM
3 - WHEEL
4 - VALVE STEM

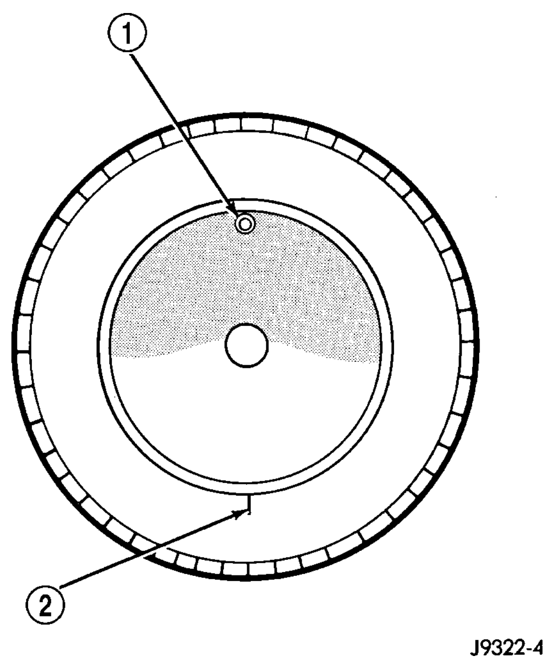


Fig. 7 Remount Tire 180 Degrees

1 - VALVE STEM
2 - REFERENCE MARK

TIRES/WHEELS (Continued)

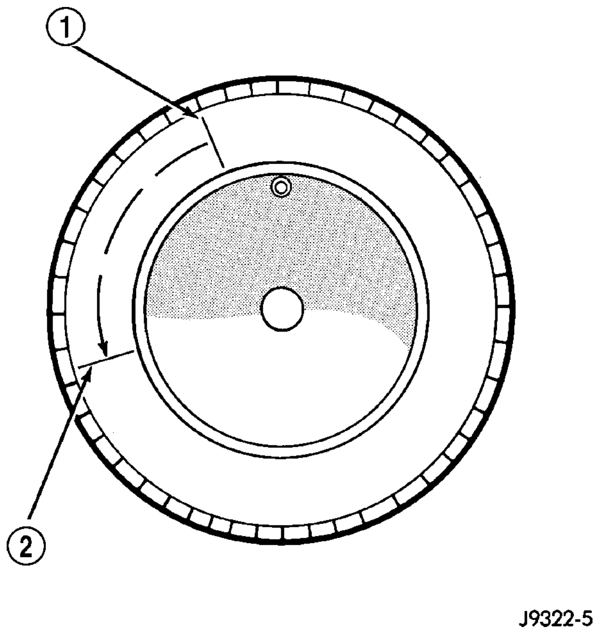


Fig. 8 Remount Tire 90 Degrees In Direction of Arrow

1 - 2ND HIGH SPOT ON TIRE
2 - 1ST HIGH SPOT ON TIRE

STANDARD PROCEDURE - TIRE AND WHEEL BALANCE

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

NOTE: Static should be used only when a two plane balancer is not available.

NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

For static balancing, find location of heavy spot causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 9).

For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (Fig. 10).

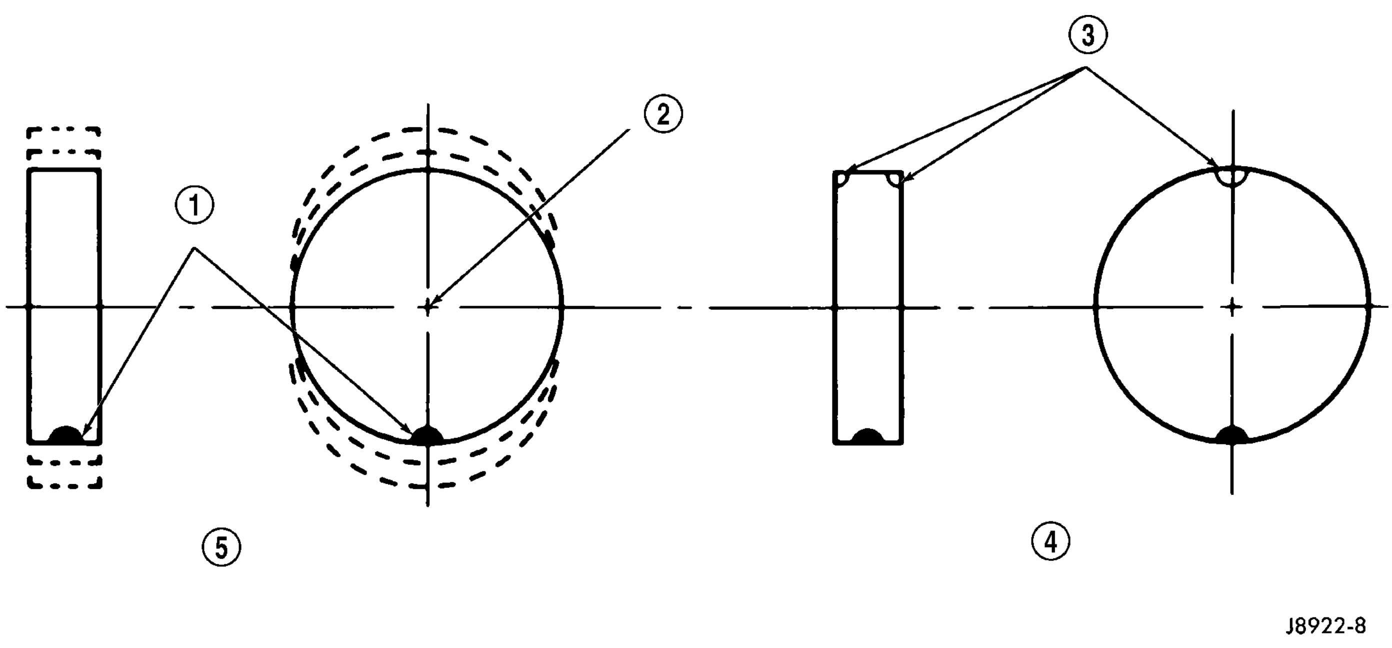


Fig. 9 Static Unbalance & Balance

1 - HEAVY SPOT
2 - CENTER LINE OF SPINDLE
3 - ADD BALANCE WEIGHTS HERE
4 - CORRECTIVE WEIGHT LOCATION
5 - TIRE OR WHEEL TRAMP, OR WHEEL HOP

TIRES/WHEELS (Continued)

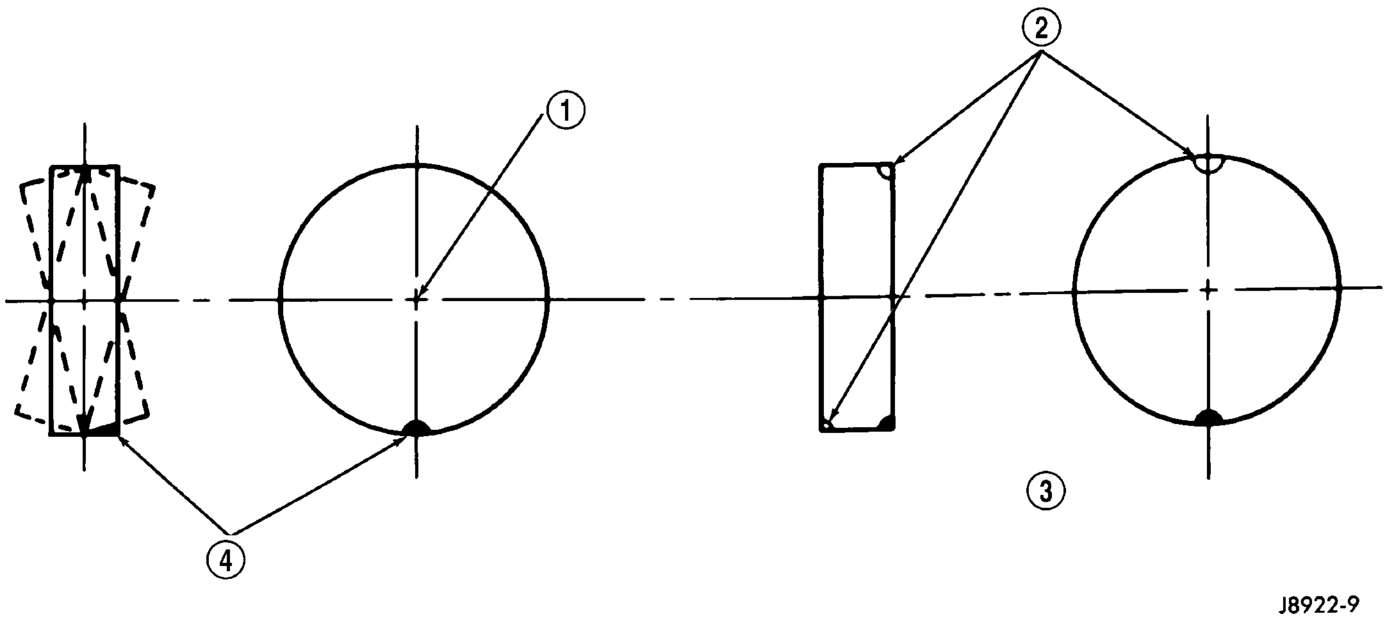


Fig. 10 Dynamic Unbalance & Balance

1 - CENTER LINE OF SPINDLE
2 - ADD BALANCE WEIGHTS HERE
3 - CORRECTIVE WEIGHT LOCATION
4 - HEAVY SPOT WHEEL SHIMMY AND VIBRATION

TIRES

DESCRIPTION

DESCRIPTION - TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE). This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 11).

Performance tires have a speed rating letter after the aspect ratio number.

LETTER	SPEED RATING
P	150 km/h (93 mph)
S	180 km/h (112 mph)
T	190 km/h (118 mph)
U	200 km/h (124 mph)
H	210 km/h (130 mph)
V	240 km/h (149 mph)
W	270 km/h (168 mph)
Y	300 km/h (186 mph)

The speed rating is not always printed on the tire sidewall.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

TIRES (Continued)

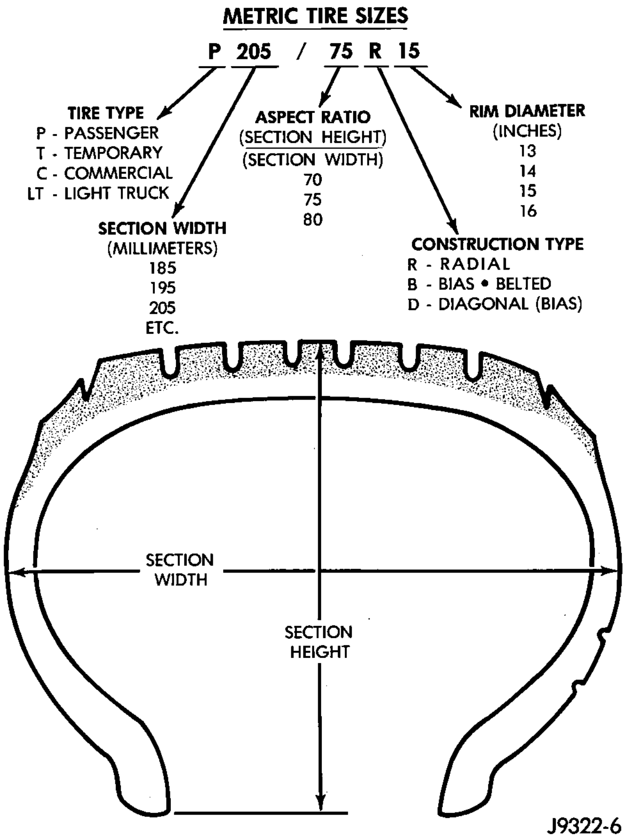


Fig. 11 Tire Identification

DESCRIPTION - RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

DESCRIPTION - TIRE INFLATION PRESSURES

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure (Fig. 12).

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks (Fig. 13).

Improper inflation can cause:

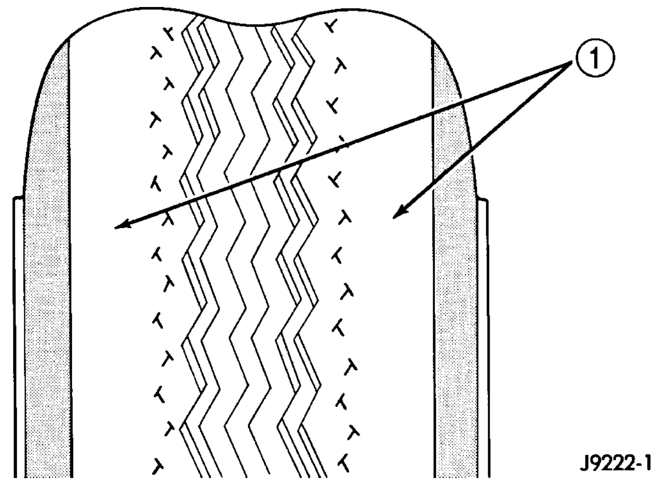


Fig. 12 Under Inflation Wear

1 - THIN TIRE THREAD AREAS

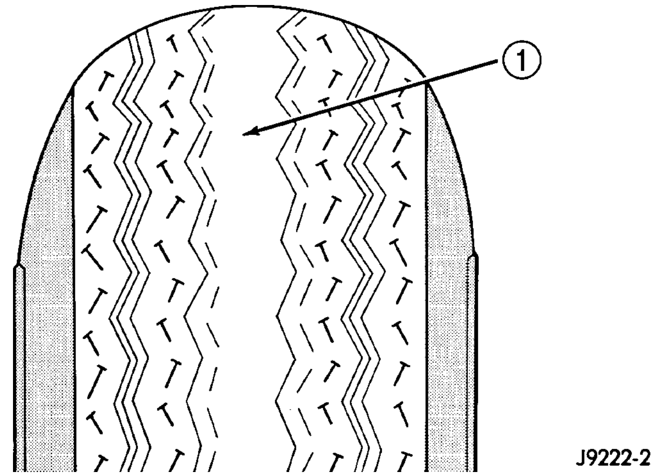


Fig. 13 Over Inflation Wear

1 - THIN TIRE THREAD AREA

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the Tire Inflation Pressure Chart provided with the vehicles Owners Manual. A Certification Label on the drivers side door pillar provides the minimum tire and rim size for the vehicle. The label also list the cold inflation pressure for these tires at full load operation

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once a month. Tire pressure decreases as the ambient temperature drops. Check tire pressure frequently when ambient temperature varies widely.

TIRES (Continued)

Tire inflation pressures are cold inflation pressure. The vehicle must sit for at least 3 hours to obtain the correct cold inflation pressure reading. Or be driven less than one mile after sitting for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

DESCRIPTION - TIRE PRESSURE FOR HIGH SPEED

Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

DESCRIPTION - REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

DIAGNOSIS AND TESTING - TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 14).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

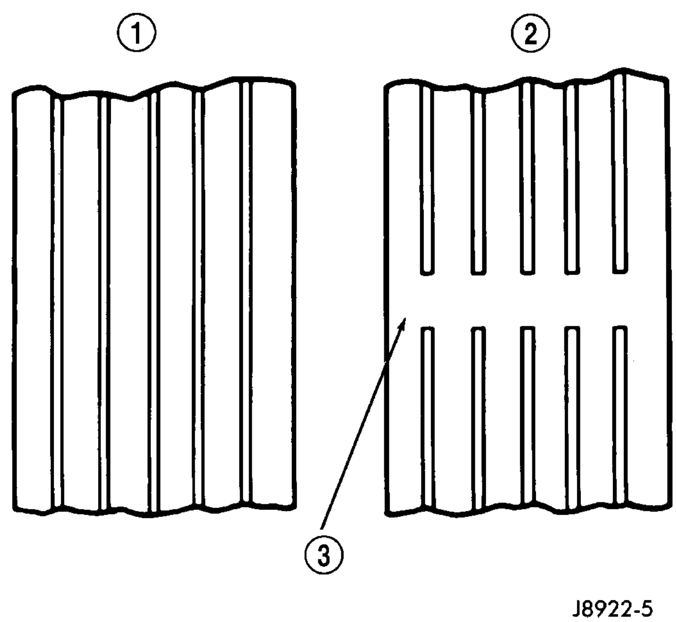


Fig. 14 Tread Wear Indicators

1 - TREAD ACCEPTABLE
2 - TREAD UNACCEPTABLE
3 - WEAR INDICATOR

DIAGNOSIS AND TESTING - TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 15).

TIRES (Continued)

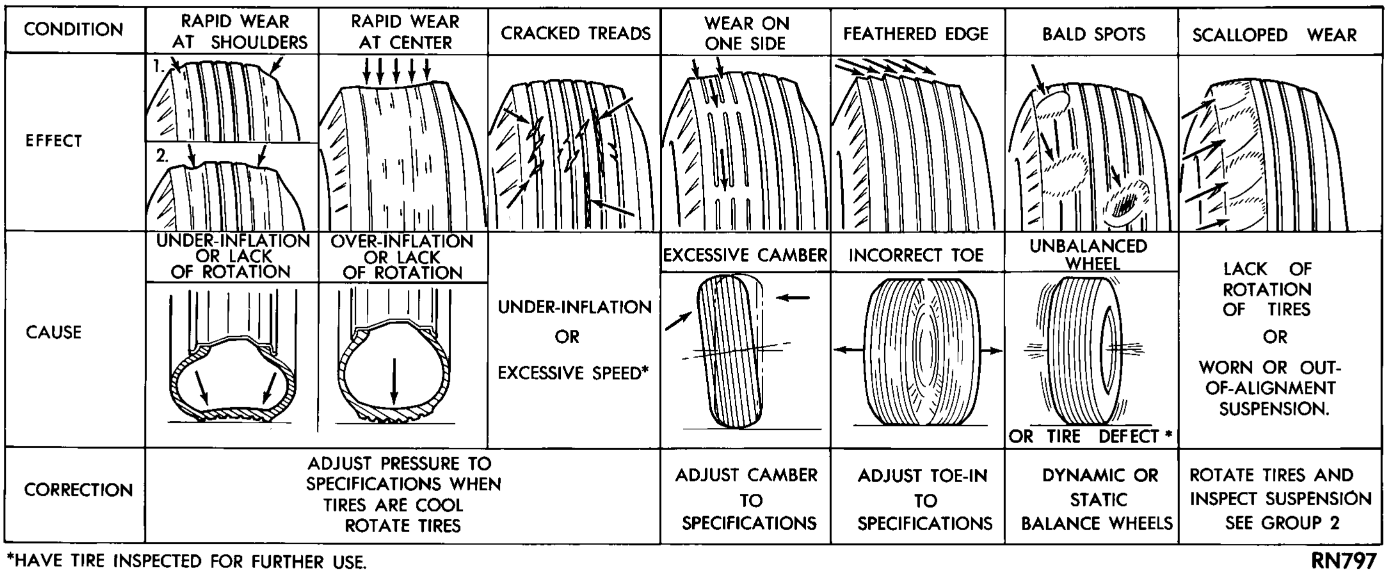


Fig. 15 Tire Wear Patterns

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 15).

DIAGNOSIS AND TESTING - TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

DIAGNOSIS AND TESTING - TIRE/VEHICLE LEAD

Use the following Vehicle Lead Diagnosis And Correction Chart to diagnose and correct a vehicle lead or drift problem (Fig. 16).

TIRES (Continued)

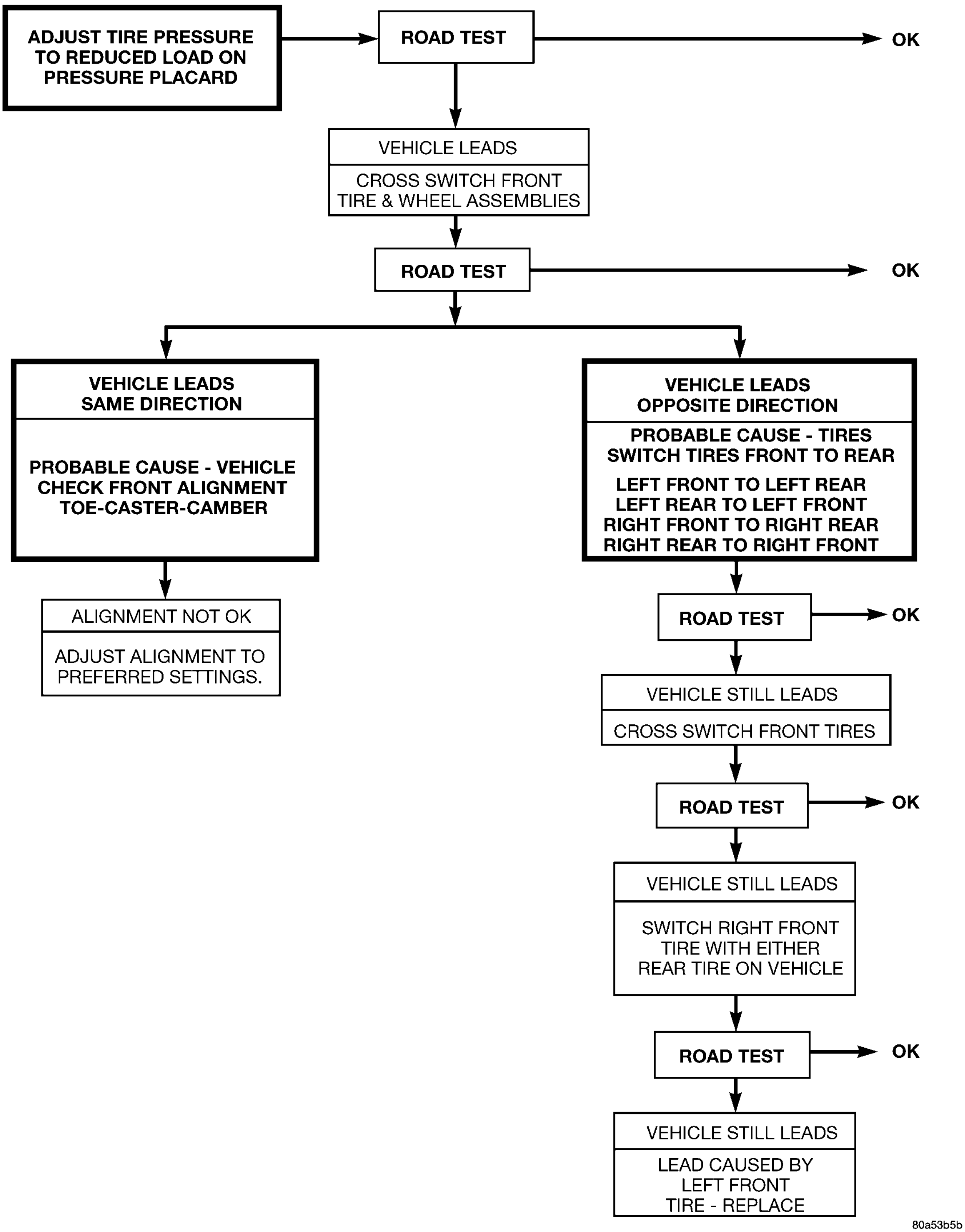


Fig. 16 VEHICLE LEAD DIAGNOSIS AND CORRECTION CHART

TIRES (Continued)

STANDARD PROCEDURE - REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 17). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification. (Refer to 22 - TIRES/WHEELS/ WHEELS - STANDARD PROCEDURE).

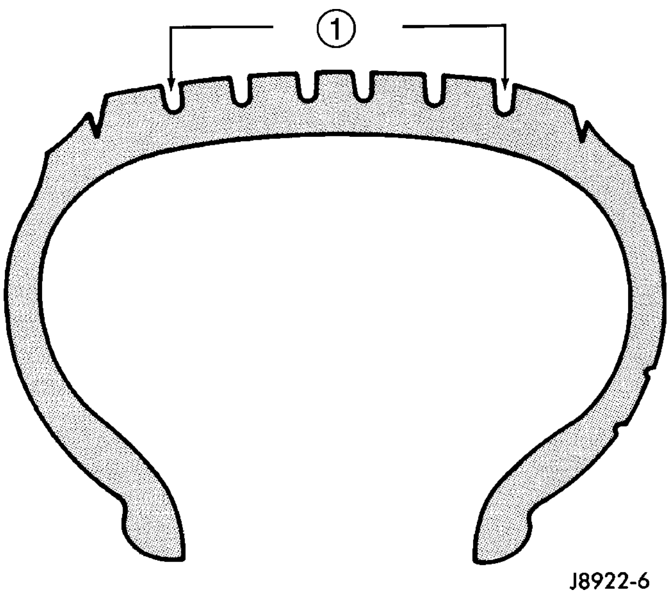


Fig. 17 Tire Repair Area

1 - REPAIRABLE AREA

CLEANING - TIRES

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.

SPECIFICATIONS

TIRE SIZE

DESCRIPTION	SPECIFICATION
TIRE	P215/75R15
TIRE	P225/75R15
TIRE	LT245/75R16
TIRE	30x9.50R15

SPARE TIRE

DESCRIPTION

DESCRIPTION - SPARE/TEMPORARY

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 50 M.P.H. when using the temporary spare tire. Refer to Owner's Manual for complete details.

DESCRIPTION - FULL SIZE, SPARE WHEEL WITH MATCHING TIRE

The spare is a full usage wheel with a matching tire, It can be used within the (posted legal) speed limits or distance limitations as of the rest of the vehicles four tires. Refer to Owner's Manual for complete details.

SPARE TIRE CARRIER

REMOVAL

(1) Remove the spare tire from the wheel bracket (Fig. 18).

(2) Remove the bolts that attach the tire bracket to the tailgate (Fig. 19).

(3) Disconnect CHMSL.

(4) Remove the bracket and the gaskets from the tailgate.

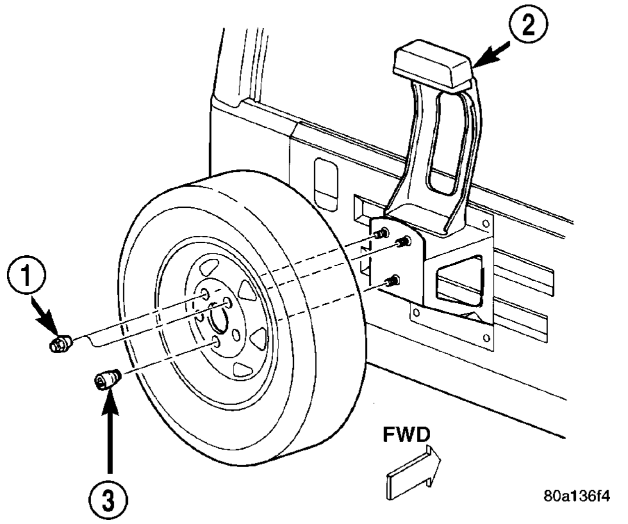


Fig. 18 Spare Tire

1 - WHEEL NUT
2 - CHMSL
3 - LOCK NUT

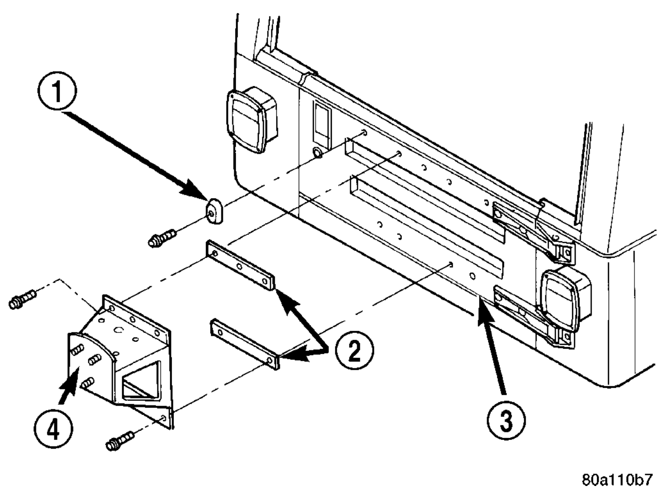


Fig. 19 Spare Tire Bracket

1 - BUMPER
2 - GASKET
3 - TAILGATE
4 - SPARE TIRE BRACKET

INSTALLATION

(1) Position the gaskets and the tire bracket on the tailgate and install the bolts. Tighten the bolts to 24 N·m (17 ft. lbs.) torque.

(2) Connect CHMSL connector.

(3) Install the spare tire on the tire bracket.

WHEELS

DESCRIPTION

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 20).

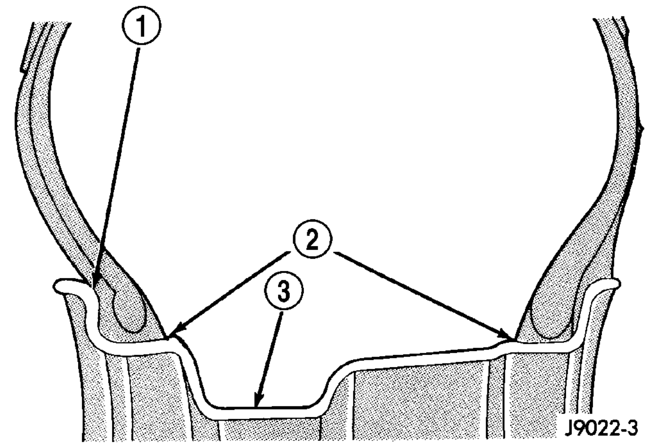


Fig. 20 Safety Rim

1 - FLANGE
2 - RIDGE
3 - WELL

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

WHEELS (Continued)

DIAGNOSIS AND TESTING - WHEEL INSPECTION

Inspect wheels for:
- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

STANDARD PROCEDURE

STANDARD PROCEDURE - WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification (Fig. 21).

WARNING: NEVER USE OIL OR GREASE ON STUDS OR NUTS. INSTALLING WHEELS WITHOUT GOOD METAL-TO-METAL CONTACT OR USING CHROME PLATED LUG NUTS WITH CHROME PLATED WHEELS COULD CAUSE LOOSENING OF WHEEL NUTS. THIS COULD AFFECT THE SAFETY AND HANDLING OF THE VEHICLE.

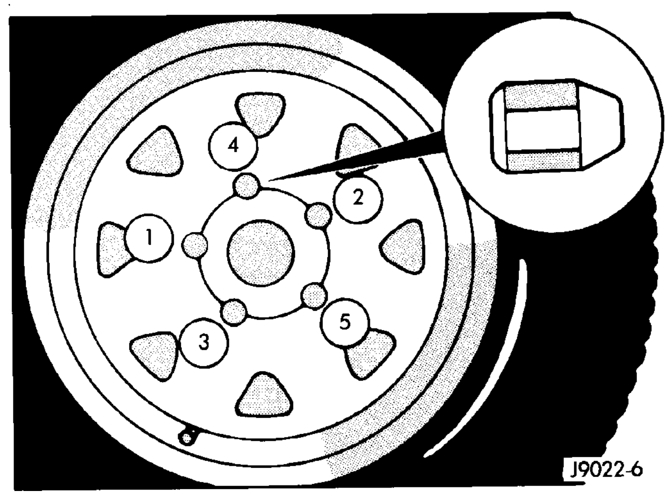


Fig. 21 Lug Nut Tightening Pattern

WHEEL REPLACEMENT

Wheels must be replaced if they have:
- Excessive runout
- Bent or dented
- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:
- Load carrying capacity
- Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

STANDARD PROCEDURE - WHEEL REPLACEMENT

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

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WHEELS (Continued)

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- Load carrying capacity
- Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Lug Nut 1/2 X 20 with 60° Cone	115-156	85-115	—

STUDS

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper, caliper adapter and rotor, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

(4) Remove stud from hub with Remover C-4150A (Fig. 22).

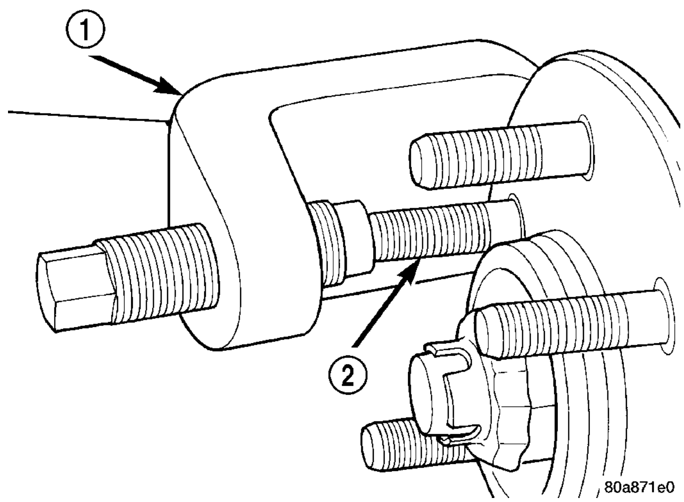


Fig. 22 Wheel Stud Removal

1 - REMOVER
2 - WHEEL STUD

INSTALLATION

(1) Install new stud into hub flange.

(2) Install three washers onto stud, then install lug nut with the flat side of the nut against the washers.

(3) Tighten lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.

(4) Remove lug nut and washers.

(5) Install the brake rotor, caliper adapter, and caliper, (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(6) Install wheel and tire assembly, use new lug nut on stud or studs that were replaced. (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

(7) Remove support and lower vehicle.

BODY

TABLE OF CONTENTS

BODY

WARNING

SAFETY PRECAUTIONS AND WARNINGS

WARNING: USE AN OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

- **AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.**
- **DO NOT STAND UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.**

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

- **Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.**
- **Always have a fire extinguisher ready for use when welding.**
- **Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.**
- **Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.**
- **Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.**
- **Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.**

STANDARD PROCEDURE

STANDARD PROCEDURE - BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

(1) When necessary, lubricate the operating mechanisms with the specified lubricants.

(2) Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.

(3) Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.

(4) The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.

(5) The door lock cylinders should be lubricated twice each year (preferably autumn and spring):

- Spray a small amount of lock cylinder lubricant directly into the lock cylinder.

BODY (Continued)

• Apply a small amount to the key and insert it into the lock cylinder.

• Rotate it to the locked position and then back to the unlocked position several times.

• Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

Component	Fluid, Lubricant, or Genuine Part
Hinges:	
Door And Hood	Mopar® Engine Oil
Liftgate	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Latches:	
Door, Hood/Safety Catch, Liftgate	Mopar® Multi-Purpose Lube NLG Grade 2 EP, GC-LB
Seat Regulator & Track	Mopar® Multi-Purpose Lube NLGI Grade 2 EP, GC-LB
Window System Components	Mopar® Spray White Lube
Lock Cylinders	Mopar® Lock Cylinder Lube
Parking Brake Mechanism	Mopar® Wheel Brg. Grease NLGI Grade 1, GC-LBB
Soft Top	Mopar® Soft Top Zipper Cleaner & Lubricant

STANDARD PROCEDURE - PLASTIC BODY PANEL REPAIR

There are many different types of plastics used in today's automotive environment. We group plastics in three different categories: Rigid, Semi-Rigid, and Flexible. Any of these plastics may require the use of an adhesion promoter for repair. These types of plastic are used extensively on DaimlerChrysler Motors vehicles. Always follow repair material manufacturer's plastic identification and repair procedures.

Rigid Plastics:

Examples of rigid plastic use: Fascias, Hoods, Doors, and other Body Panels, which include SMC, ABS, and Polycarbonates.

Semi-Rigid Plastics:

Examples of semi-rigid plastic use: Interior Panels, Under Hood Panels, and other Body Trim Panels.

Flexible Plastics:

Examples of flexible plastic use: Fascias, Body Moldings, and upper and lower Fascia Covers.

Repair Procedure:

The repair procedure for all three categories of plastics is basically the same. The one difference is the material used for the repair. The materials must be specific for each substrate, rigid repair material for rigid plastic repair, semi-rigid repair material for semi-rigid plastic repair and flexible repair material for flexible plastic repair.

Adhesion Promoter/Surface Modifier:

Adhesion Promoters/Surface Modifiers are required for certain plastics. All three categories may have plastics that require the use of adhesion promoter/surface modifiers. Always follow repair material manufacturer's plastic identification and repair procedures.

SAFETY PRECAUTION AND WARNINGS

WARNING:

• EYE PROTECTION SHOULD BE USED WHEN SERVICING COMPONENTS. PERSONAL INJURY CAN RESULT.

• USE AN OSHA APPROVED BREATHING MASK WHEN MIXING EPOXY, GRINDING, AND SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

• AVOID PROLONGED SKIN CONTACT WITH RESIN, PETROLEUM, OR ALCOHOL BASED SOLVENTS. PERSONAL INJURY CAN RESULT.

• DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.

NOTE:

• When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.

• Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.

BODY (Continued)

RIGID, SEMI-RIGID, AND FLEXIBLE PLASTIC PARTS TYPES

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
ASA	ACRYLONITRILE STYRENE ACRYLITE	LURAN S	CONSOLES, GRILLES
ABS	ACRYLONITRILE BUTADIENE STYRENE	TERLURAN	″A″ PILLARS, CONSOLES, GRILLES
ABS/PC	ABS/PC ALLOY	PULSE, PROLOY, BAYBLEND	DOORS, INSTRUMENT PANELS
ABS/PVC	ABS/PV ALLOY	PROLOY, PULSE, LUSTRAN, CYCLOVIN	DOOR PANELS, GRILLES, TRIM
BMC	BULK MOLDING COMPOUND	BMC	FENDER EXTENSIONS
EMA	EHTYLENE METHYL ACRYLATE/IONOMER	SURLYN, EMA, IONOMER	BUMPER GUARDS, PADS
METTON	METTON	METTON	GRILLES, KICK PANELS, RUNNING BOARDS
MPPO	MODIFIED POLYPHENYLENE OXIDE	MPPO	SPOILER ASSEMBLY
PA	POLYAMID	ZYTEL, VYDYNE, PA, MINLON	FENDERS, QUARTER PANELS
PET	THERMOPLASTIC POLYESTER	RYNITE	TRIM
PBT/PPO	PBT/PPO ALLOY	GERMAX	CLADDINGS
PBTP	POLYBUTYLENE THEREPTHALATE	PBT, PBTP, POCAN, VALOX	WHEEL COVERS, FENDERS, GRILLES
PBTP/EEBC	POLYBUTYLENE THEREPTHALATE/EEBC ALLOY	BEXLOY, ″M″, PBTP/EEBC	FASCIAS, ROCKER PANEL, MOLDINGS
PC	POLYCARBONATE	LEXAN, MERLON, CALIBRE, MAKROLON PC	TAIL LIGHT LENSES, IP TRIM, VALANCE PANELS
PC/ABS	PC/ABS ALLOY	GERMAX, BAY BLENDS, PULSE	DOORS, INSTRUMENT PANELS
PPO	POLYPHENYLENE OXIDE	AZDEL, HOSTALEN, MARLEX, PRFAX, NORYL, GTX, PPO	INTERIOR TRIM, DOOR PANELS, SPLASH SHIELDS, STEERING COLUMN SHROUD
PPO/PA	POLYPHENYLENE/ POLYAMID	PPO/PA, GTX 910	FENDERS, QUARTER PANELS
PR/FV	FIBERGLASS REINFORCED PLASTIC	FIBERGLASS, FV, PR/FV	BODY PANELS
PS	POLYSTYRENE	LUSTREX, STYRON, PS	DOOR PANELS, DASH PANELS
RTM	RESIN TRANSFER MOLDING COMPOUND	RTM	BODY PANELS
SMC	SHEET MOLDED COMPOUND	SMC	BODY PANELS
TMC	TRANSFER MOLDING COMPOUND	TMC	GRILLES

BODY (Continued)

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
UP	UNSATURATED POLYESTER (THERMOSETTING)	SMC, BMC, TMC, ZMC, IMC, XSMC, UP	GRILLE OPENING PANEL, LIFTGATES, FLARESIDE FENDERS, FENDER EXTENSIONS
EEBC	ETHER/ESTER BLOCKED CO-POLYMER	EEBC	BUMPERS
EEBC/PBTP	EEBC/POLYBUTYLENE TEREPTHALATE	EEBC, PBTP, BEXLOY	BUMPER, ROCKER PANELS
EMPP	ETHYLENE MODIFIED POLYPROPYLENE	EMPP	BUMPER COVERS
EPDM	ETHYLENE/ PROPROPYLENE DIENE MONOMER	EPDM, NORDEL, VISTALON	BUMPERS
EPM	ETHYLENE/ PROPROPYLENE CO-POLYMER	EPM	FENDERS
MPU	FOAM POLYURETHANE	MPU	SPOILERS
PE	POLYETHYLENE	ALATHON, DYLAN, LUPOLEN, MARLEX	-
PP	POLYPROPYLENE (BLENDS)	NORYL, AZDEL, MARLOX, DYLON, PRAVEX	INNER FENDER, SPOILERS, KICK PANELS,A-PILLARS, DOOR PANELS, B-PILLARS, QUARTER PANELS, SPORT BAR TRIM, LIFTGATE TRIM, DECKLID TRIM SCUFF PLATES, KICK PANELS, CONSOLES
PP/EPDM	PP/EPDM ALLOY	PP/EPDM	SPOILERS, GRILLES
PUR	POLYURETHANE	COLONELS, PUR, PU	FASCIAS, BUMPERS
PUR/PC	PUR/PC ALLOY	TEXIN	BUMPERS
PVC	POLYVINYL CHLORIDE	APEX, GEON, VINYLITE	BODY MOLDINGS, WIRE INSULATION, STEERING WHEELS
RIM	REACTION INJECTED MOLDED POLYURETHANE	RIM, BAYFLEX	FRONT FASCIAS, MODULAR WINDOWS
RRIM	REINFORCED REACTION INJECTED MOLDED	PUR, RRIM	FASCIAS, BODY PANELS, BODY TRIMS
TPE	THERMO POLYETHYLENE	TPE, HYTREL, BEXLOY-V	FASCIAS, BUMPERS, CLADDINGS
TPO	THERMOPOLYOLEFIN	POLYTROPE, RENFLEX, SANTOPRENE, VISAFLEX, ETA, APEX, TPO, SHIELDS, CLADDINGS	BUMPERS, END CAPS, TELCAR, RUBBER, STRIPS, SIGHT, INTERIOR B POST
TPP	THERMO-POLYPROPYLENE	TPP	BUMPERS
TPU	THERMOPOLYURETHANE, POLYESTER	TPU, HYTREL, TEXIN, ESTANE	BUMPERS, BODY SIDE, MOLDINGS, FENDERS, FASCIAS

BODY (Continued)

PANEL SECTIONING

If it is required to section a large panel for a plastic repair, it will be necessary to reinforce the panel (Fig. 1). To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be “V’d” at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

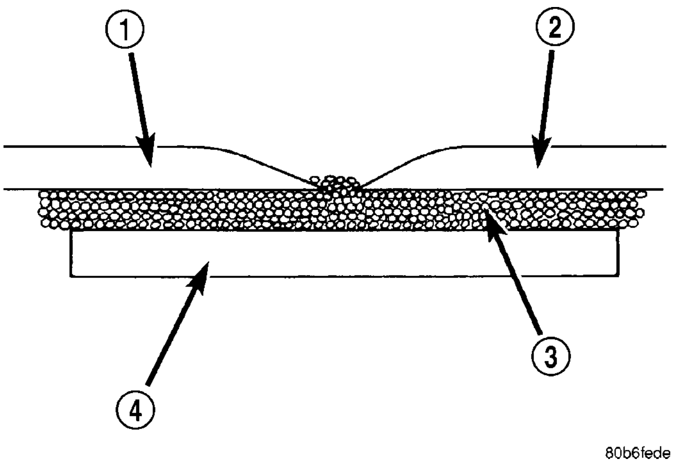


Fig. 1 PANEL SECTIONING

1 - EXISTING PANEL
2 - NEW PANEL
3 - PANEL ADHESIVE
4 - BONDING STRIP

When bonding plastic panels, Follow repair material manufacturers recommendations. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun. After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spreader, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

PANEL REINFORCEMENT

Structural repair procedures for rigid panels with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with structural adhesive. Semi-rigid or flexible repair materials should be used for semi-rigid or flexible backing reinforcement (Fig. 2) and (Fig. 3). Open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the adhesive. Structurally, the more dry wall tape used, the stronger the repair.

Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.

When repairing plastic, the damaged area is first “V’d” out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 degree angle will increase the bonding surface for a repair (Fig. 4). It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.

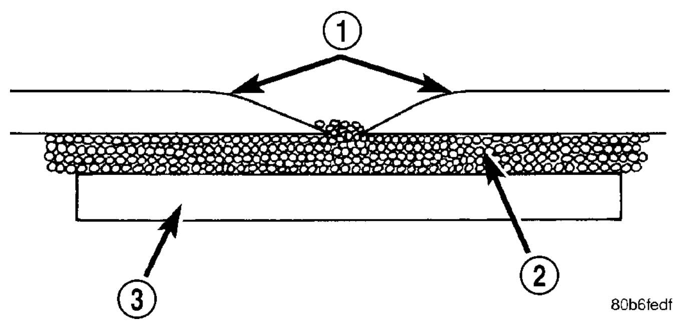


Fig. 2 SOFTENED EDGES

1 - SOFTENED EDGES
2 - PANEL ADHESIVE
3 - BONDING STRIP

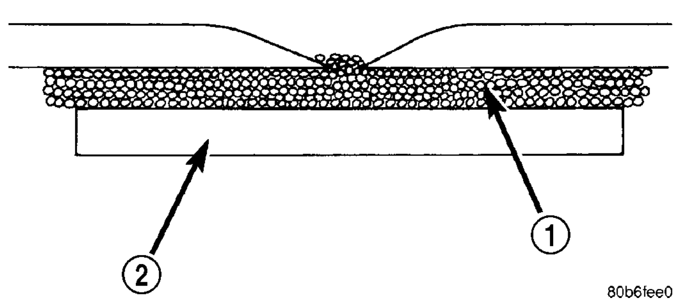


Fig. 3 PANEL REINFORCEMENT

1 - PANEL ADHESIVE
2 - REINFORCEMENT

BODY (Continued)

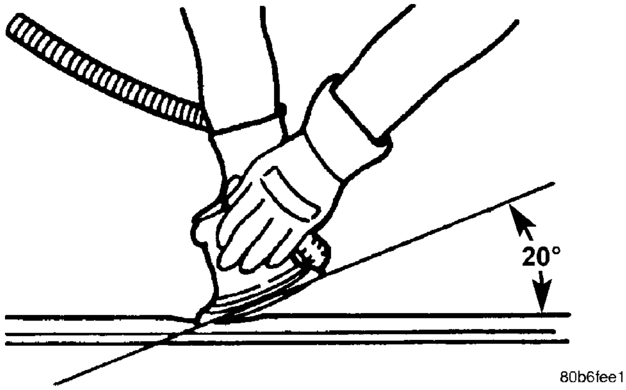


Fig. 4 BEVELING ANGLE - 20 DEGREE

- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used (Fig. 5).
- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when every possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.

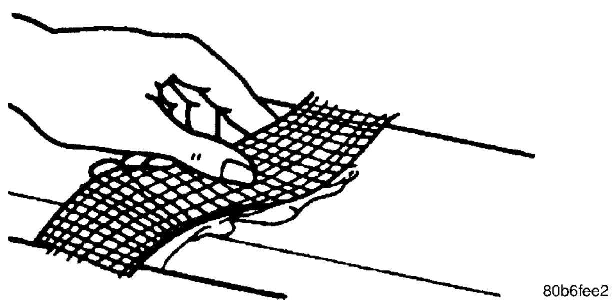


Fig. 5 FIBERGLASS TAPE

VISUAL INSPECTION

Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structures need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair: Puncture or Crack - Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind (Fig. 7) (Fig. 6).

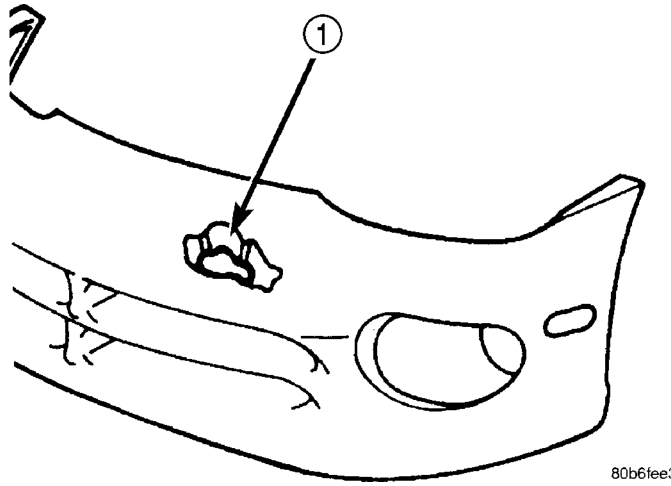


Fig. 6 DAMAGE COMPONENT

1 - PUNCTURE

PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area with 360 grit wet/dry sandpaper, or equivalent, to assure adhesion of repair materials.

PATCHING PANELS

An panel that has extensive puncture type damage can be repaired by cutting out the damaged material (Fig. 7). Use a suitable reciprocating saw or cut off wheel to remove the section of the panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20 degrees to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.

PANEL PATCH FABRICATIONS

A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with adhesive and reinforcement mesh (dry wall tape). Perform the following operation if required:

BODY (Continued)

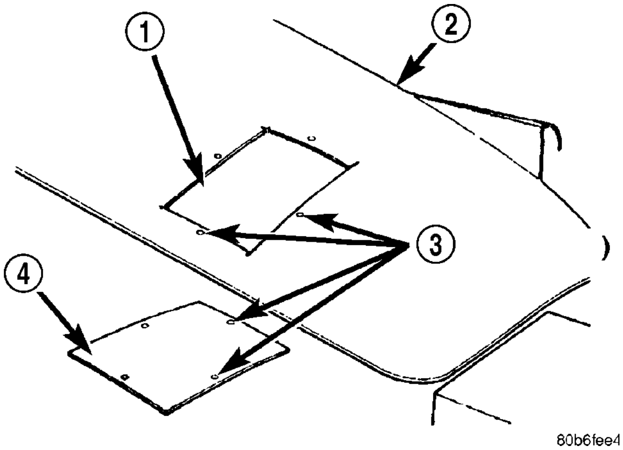


Fig. 7 DAMAGED PANEL CUTOUT AND PATCH

1 - CUTOUT
2 - DAMAGED BODY PANEL
3 - 4 MM (0.160 IN.) HOLES
4 - PATCH CUT TO SIZE

(1) Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required (Fig. 8).

(2) Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.

(3) Apply a liberal coat of adhesive over the reinforcement mesh (Fig. 8). If necessary apply a second or third coat of adhesive and mesh after first coat has cured. The thickness of the patch should be the same as the repair area.

(4) After patch has cured, peel waxed paper or plastic from the back of the patch.

(5) If desired, a thin film coat of adhesive can be applied to the back of the patch to cover mesh for added strength.

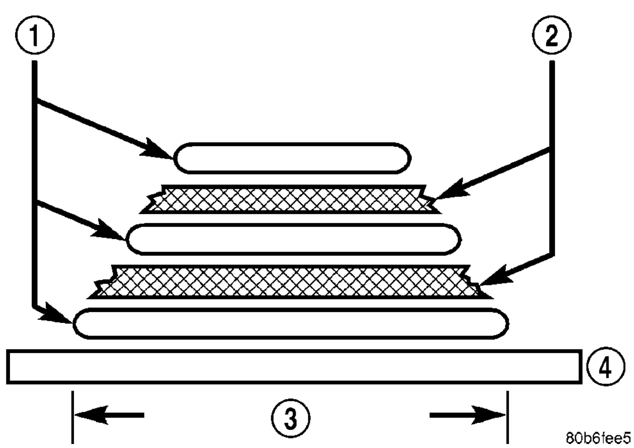


Fig. 8 FABRICATED PANEL

1 - STRUCTURAL ADHESIVE
2 - FIBERGLASS CLOTH OR FIBERGLASS MESH TAPE
3 - WIDTH OF V-GROOVE
4 - WAXED PAPER

PANEL PATCH INSTALLATION

(1) Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.

(2) Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.

(3) Using the pattern as a guide, cut the patch to size.

(4) Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.

(5) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole (Fig. 7).

(6) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) away from edge of patch across from holes drilled around cutout.

(7) Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.

(8) Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.

(9) Mix enough adhesive to cover one side of all support squares.

(10) Apply adhesive to cover one side of all support squares.

(11) Using number 8 sheet metal screws, secure support squares to back side of body panel with adhesive sandwiched between the panel and squares (Fig. 9).

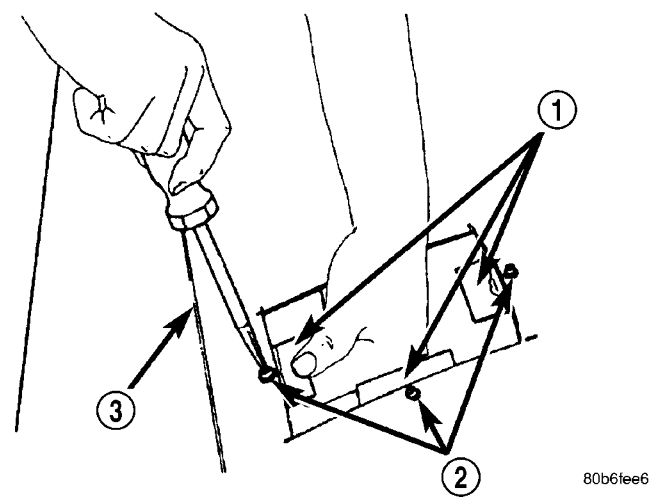


Fig. 9 SECURE SUPPORT SQUARES TO BODY PANEL

1 - SUPPORT SQUARES
2 - SCREWS
3 - DAMAGED BODY PANEL

(12) Position patch in cutout against support squares and adjust patch until the gap is equal along all sides (Fig. 10).

(13) Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.

BODY (Continued)

(14) Apply a coat of adhesive to the exposed ends of the support squares (Fig. 11).

(15) Install screws to hold the patch to support squares (Fig. 12). Tighten screws until patch surface is flush with panel surface.

(16) Allow adhesive to cure, and remove all screws.

(17) Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch (Fig. 13). With compressed air, blow dust from around patch.

(18) Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch (Fig. 14).

(19) Mix enough adhesive to cover the entire patch area.

(20) Apply adhesive over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and adhesive to create a stronger repair (Fig. 15).

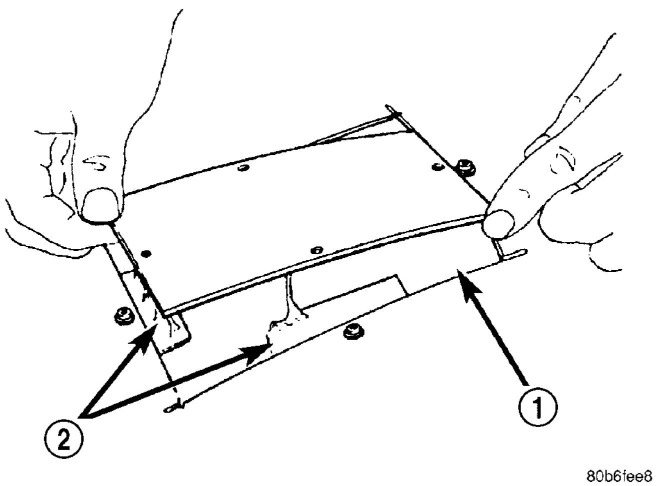


Fig. 10 POSITION PATCH IN CUTOUT AND ALIGN

1 - CUTOUT
2 - SUPPORT SQUARES

PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

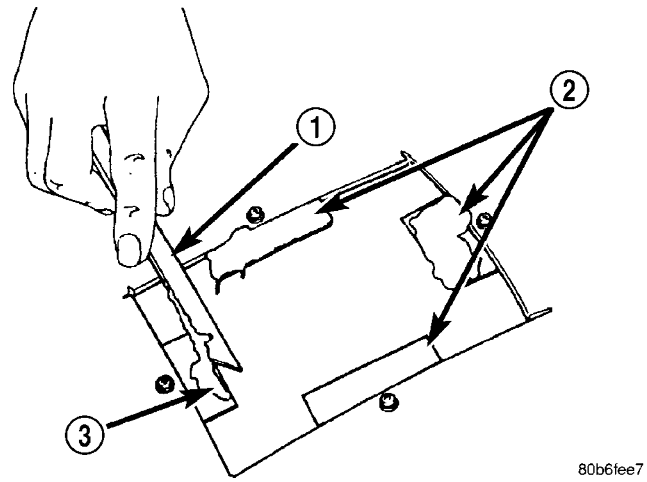


Fig. 11 APPLY ADHESIVE TO SUPPORT SQUARES

1 - APPLICATOR
2 - SUPPORT SQUARES
3 - ADHESIVE

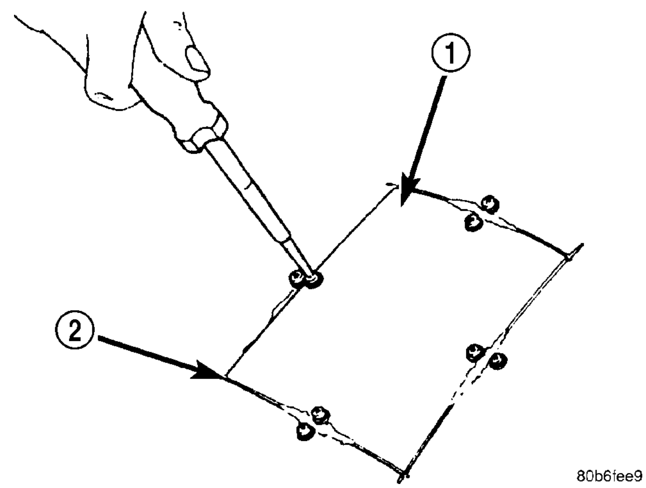


Fig. 12 INSTALL SCREWS

1 - PATCH
2 - GAP

BODY (Continued)

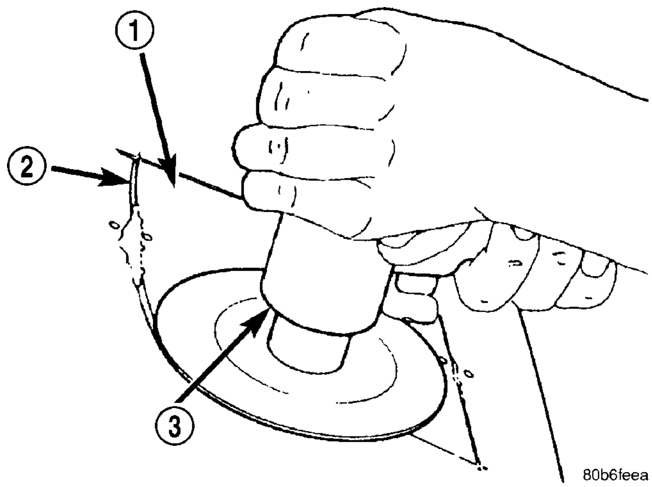


Fig. 13 GRIND SURFACE

1 - PATCH
2 - GAP
3 - DISC GRINDER

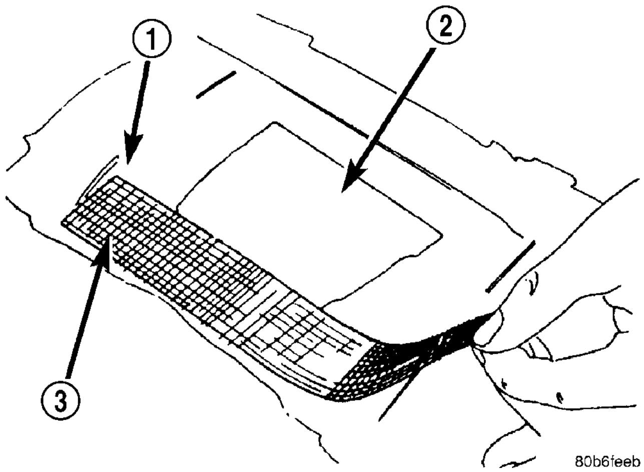


Fig. 14 COVER GAPS WITH MESH

1 - GROUND DOWN AREA
2 - PATCH
3 - MESH

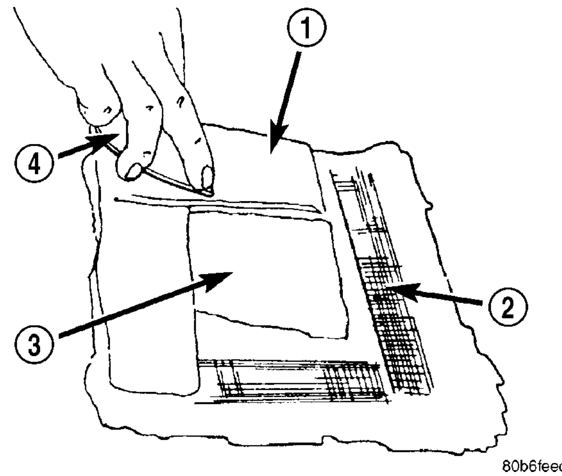


Fig. 15 COVER MESH WITH ADHESIVE

1 - ADHESIVE
2 - MESH
3 - PATCH
4 - SPREADER

STANDARD PROCEDURE - BUZZ, SQUEAK & RATTLE

Buzz, Squeak & Rattles (BSR) may be caused by any one or more of the following and may be corrected as indicated:

- Loose fasteners should be tightened to specifications.
- Damaged or missing clips should be replaced.
- Damaged trim panels should be replaced.
- Incorrectly installed trim panels should be reinstalled properly.

Many BSR complaints such as loose trim, can be serviced using the Mopar® Parts BSR Noise Reduction Kit. This kit contains various tapes including foam, flock and anti-squeak used to eliminate noises caused by metal, plastic and vinyl components. Long life lubricants and greases can also be used on a variety of components. Refer to the Buzz, Squeak & Rattle Kit table for material contents and usage.

BUZZ, SQUEAK & RATTLE KIT

ITEM	FEATURES	APPLICATIONS	SERVICE TEMP
Itch And Squeak Tape	An abrasion resistant material thin enough to conform to most irregular surfaces. Stops most itches and squeaks.	Between metal and metal, metal and plastic, metal and vinyl, vinyl and plastic. Interior. Examples: Trim panels and bezels.	-40° to 225° Fahrenheit (-40° to 107° Celsius)

BODY (Continued)

ITEM	FEATURES	APPLICATIONS	SERVICE TEMP
Black Nylon Flock	Nylon Flock with an aggressive acrylic adhesive. Provides for cushioning and compression fit, also isolates components. Water-resistant.	Between metal and metal, metal and plastic, vinyl and plastic. Examples: Pull cups, bezels, clips, ducts, top cover to glass, cowl panel.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
High Density Urethane Foam	Tear resistant, highly resilient and durable.	Between metal and metal, metal and plastic. Water-resistant. Examples: I/P, heavy metal rattles, isolating brackets.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Open Cell Foam Tape	Soft foam conforms to irregular surfaces.	Wire harness and connector wrap. Examples: Seals, gasket, wiring, heat ducts.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Closed Cell Low Density Foam Tape	Soft, conformable. Water-resistant.	Wherever bulk is needed. Prevents closing flutters and rattles when applied to door watershield. Examples: Door, I/P.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
NYE® Grease 880	Long life.	Suspensions. Examples: Strut busings, sway bars.	-40° to 390° Fahrenheit (-40° to 200° Celsius)
Krytox® Oil	Long life. Will not dry out or harm plastics or rubber.	When access is not possible, oil will migrate to condition. Vinyl, rubber, plastic, metal. Examples: Convertible top bushings, pull cups trim panel inserts.	-30° to 400° Fahrenheit (-34° to 205° Celsius)
Krytox® Grease	Long life. Will not dry out or harm plastics or rubber.	Vinyl, rubber, plastic, metal, glass. Examples: Weather-strips, backlite and windshield moldings.	-30° to 400° Fahrenheit (-34° to 205° Celsius)

SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

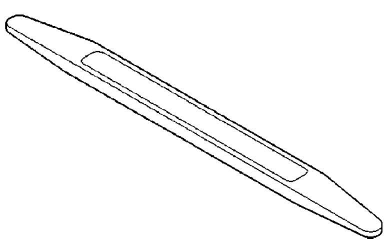
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Body side guard/side bolts	5	—	45
Body side guard/support tab bolts	11	8	—
Hood assist spring bolt	3	—	25
Hood catch nuts	18	13	—
Hood catch bracket nuts	11	8	—
Hood hinge screws	24	18	—
Hood safety latch bolt	9	—	80
Bucket seat front anchor bolt	47	35	—

BODY (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bucket seat rear inboard anchor bolt	74	55	—
Bucket seat rear outboard anchor bolt	33	25	—
Liftgate glass ball stud nut	13	10	—
Liftgate glass hinge nut	6	—	53
Liftgate hinge to hardtop bolt	11	8	95
Front turning loop bolt	47	35	—
Front retractor bolt	47	35	—
Rear retractor bolt	47	35	—
Rear turning loop bolt	47	35	—
Rear belt anchor bolt	47	35	—
Rearview mirror set screw	1	—	9
Rear buckle anchor bolt	43	32	—
Side support bar to sport bar bolts	20	15	—
Side support sport bar to windshield frame bolts	32	24	—
Sport bar bracket bolt	68	50	—
Sport bar speaker pod bolts	68	50	—
Sport bar to wheelhouse bolts	40	30	—
Sport bar to cargo floor bolts	40	30	—
Tailgate hinge screws	23	17	—
Tailgate striker	71	52	—

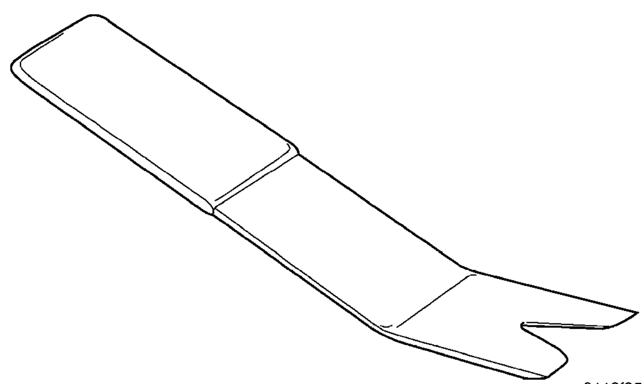
SPECIAL TOOLS

BODY



Trim Stick C-4755

TORX BIT SET C-4794-B



REMOVER, MOLDINGS C-4829-A

TAILGATE

TABLE OF CONTENTS

TAILGATE OUTSIDE HANDLE

REMOVAL

(1) Remove the latch from the tailgate. (Refer to 23 - BODY/TAILGATE/LATCH - REMOVAL)

(2) Remove the screws attaching the outside handle to the tailgate (Fig. 1).

(3) Separate the outside handle and seal from the tailgate.

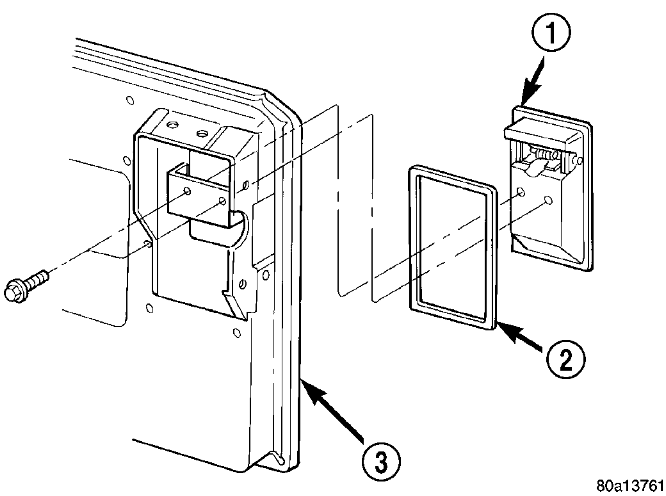


Fig. 1 TAILGATE OUTSIDE HANDLE

1 - OUTSIDE HANDLE
2 - SEAL
3 - TAILGATE

INSTALLATION

(1) Position the seal and outside release handle on the tailgate. and install screws.

(2) Install the screws attaching the outside handle to the tailgate.

(3) Install the latch. (Refer to 23 - BODY/TAILGATE/LATCH - INSTALLATION)

TAILGATE HINGE

REMOVAL

NOTE: Hinges may be serviced individually. If both are to be serviced, remove/install hinges one at a time.

(1) Using a grease pencil or equivalent, mark the position of the hinge on the body.

(2) Remove the screws attaching the hinge to the body and tailgate (Fig. 2).

(3) Separate the hinge from the tailgate.

INSTALLATION

NOTE: Hinges may be serviced individually. If both are to be serviced, remove/install hinges one at a time.

(1) Prepare and paint the replacement hinge to match the body paint color.

TAILGATE HINGE (Continued)

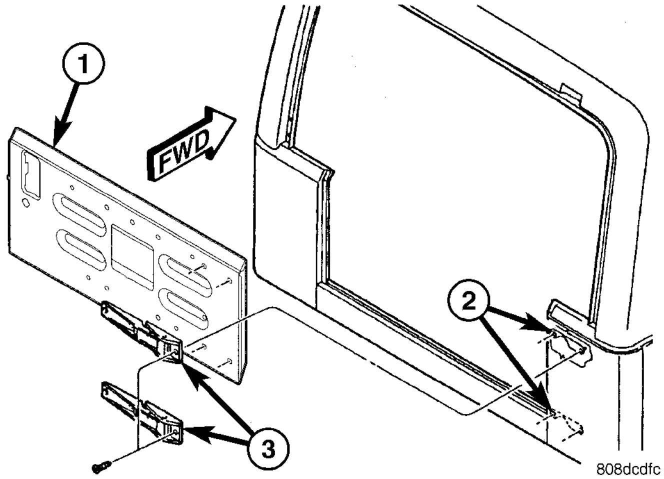


Fig. 2 TAILGATE HINGE

1 - TAILGATE
2 - NUT PLATE
3 - HINGE

(2) Lubricate the hinge with spray lubricant.

(3) Align and position the hinge on the body and tailgate.

(4) Install the screws and tighten the screws to 23 N·m (200 in. lbs.).

TAILGATE LATCH

REMOVAL

(1) Open the tailgate and remove the latch trim cover (Fig. 3).

(2) Disconnect the outside handle to latch rod.

(3) Disconnect the lock cylinder to latch rod.

(4) Remove the screw attaching latch to tailgate.

(5) Separate the latch from the tailgate.

INSTALLATION

(1) Position the latch in the tailgate.

(2) Install the screw attaching latch to tailgate. Do not tighten screw.

(3) Connect the lock cylinder to latch rod.

(4) Connect the outside handle to latch rod.

(5) Install the latch trim cover.

TAILGATE LATCH STRIKER

REMOVAL

(1) Remove the striker from the bracket.

(2) Remove the shim washers from the bracket.

(3) Remove the screws attaching the striker bracket to the body.

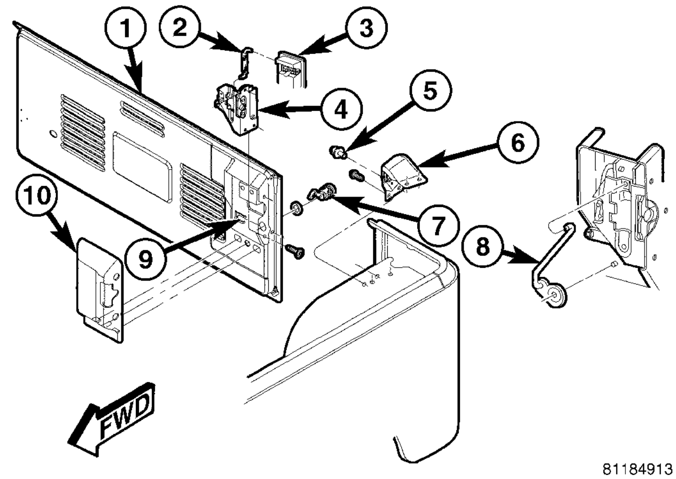


Fig. 3 TAILGATE LATCH

1 - TAILGATE
2 - OUTSIDE HANDLE ROD
3 - OUTSIDE HANDLE
4 - LATCH
5 - STRIKER
6 - STRIKER MOUNTING BRACKET
7 - LOCK CYLINDER
8 - LOCK CYLINDER ROD
9 - LOCK CYLINDER RETAINER CLIP
10 - LATCH COVER

INSTALLATION

(1) Position the striker bracket on the body and install the screws.

(2) Position the striker and shim washers on the striker bracket.

(3) Install the striker in the bracket and tighten the striker to 71 N·m (52 ft. lbs.).

LIFTGATE GLASS HINGE

REMOVAL

(1) Open tailgate.

(2) Open and support liftgate glass.

(3) Remove wiper motor cover (right hinge only). (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - REMOVAL)

(4) Remove the wiper blade. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER BLADE - REMOVAL)

(5) Remove the nut attaching the liftgate hinge to the liftgate glass.

(6) Mark the position of the hinge in the top and remove the bolts attaching the hinge to the top (Fig. 4).

INSTALLATION

(1) Align and position the hinge on the top and install the bolts.

LIFTGATE GLASS HINGE (Continued)

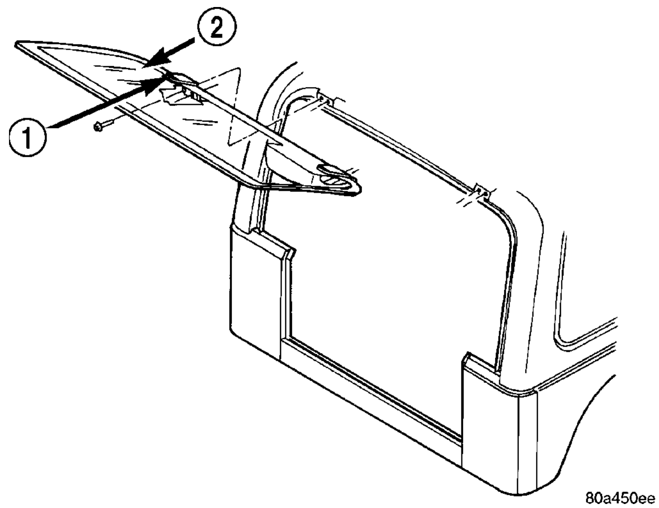


Fig. 4 LIFTGATE HINGE

1 - LIFTGATE HINGE
2 - LIFTGATE GLASS

(2) Install the nut attaching the liftgate hinge to the liftgate glass and tighten to 6 N·m (53 in. lbs.).

(3) Install wiper motor cover. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER MOTOR TRIM COVER - INSTALLATION)

(4) Install the wiper blade. (Refer to 8 - ELECTRICAL/REAR WIPERS/WASHERS/REAR WIPER BLADE - INSTALLATION)

LIFTGATE GLASS

REMOVAL

(1) Disconnect the rear defroster harness connectors.

(2) Disconnect the wiper motor harness connectors.

WARNING: DO NOT REMOVE THE LIFTGATE SUPPORT RODS WITH THE LIFTGATE CLOSED. THE SUPPORT ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS AND COULD CAUSE PERSONAL INJURY AND/OR VEHICLE DAMAGE IF THEY ARE REMOVED WITH THE PISTONS COMPRESSED (LIFTGATE CLOSED). ONCE REMOVED, DO NOT ATTEMPT TO DISASSEMBLE OR REPAIR THE SUPPORT RODS.

(3) Open the tailgate and liftgate.

(4) Remove support rod cylinders. (Refer to 23 - BODY/TAILGATE/SUPPORT CYLINDER - REMOVAL)

(5) Remove the bolts attaching the liftgate hinge to the hardtop (Fig. 5).

(6) Separate the liftgate glass from the hard top.

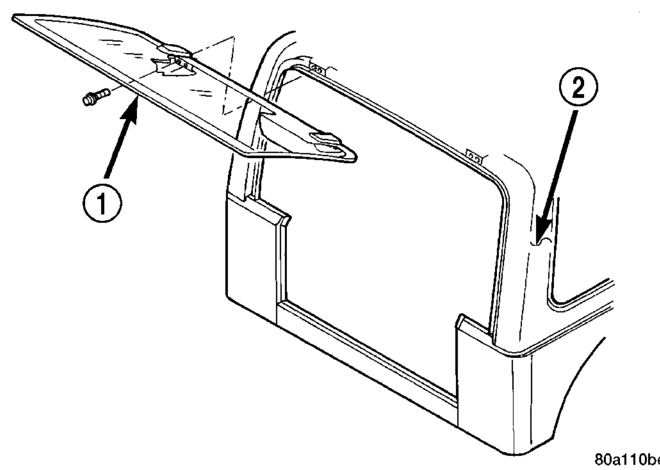


Fig. 5 LIFTGATE GLASS

1 - LIFTGATE REAR WINDOW
2 - HARD TOP

INSTALLATION

Transfer all related components.

(1) If removed, install support rod ball studs and tighten the nut to 12 N·m (112 in. lbs.).

(2) Position the liftgate glass at the hard top.

(3) Install the bolts attaching the liftgate hinge to the hardtop and tighten to 10 N·m (95 in. lbs.).

(4) Install the support rod cylinders. (Refer to 23 - BODY/TAILGATE/SUPPORT CYLINDER - INSTALLATION)

LIFTGATE GLASS WEATHERSTRIP

DESCRIPTION

The liftgate glass weatherstrip is attached to the liftgate glass and is not serviceable. If the liftgate glass weatherstrip needs to be replaced, replace the liftgate glass. (Refer to 23 - BODY/LIFTGATE GLASS - REMOVAL)

TAILGATE LOCK CYLINDER

REMOVAL

(1) Open the tailgate.

(2) Remove the latch cover.

(3) Remove the lock cylinder retainer clip.

(4) Remove the lock cylinder from the tailgate opening.

INSTALLATION

(1) Position the lock cylinder in the tailgate opening.

(2) Connect the lock cylinder to latch rod.

(3) Install the lock cylinder retainer clip.

(4) Install the latch cover.

LIFTGATE GLASS SUPPORT CYLINDER

REMOVAL

WARNING: DO NOT REMOVE THE LIFTGATE SUPPORT RODS WITH THE LIFTGATE CLOSED. THE SUPPORT ROD PISTONS ARE OPERATED BY HIGH PRESSURE GAS AND COULD CAUSE PERSONAL INJURY AND/OR VEHICLE DAMAGE IF THEY ARE REMOVED WITH THE PISTONS COMPRESSED (LIFTGATE CLOSED). ONCE REMOVED, DO NOT ATTEMPT TO DISASSEMBLE OR REPAIR THE SUPPORT RODS.

(1) Open and support the liftgate glass.
(2) Release the support rod cylinder retaining clips at both ends of each support rod cylinder. (Fig. 6)
(3) Pull the support rods off the ball studs (Fig. 7).

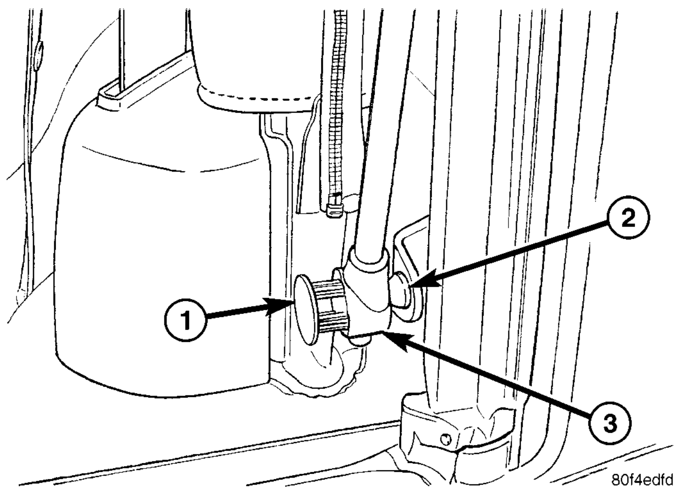


Fig. 6 SUPPORT ROD CYLINDER CONNECTION

1 - CLIP
2 - BALL STUD
3 - SUPPORT ROD END

INSTALLATION

(1) Position the support rod cylinders on the ball studs.

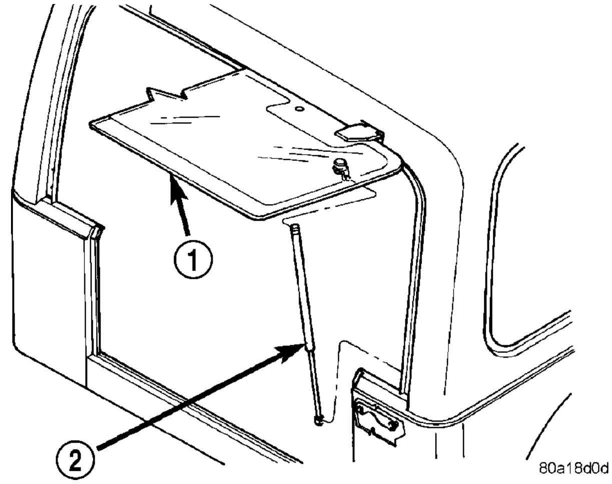


Fig. 7 SUPPORT ROD CYLINDER REMOVAL

1 - REAR WINDOW LIFT GLASS
2 - SUPPORT CYLINDER

(2) Install the support rod cylinder retainer clips.

TAILGATE

REMOVAL

(1) Remove the spare tire.
(2) Open the tailgate and remove the center high mounted stop lamp (CHMSL) contact cover (Fig. 8).
(3) Disengage the CHMSL electrical connectors.
(4) Remove the screws that attach the tailgate hinge to the tailgate.
(5) Separate the tailgate from the vehicle.

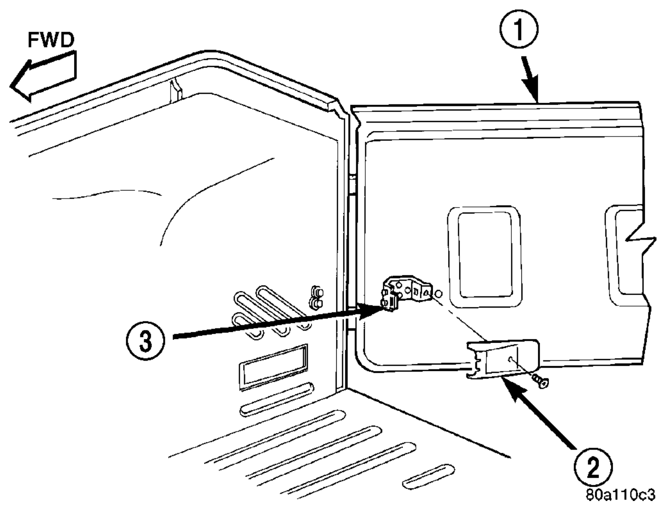


Fig. 8 CHMSL CONTACT COVER

1 - TAILGATE
2 - COVER
3 - CHMSL CONTACT COVER BRACKET

TAILGATE (Continued)

INSTALLATION

NOTE: If necessary, transfer tailgate related components.

(1) Install the screws that attach the tailgate hinge to the tailgate.
(2) Engage the CHMSL electrical connectors.
(3) Install the CHMSL contact cover.
(4) Close the tailgate and install the spare tire.

ADJUSTMENTS

ADJUSTMENT

(1) Loosen the tailgate hinge-to-body screws.
(2) Align the tailgate in the body opening and tighten the hinge screws. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

FULL DOOR

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DOOR

REMOVAL

(1) Open the door.

(2) Disconnect the door restraint strap from the pin (Fig. 1).

(3) Remove the nuts at the door hinge pivots and lift the door from the body.

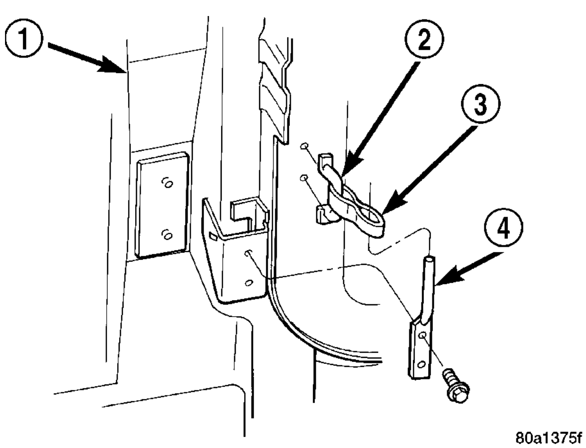

Fig. 1 RESTRAINT STRAP

1 - BODY
2 - FOOTMAN LOOP
3 - STRAP
4 - RESTRAINT PIN

INSTALLATION

(1) Position the door in the hinge and install the nuts.

(2) Connect the door restraint strap at the pin.

ADJUSTMENTS

ADJUSTMENT

The doors are adjusted at the hinge attaching locations on either the body or the door. Enlarged holes are located in the body (lower hinge only) for fore, aft and tilt adjustments. Enlarged holes are also located in the door (upper and lower hinges) for up, down, fore, aft and tilt adjustments.

Prior to door adjustment or alignment, the door latch must be removed to allow the door to close freely and be properly aligned.

The door latch striker should be adjusted in or out to allow the door latch to be fully engaged. The door should be flush with the adjacent body panels.

DOOR GLASS

REMOVAL

(1) Remove the door trim panel and the waterdam. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - REMOVAL)

DOOR GLASS (Continued)

(2) Pull the door glass run channel from the door sail.

(3) Roll glass fully downward.

(4) Using a trim stick C-4755 or equivalent, remove the screws and remove the door sail panel (Fig. 2) and (Fig. 3).

(5) Roll glass 1/4 upward to access regulator arm guide.

(6) Remove the screws that attach the regulator arm guide to the glass.

(7) Lift the glass upward while tilting inward and remove from the door.

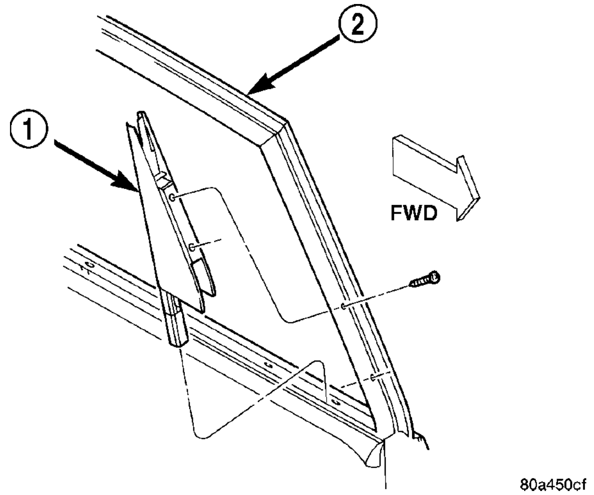

Fig. 2 DOOR SAIL SCREWS

1 - DOOR SAIL
2 - DOOR

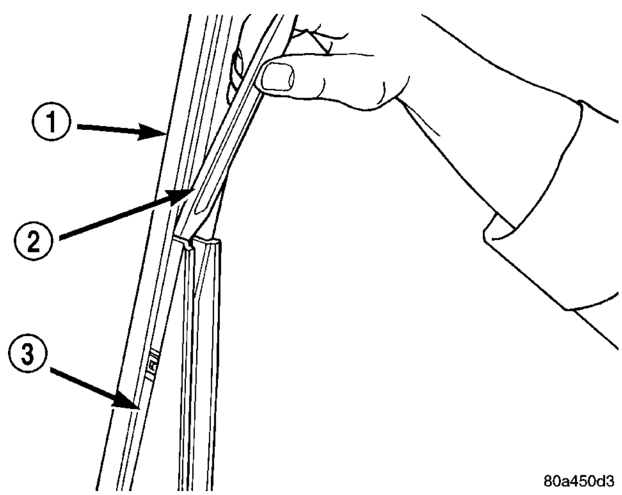

Fig. 3 DOOR SAIL REMOVAL

1 - DOOR FRAME
2 - TRIM STICK
3 - DOOR SAIL

INSTALLATION

(1) Position the glass in the door ensuring the glass is aligned in the glass run channel.

(2) Install the screws that attach the regulator arm guide to the glass.

(3) Install the door sail panel.

(4) Install the run channel in the door sail.

(5) Install the waterdam and the door trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - INSTALLATION)

WINDOW REGULATOR

REMOVAL

(1) Remove door glass. (Refer to 23 - BODY/FULL DOOR/DOOR GLASS - REMOVAL)

(2) Loosen the bolts in the slotted holes (Fig. 4).

(3) Remove the bolts attaching the regulator to the door inner panel.

(4) Lift the regulator upward to free it from the slotted holes in the door inner panel.

(5) Lower the regulator and remove it through the access hole in the door inner panel (Fig. 5).

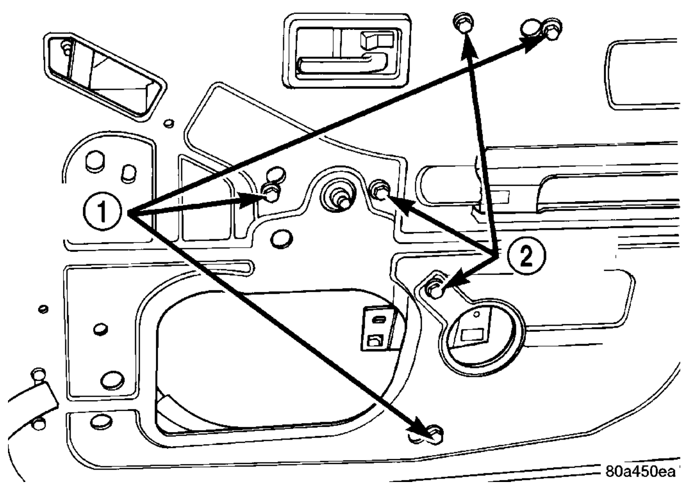

Fig. 4 WINDOW REGULATOR BOLTS

1 - LOOSEN BOLTS
2 - REMOVE BOLTS

INSTALLATION

(1) Position the regulator in the door.

(2) Align regulator bolts into slotted holes.

(3) Install bolts attaching regulator to the inner door panel.

(4) Tighten the bolts in the slotted holes.

(5) Install door glass. (Refer to 23 - BODY/FULL DOOR/DOOR GLASS - INSTALLATION)

WINDOW REGULATOR (Continued)

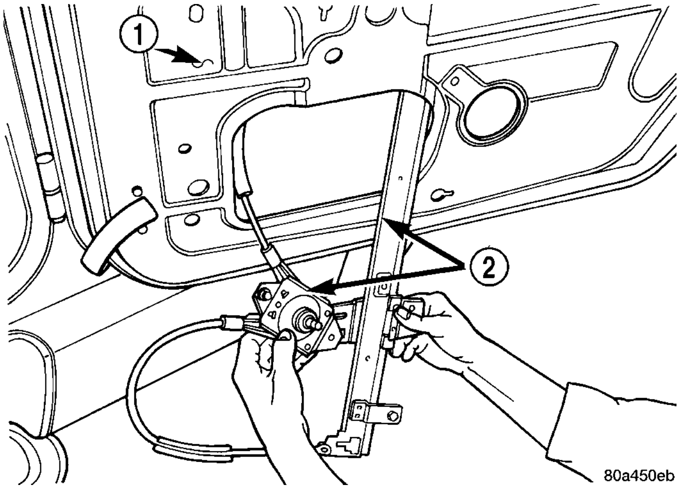

Fig. 5 REGULATOR REMOVAL

1 - DOOR
2 - REGULATOR ASSEMBLY

EXTERIOR HANDLE

REMOVAL

(1) Remove the door trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - REMOVAL)

(2) Position the window in the full upward position.

(3) Remove the grab handle support bracket (Fig. 6).

(4) Peel back the waterdam from the door inner panel to access the door latch.

(5) Disconnect from the latch, the inside lock knob to latch rod and, the outside release handle to latch rod.

(6) Disengage tail of retainer from handle keeper.

(7) Using a long flat blade, tap the handle keepers upward and remove from the door handle (Fig. 7).

(8) Remove the latch release rod from the door handle.

(9) Separate the handle and gasket from the door.

INSTALLATION

(1) Engage the latch release rod to the door handle.

(2) Position the gasket and handle in the door.

(3) Slide the keepers into the door handle from the top.

(4) Lower the window.

(5) Using a long flat blade, lightly tap the handle keepers downward to secure the handle. The tail of the retainer must be positioned on the 2nd or 3rd step from the bottom on the handle keeper.

(6) Raise the window.

(7) Connect to the latch, the inside lock knob to latch rod and, the outside release handle to latch rod.

(8) Reposition the waterdam

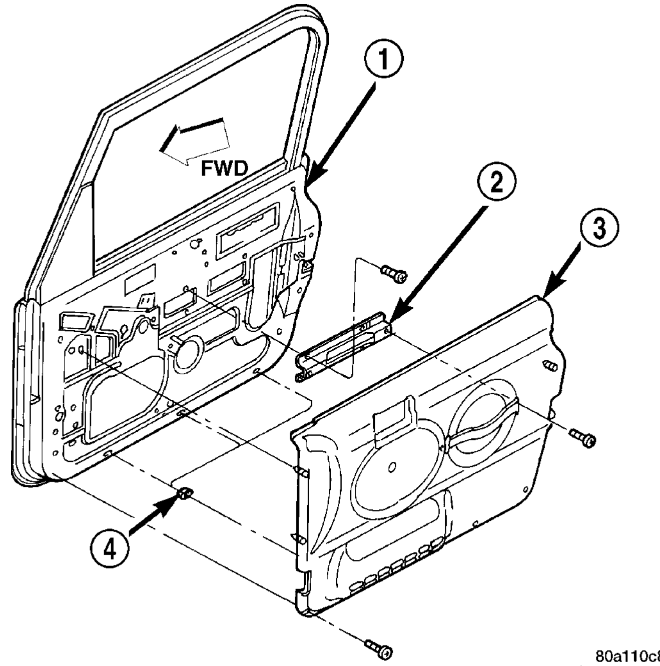

Fig. 6 GRAB HANDLE SUPPORT BRACKET

1 - FULL DOOR
2 - GRAB HANDLE BRACKET
3 - TRIM PANEL
4 - NUT

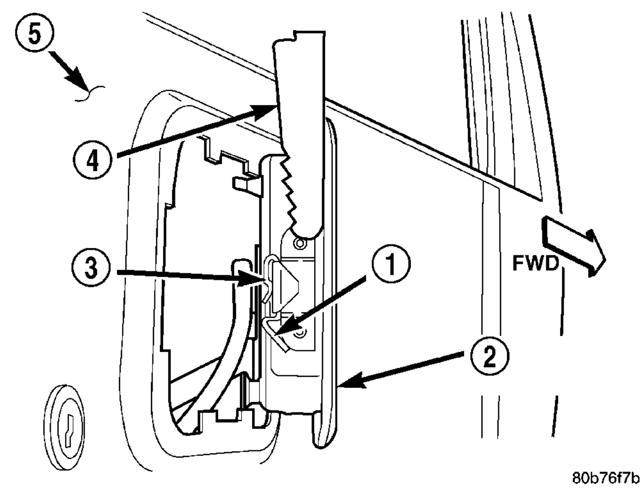

Fig. 7 OUTSIDE DOOR HANDLE REMOVAL

1 - TAIL
2 - OUTSIDE HANDLE
3 - RETAINER
4 - HANDLE KEEPER
5 - DOOR

(9) Install the grab handle support bracket.

(10) Install the door trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - INSTALLATION)

GLASS RUN CHANNEL

REMOVAL

(1) Lower the window.

(2) Using a trim stick C-4755 or equivalent, carefully pry the glass run channel weatherstrip from the window opening frame.

(3) Remove the door glass. (Refer to 23 - BODY/ FULL DOOR/DOOR GLASS - REMOVAL)

(4) Grasp the glass run channel weatherstrip in the door (Fig. 8) and pull from the channel.

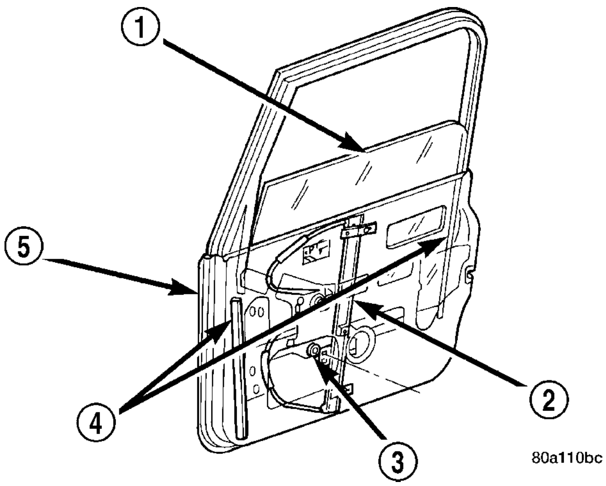

Fig. 8 FULL DOOR GLASS RUN CHANNEL WEATHERSTRIP

1 - WINDOW GLASS
2 - REGULATOR
3 - GROMMET
4 - GLASS RUN CHANNEL WEATHERSTRIP
5 - DOOR

INSTALLATION

NOTE: Applying a small amount of lubricant to the weatherstrip may ease the installation.

(1) Position the weatherstrip in the lower door channels and press into place.

(2) Install the door glass. (Refer to 23 - BODY/ FULL DOOR/DOOR GLASS - INSTALLATION)

(3) Position the weatherstrip in the window opening frame and press into place.

NOTE: Ensure that the glass is seated properly. Improperly seated door glass will result in high glass roll-up/roll-down effort.

HINGE

REMOVAL

(1) Remove the door. (Refer to 23 - BODY/FULL DOOR/DOOR - REMOVAL)

(2) Using a grease pencil or equivalent, mark the outline of the existing hinge on the body and the door for installation alignment reference.

(3) Remove the nut from the upper hinge pin (Fig. 9).

NOTE: When removing the door or hinge DO NOT discard the plastic shims or the hinge pin.

(4) Remove the hinge-to-body screws and the hinge-to-door screws. Remove the hinge from the door and body. Support the door as necessary. The upper hinge is integrated with the windshield hinge. When removing it, support the windshield frame with an appropriate device prior to removal.

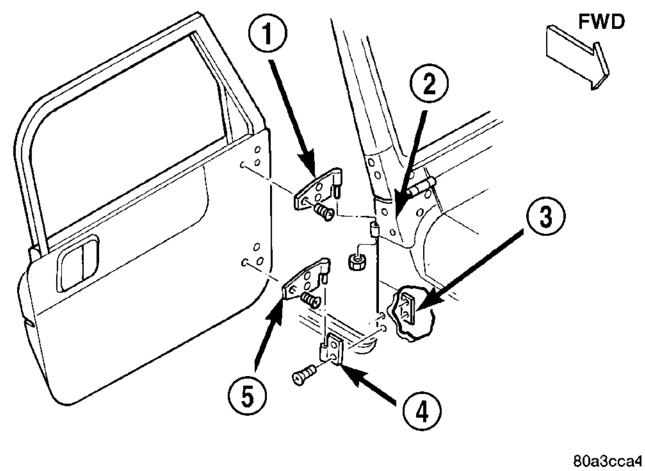

Fig. 9 FULL DOOR HINGE

1 - HINGE HALF
2 - HINGE HALF
3 - TAPPING PLATE
4 - HINGE HALF
5 - HINGE HALF

INSTALLATION

(1) Clean the replacement hinge with an appropriate solvent and dry it with compressed air.

(2) Paint the hinge to match the vehicle body.

(3) Lubricate the hinge with spray lubricant.

(4) Position the hinge on the door, align carefully with the wax pencil installation alignment reference marks, and install the screws.

HINGE (Continued)

(5) Position the hinge on the vehicle body. Align the wax pencil marks installation alignment reference marks. Install the screws.

(6) Install the door. (Refer to 23 - BODY/FULL DOOR/DOOR - INSTALLATION)

(7) Inspect the windshield alignment after hinge installation.

(8) Inspect the door alignment and adjust, if necessary. (Refer to 23 - BODY/FULL DOOR/DOOR - ADJUSTMENTS)

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove the torx screw attaching the inside handle to the door.

(2) Carefully pull the handle from the door.

(3) Disconnect the latch rods from the handle (Fig. 10).

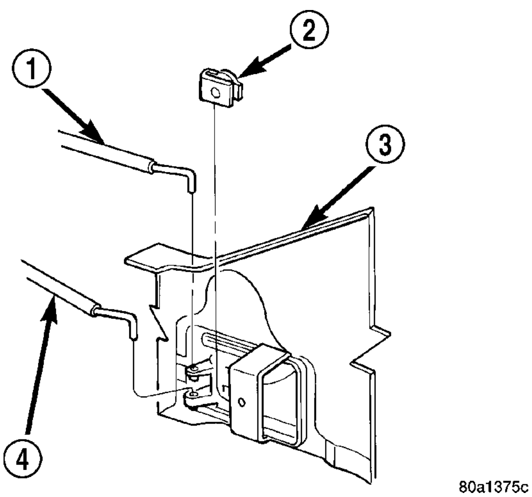

Fig. 10 INSIDE HANDLE ACTUATOR

1 - LOCK KNOB TO LATCH ROD
2 - U-NUT
3 - HALF DOOR TRIM PANEL
4 - INSIDE RELEASE HANDLE TO LATCH ROD

INSTALLATION

(1) Connect the latch rods to the handle.

(2) Position handle and seal in door.

(3) Install the torx screw attaching the inside handle the to door.

LATCH

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - REMOVAL)

(2) Roll window to full upward position.

(3) Disconnect the lock cylinder to latch rod. (Fig. 11)

(4) Disconnect the lock knob to latch rod.

(5) Disconnect the outside handle to latch release rod.

(6) Remove the screws attaching the latch to the door.

(7) Lower the latch in the door and disconnect the inside handle to latch rod.

(8) Remove the latch from the door.

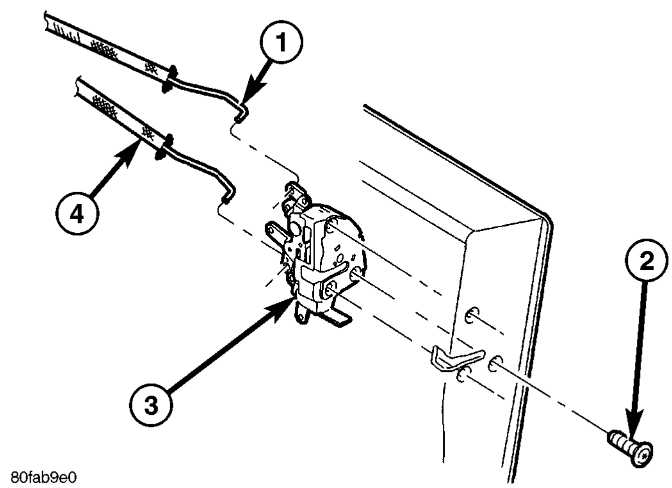

Fig. 11 DOOR LATCH ASSEMBLY

1 - RELEASE ROD
2 - SCREWS (3)
3 - LATCH ASSEMBLY
4 - LOCK ROD

INSTALLATION

(1) Position the latch in the door.

(2) Connect the inside handle to latch rod.

(3) Install the screws attaching the latch to the door.

(4) Position the door weatherstrip in place, apply adhesive as necessary.

(5) Connect the outside handle to latch rod.

(6) Connect the lock knob to latch rod.

(7) Connect the lock cylinder to latch rod.

(8) Install trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - INSTALLATION)

LATCH STRIKER

REMOVAL

(1) Remove the screws attaching the striker to the body.

(2) Separate the striker and the spacer from the body (Fig. 12).

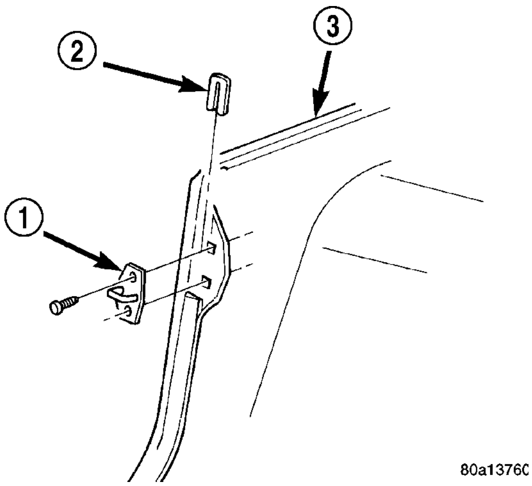

Fig. 12 LATCH STRIKER

1 - STRIKER
2 - SPACER
3 - BODY

INSTALLATION

(1) Position the striker and the spacer on the body.

(2) Install the screws attaching the striker and spacer to the body.

LOCK CYLINDER

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/FULL DOOR/TRIM PANEL - REMOVAL)

(2) Peel back waterdam.

(3) Disconnect lock cylinder to latch rod.

(4) Remove lock cylinder retaining clip.

(5) Remove the lock cylinder from the door.

INSTALLATION

(1) Install the lock cylinder in the door.

(2) Install lock cylinder retaining clip.

(3) Connect lock cylinder to latch rod.

(4) Secure the waterdam to the door.

(5) Install trim panel. (Refer to 23 - BODY/FULL DOOR/LOCK CYLINDER - INSTALLATION)

TRIM PANEL

REMOVAL

(1) Lower the window.

(2) Remove the clip attaching the window glass regulator handle to the regulator. Remove the handle.

(3) Remove the screws attaching trim panel to door (Fig. 13).

(4) Using a special tool C-4829 or equivalent, remove push-in fasteners attaching trim panel to door.

(5) Lift the trim panel upward and separate the trim panel from the door.

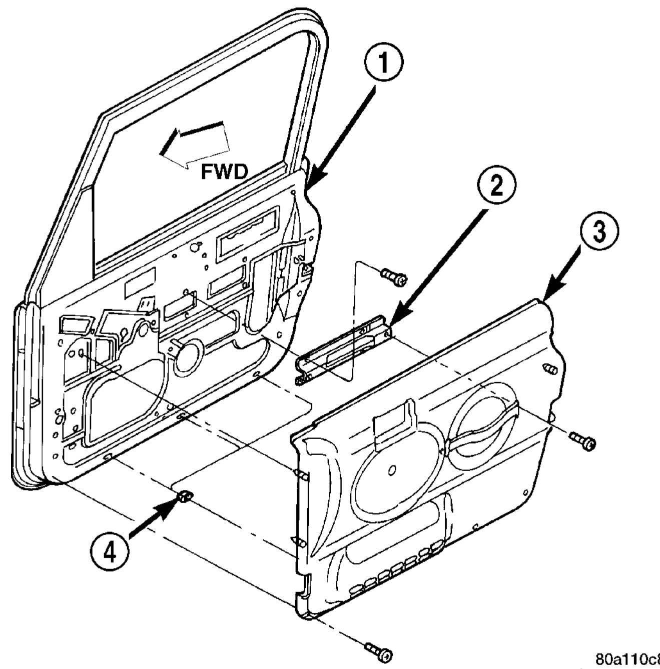

Fig. 13 FULL

1 - FULL DOOR
2 - GRAB HANDLE BRACKET
3 - TRIM PANEL
4 - NUT

INSTALLATION

(1) Position the trim panel on the door.

(2) Press the push-in fasteners attaching trim panel to door into place.

(3) Install the screws attaching trim panel to door.

(4) Position the clip on regulator handle and install the handle on the regulator.

HALF DOOR

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DOOR

REMOVAL

(1) Open the door.
(2) Disconnect the door restraint strap from the pin (Fig. 1).
(3) Remove the nuts at the door hinge pivots and lift the door from the body.

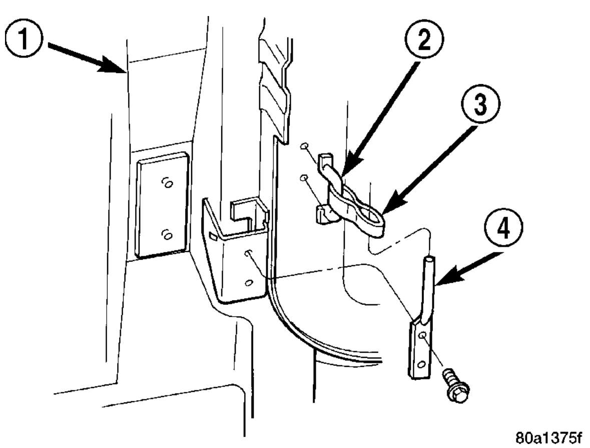

Fig. 1 RESTRAINT STRAP

1 - BODY
2 - FOOTMAN LOOP
3 - STRAP
4 - RESTRAINT PIN

INSTALLATION

(1) Position the door in the hinge and install the nuts.
(2) Connect the door restraint strap at the pin.
(3) Check for proper operation.

WINDOW

REMOVAL

(1) Open the door.
(2) Grasp the window at both front and rear edges and firmly lift upward (Fig. 2).

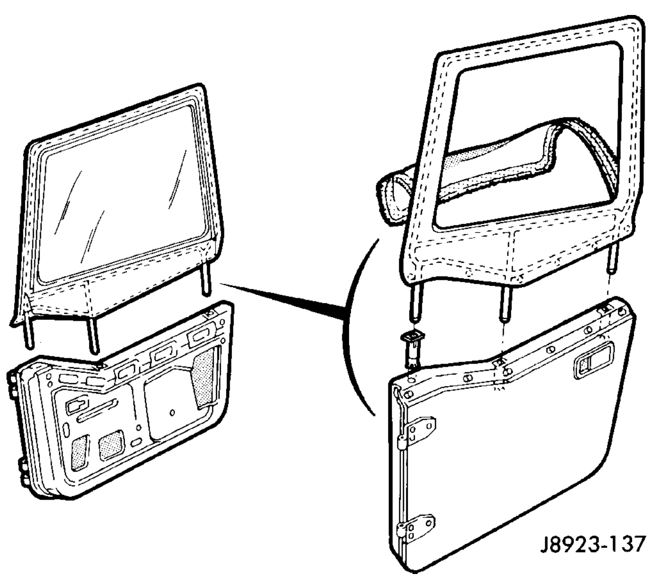

Fig. 2 HALF WINDOW

INSTALLATION

(1) Starting at the most forward alignment pin, position the window alignment pins into the restraint sleeves and push downward until seated.

EXTERIOR HANDLE

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - REMOVAL)

(2) Disconnect the outside handle to latch rod.

(3) Remove screws attaching the outside handle to the door.

(4) Separate the outside handle and seal from the door.

INSTALLATION

(1) Position the outside handle and seal in the door.

(2) Install screws attaching the outside handle to the door.

(3) Connect the outside handle to latch rod.

(4) Install trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - INSTALLATION)

HINGE

DESCRIPTION

The service procedures for the half door hinge are the same as the full door hinge. (Refer to 23 - BODY/FULL DOOR/HINGE - REMOVAL) and (Refer to 23 - BODY/FULL DOOR/HINGE - INSTALLATION).

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove the torx screw attaching the inside handle to the door.

(2) Carefully pull handle from door.

(3) Disconnect the latch rods from the handle (Fig. 3).

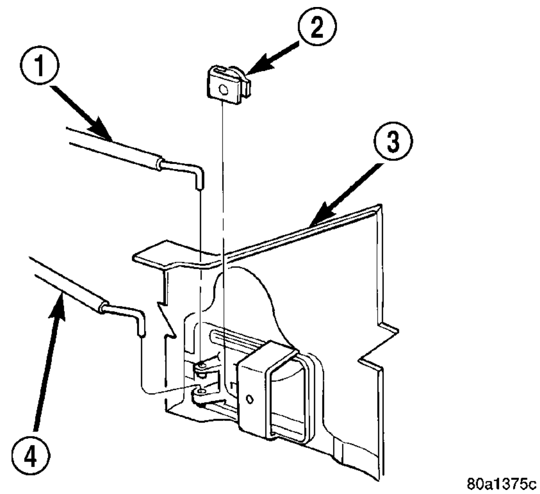

Fig. 3 INSIDE HANDLE ACTUATOR

1 - LOCK KNOB TO LATCH ROD
2 - U-NUT
3 - HALF DOOR TRIM PANEL
4 - INSIDE RELEASE HANDLE TO LATCH ROD

INSTALLATION

(1) Connect the latch rods to the handle.

(2) Position handle and seal in door.

(3) Install the torx screw attaching the inside handle the to door.

LATCH

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - REMOVAL)

(2) Disconnect the lock cylinder to latch rod (Fig. 4).

(3) Disconnect the lock knob to latch rod.

(4) Disconnect the outside handle to latch rod.

(5) Using a trim stick or equivalent, pry back the door weatherstrip at the latch to access the screw attaching the latch to the door.

(6) Remove the screws attaching the latch to the door (Fig. 5).

(7) Lower the latch in the door and disconnect the inside handle to latch rod.

(8) Remove the latch from the door.

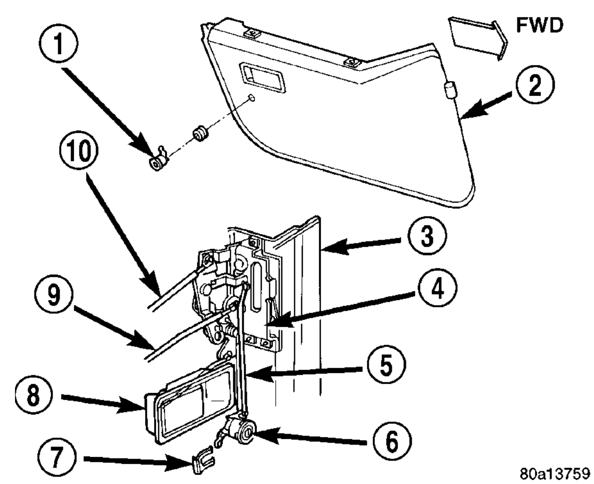

Fig. 4 HALF DOOR LATCH RODS

1 - LOCK CYLINDER
2 - HALF DOOR
3 - HALF DOOR
4 - LATCH
5 - LOCK CYLINDER TO LATCH ROD
6 - LOCK CYLINDER
7 - RETAINER
8 - OUTSIDE HANDLE
9 - INSIDE HANDLE TO LATCH ROD
10 - INSIDE LOCK TO LATCH ROD

LATCH (Continued)

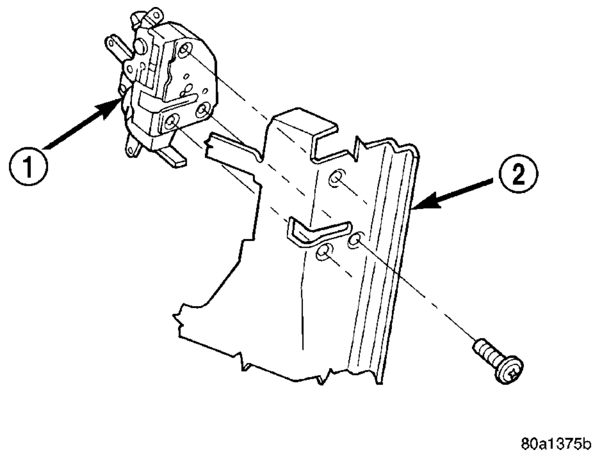

Fig. 5 DOOR LATCH

1 - LATCH
2 - HALF DOOR

INSTALLATION

(1) Position the latch in the door.
(2) Connect the inside handle to latch rod.
(3) Install the screws attaching the latch to the door.
(4) Position the door weatherstrip in place, apply adhesive as necessary.
(5) Connect the outside handle to latch rod.
(6) Connect the lock knob to latch rod.
(7) Connect the lock cylinder to latch rod (Fig. 4).
(8) Install trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - INSTALLATION)

LATCH STRIKER

REMOVAL

(1) Remove the screws attaching the striker to the body.
(2) Separate the striker and the spacer from the body (Fig. 6).

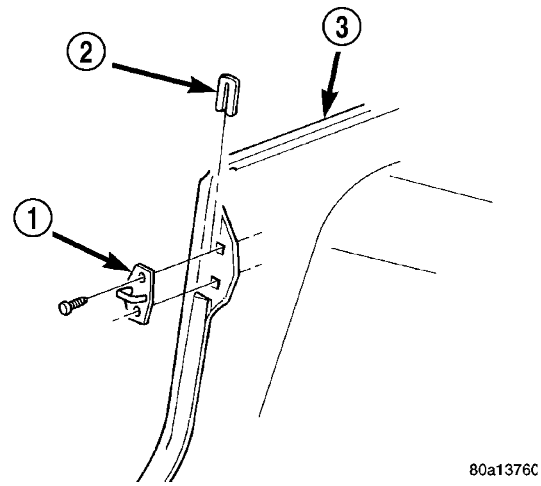

Fig. 6 LATCH STRIKER

1 - STRIKER
2 - SPACER
3 - BODY

INSTALLATION

(1) Position the striker and the spacer on the body.
(2) Install the screws attaching the striker and spacer to the body.

LOCK CYLINDER

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - REMOVAL)
(2) Disconnect lock cylinder to latch rod (Fig. 4).
(3) Remove lock cylinder retaining clip.
(4) Remove the lock cylinder from the door.

INSTALLATION

(1) Install the lock cylinder in the door.
(2) Install lock cylinder retaining clip.
(3) Connect lock cylinder to latch rod.
(4) Install trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - INSTALLATION)

TRIM PANEL

REMOVAL

(1) Remove half door window. (Refer to 23 - BODY/HALF DOOR/WINDOW - REMOVAL)
(2) Rotate window retainer sleeves 90°. Using a trim stick C-4755 or equivalent, pry sleeve retainers from door.
(3) Remove the screws attaching trim panel to door.
(4) Using a trim stick C-4829 or equivalent, remove push-in fasteners attaching trim panel to door.
(5) Separate the trim panel from the door.

INSTALLATION

(1) Position the trim panel on the door.
(2) Press the push-in fasteners attaching trim panel to door into place.
(3) Install the screws attaching trim panel to door.
(4) Position retainer sleeves into door. Rotate retainer sleeves 90° to secure into place.
(5) Install half door window. (Refer to 23 - BODY/HALF DOOR/WINDOW - INSTALLATION)

EXTERIOR

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BODY DECALS

DESCRIPTION

TJ decals are durable tape decals with a adhesive backing.

To eliminate blisters and air bubbles in a decal, pierce them with a needle or pin. Force the trapped air out of the hole.

A heat gun can also be used to remove small wrinkles and irregularities in a decal.

REMOVAL

NOTE: The key to successful decal removal is to apply heat to area and slowly peel the decal from panel.

(1) Clean the surface as necessary.

(2) Place a piece of masking tape above or below the decal as a reference mark.

(3) Start at one end of the decal and apply heat with a heat gun. Slowly peel the decal from the panel by pulling it back. **Do not pull the decal outward from the panel.**

INSTALLATION

(1) The area that will be covered by the decal must be cleaned with an cleaning solution to remove any residue paint. Freshly painted surfaces must be thoroughly dry.

(2) Clean painted surface with a commercial wax and silicone removal solution. Wipe surface with a clean cloth and allow to dry.

(3) Position decal and carrier on panel and hold it in-place with pieces masking tape.

(4) Lift the bottom edge of the decal and carrier, use the tape sections as hinges, and reverse the position of the decal and carrier.

CAUTION: Always remove the carrier from the tape stripe/decal, never remove the tape stripe/decal from the carrier.

(5) Bend a corner of the carrier outward, separate the corner of the carrier from the decal.

(6) Using the masking tape on the body panel, align the decal.

(7) Separate the carrier from one end of the decal.

(8) Hold tape decal firmly against the panel surface while separating the carrier from the decal.

(9) Inspect tape decal with reflected light to check for defects that could have developed during the installation process. Remove all air and/or moisture bubbles.

COWL GRILLE AND SCREEN

REMOVAL

(1) Remove the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

CAUTION: Use masking tape or equivalent on the wiper arm pivots to prevent damage to the cowl grille paint.

(2) Remove the four screws at the rear of the cowl grille.

(3) Open the hood and remove the screws that attach the cowl grille and screen to the cowl (Fig. 1).

(4) Remove the grille and screen from the cowl.

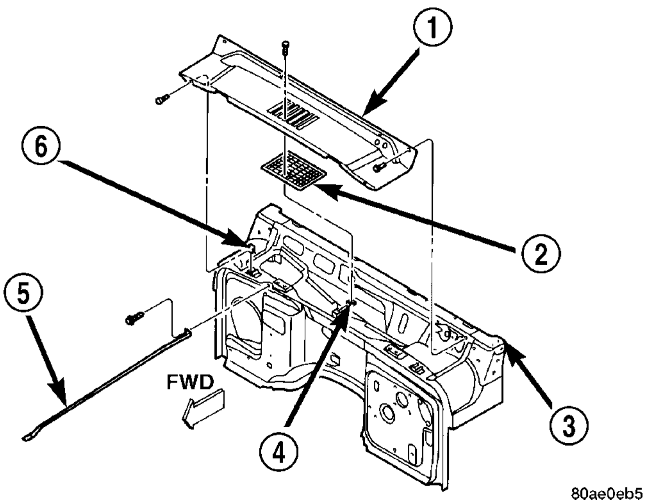

Fig. 1 COWL GRILLE AND SCREEN

1 - COWL GRILLE
2 - COWL GRILLE SCREEN
3 - COWL
4 - U NUT
5 - DASH PANEL TIE ROD
6 - U NUT

INSTALLATION

NOTE: When installing the cowl grille, ensure the snorkels on the cowl are positioned correctly and in good condition. Misaligned or damaged seals may allow water to enter the HVAC.

(1) Position the cowl screen and grille on the cowl.

(2) Install the screws that attach the grille and screen to the cowl.

(3) Remove the tape from the wiper pivots and install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

RIGHT FRONT FENDER

REMOVAL

(1) Remove the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL)

(2) Remove the air cleaner housing.

(3) Remove the bolts attaching the Power Distribution Center (PDC) to the fender.

(4) Disengage the PDC wire harness retainers on the battery tray and fender.

(5) Move and secure the PDC.

(6) Disengage the high pressure air conditioning line retainer on the fender.

(7) Disengage the front end lighting wire harness retainers on the fender.

(8) Disengage the battery temperature sensor connector.

(9) Disengage the vacuum line at the reservoir under the battery tray reinforcement bracket.

(10) Disengage the headlamp wire connector.

(11) Route the fog lamp (if equipped), park lamp and side marker wire harness through the access hole in the fender well.

(12) If equipped, remove the fender flare extension.

(13) Remove the bolts attaching the fender to the cowl (Fig. 2).

(14) Remove the bolts attaching the fender to the battery tray reinforcement bracket.

(15) Remove the bolts attaching the fender to the grille.

(16) Separate the fender from the vehicle.

INSTALLATION

Transfer all related components. Replace harness retainers if damaged.

(1) Position the fender on the vehicle.

(2) Install the bolts attaching the fender to the grille.

(3) Install the bolts attaching the fender to the battery tray reinforcement bracket.

(4) Install the bolts attaching the fender to the cowl.

(5) If equipped, install the fender flare extension and body side molding.

(6) Route the fog lamp (if equipped), park lamp and side marker wire harness through the access hole in the fender well. Seat the grommet.

(7) Engage the headlamp wire connector.

(8) Engage the battery temperature sensor connector.

(9) Engage the vacuum line at the reservoir under the battery tray reinforcement bracket.

(10) Position the front end lighting wire harness into the retainers on the fender. Engage the retainers to secure.

RIGHT FRONT FENDER (Continued)

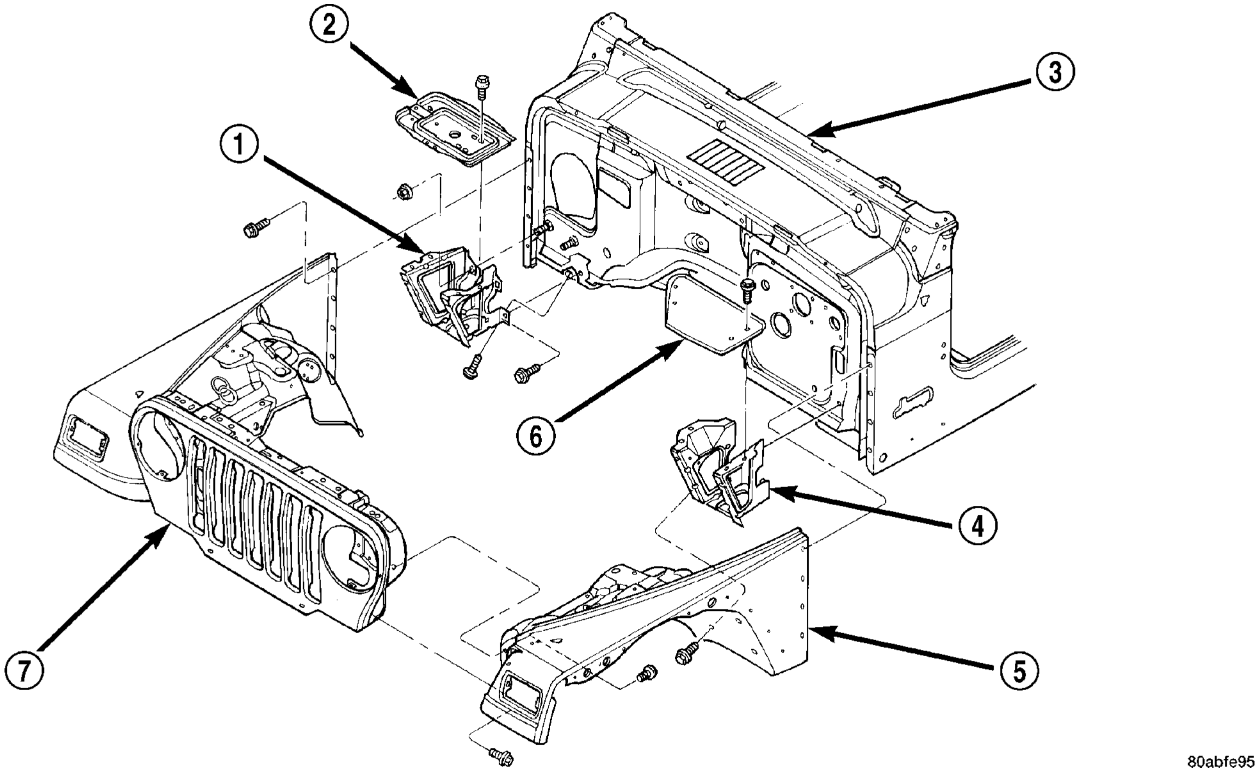

Fig. 2 FRONT FENDER

1 - REINFORCEMENT
2 - BATTERY TRAY
3 - BODY
4 - REINFORCEMENT
5 - FENDER
6 - TRAY
7 - RADIATOR GRILLE PANEL

(11) Position the high pressure air conditioning line into the retainer on the fender. Engage the retainer to secure.

(12) Position the PDC on the fender and install the bolts.

(13) Position the PDC wire harness into the retainers on the fender and battery tray. Engage the retainers to secure.

(14) Install the air cleaner housing.

(15) Install the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION)

LEFT FRONT FENDER

REMOVAL

(1) Disconnect the negative terminal on the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - REMOVAL)

(2) Remove the windshield washer reservoir.

(3) Remove horns. (Refer to 8 - ELECTRICAL/HORN/HORN - REMOVAL)

(4) Remove EVAP canister.

(5) Remove the bolts attaching the ABS Hydraulic Control Unit (HCU) to the support tray.

(6) Secure the HCU.

(7) Remove the HCU tray.

(8) Disengage the front end lighting wire harness retainers on the fender.

(9) Disengage the headlamp wire connector.

(10) Route the fog lamp (if equipped), park lamp and side marker wire harness through the access hole in the fender well.

(11) Remove the bolts attaching the fender to the cowl (Fig. 3).

(12) Remove the bolts attaching the fender to the HCU tray reinforcement bracket.

(13) Remove the bolts attaching the fender to the grille.

(14) Separate the fender from the vehicle.

INSTALLATION

Transfer all related components. Replace harness retainers if damaged.

(1) Position the fender on the vehicle.

(2) Install the bolts attaching the fender to the grille.

LEFT FRONT FENDER (Continued)

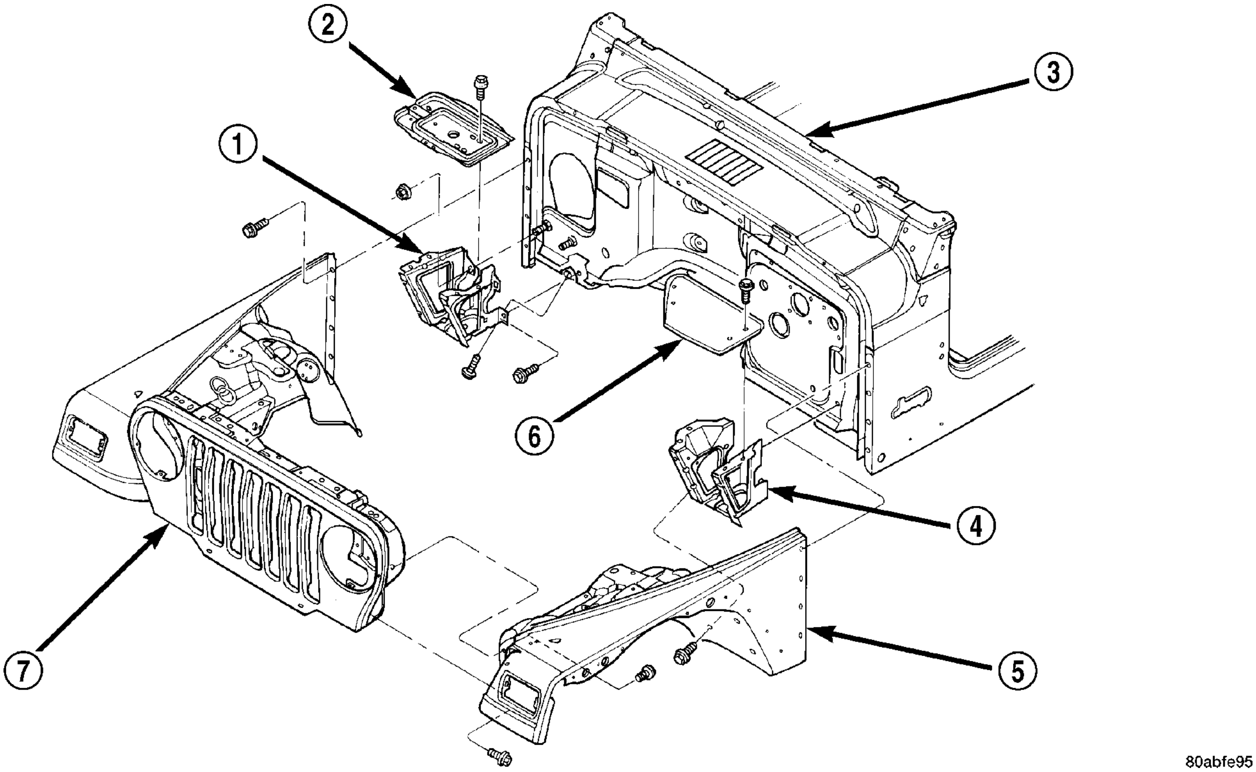

Fig. 3 FRONT FENDER

1 - REINFORCEMENT
2 - BATTERY TRAY
3 - BODY
4 - REINFORCEMENT
5 - FENDER
6 - TRAY
7 - RADIATOR GRILLE PANEL

(3) Position the front end lighting wire harness into the retainers on the fender. Engage the retainers to secure.

(4) Install the bolts attaching the fender to the HCU tray reinforcement bracket.

(5) Install the bolts attaching the fender to the cowl.

(6) If equipped, install the body side molding.

(7) Route the fog lamp (if equipped), park lamp and side marker wire harness through the access hole in the fender well. Seat the grommet.

(8) Engage the headlamp wire connector.

(9) Install the HCU tray.

(10) Position the HCU on the support tray and install the bolts.

(11) Install EVAP canister.

(12) Install horns. (Refer to 8 - ELECTRICAL/HORN/HORN - INSTALLATION)

(13) Engage horn wire connectors.

(14) Install the windshield washer reservoir.

(15) Connect the negative terminal on the battery. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/CABLES - INSTALLATION)

RADIATOR GRILLE PANEL

REMOVAL

(1) Remove the front crossmember cover.

(2) Remove the crossmember valence cover.

(3) Remove the radiator overflow bottle.

(4) Remove the bolts that attach the radiator and shroud from the grille panel.

(5) If A/C equipped:

(a) Evacuate the system.

(b) Disconnect the high and low pressure lines at the quick disconnect couplings.

(c) Cover (cap) the lines to prevent contamination.

(6) Remove the bolts attaching the radiator support rods to the grille panel.

(7) Disconnect the head lamp, turn signal, marker lamp and horn wire harness connectors.

(8) Remove the bolts attaching the fenders to the grille panel.

(9) Remove the bolt attaching the grille to the frame mount.

(10) Separate the grille from the vehicle.

RADIATOR GRILLE PANEL (Continued)

INSTALLATION

Transfer all related components.

(1) Position the grille panel on the vehicle. Ensure the rubber support bumpers are aligned (Fig. 4).

(2) Install the bolt attaching the grille to the frame mount.

(3) Install the bolts attaching the fenders to the grille panel.

(4) Connect the head lamp, turn signal, marker lamp and horn wire harness connectors.

(5) Install the bolts attaching the radiator support rods to the grille panel.

(6) If A/C equipped:

(a) Connect the high and low pressure lines at the quick disconnect couplings.

(b) Evacuate and charge the system.

(7) Install the radiator and shroud to the grille panel.

(8) Install the radiator overflow bottle.

(9) Install the crossmember valence cover.

(10) Install the front crossmember cover.

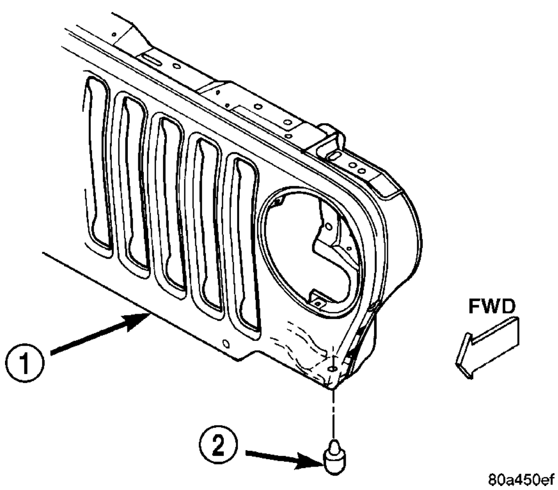

Fig. 4 GRILLE BUMPERS

1 - GRILLE PANEL
2 - BUMPER

WHEELHOUSE SPLASH SHIELD

REMOVAL

(1) Remove the plastic push pins that attach the splash shield to the wheelhouse (Fig. 5).

(2) Remove the push-in fasteners attaching the splash shield to the wheelhouse. (The push-in fasteners are molded into the splash shield.)

(3) Remove the splash shield from the wheelhouse.

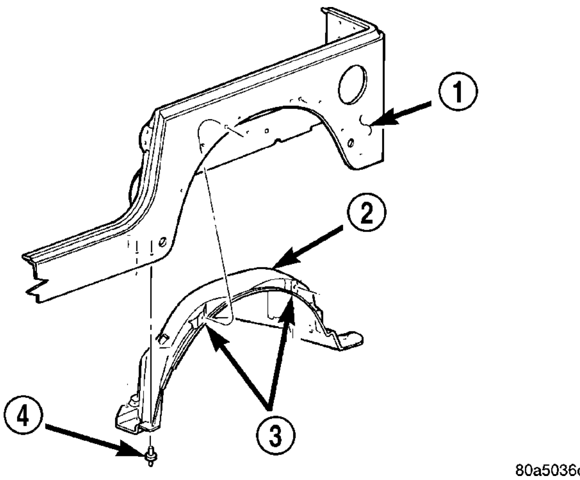

Fig. 5 Wheelhouse Splash Shield

1 - BODY
2 - WHEELHOUSE SPLASH SHIELD
3 - PUSH-IN FASTENERS
4 - RIVET

INSTALLATION

(1) Position the splash shield in the wheelhouse.

(2) Press the splash shield push-in fasteners into place.

(3) Attach the splash shield to the wheelhouse with push pins.

SIDE VIEW MIRROR

REMOVAL

(1) Remove the screws attaching the mirror to the door hinge (Fig. 6).

(2) Remove the mirror from the door hinge.

(3) Disconnect the electrical connector, if equipped.

INSTALLATION

(1) Clean the door hinge-mirror base contact surface.

(2) Position the mirror base at the door hinge.

(3) Install the three screws attaching the mirror base to the door hinge.

WHEEL OPENING FLARE MOLDING (Continued)

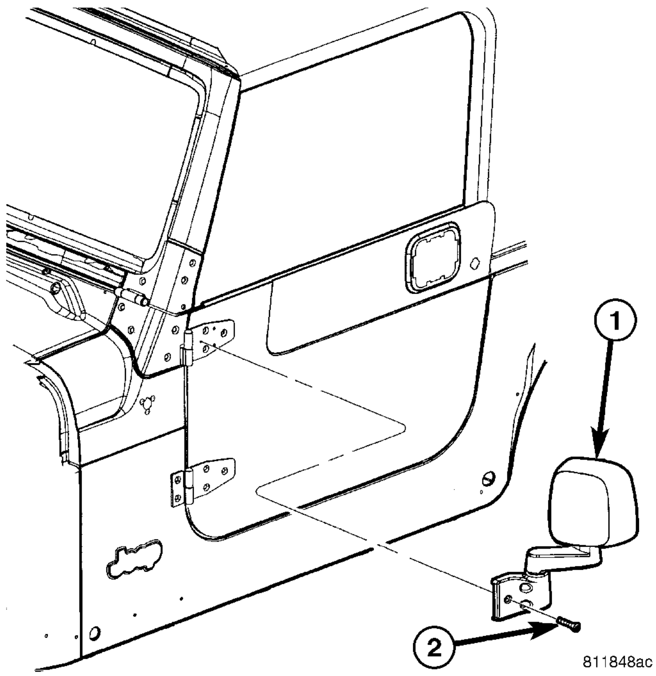

Fig. 6 SIDE VIEW MIRROR

1 - MIRROR ASSEMBLY
2 - SCREWS (3)

WHEEL OPENING FLARE MOLDING

REMOVAL

(1) Remove the side marker lamp. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/ MARKER LAMP UNIT - REMOVAL)

(2) Remove the screws that attach the flare to the front fender or rear wheelhouse (Fig. 7).

(3) Separate the flare from the body.

INSTALLATION

(1) Clean the contact surface on the body.

(2) Clean the contact surface on the flare and position it on the front fender or wheelhouse.

(3) Install the screws attaching the flares to the front fender or wheelhouse.

(4) If removed, install the side marker lamp.

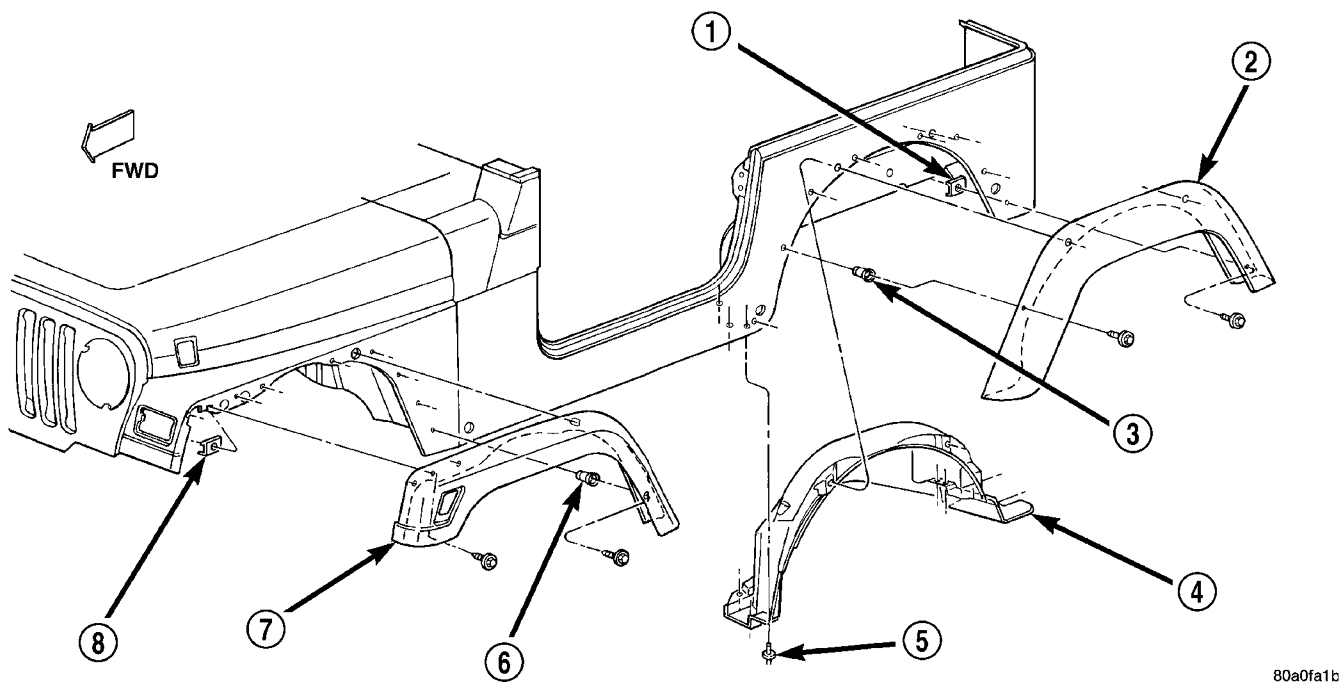

Fig. 7 FENDER FLARES

1 - U-NUT
2 - FENDER FLARE
3 - NUTSERT
4 - SPLASH SHIELD
5 - RIVET
6 - NUTSERT
7 - FENDER FLARE
8 - U-NUT

EXHAUSTER

REMOVAL

(1) Remove the spare tire carrier. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE CARRIER - REMOVAL)

(2) Using a trim stick C-4755 or equivalent, separate the exhauster from the tailgate. (Fig. 8)

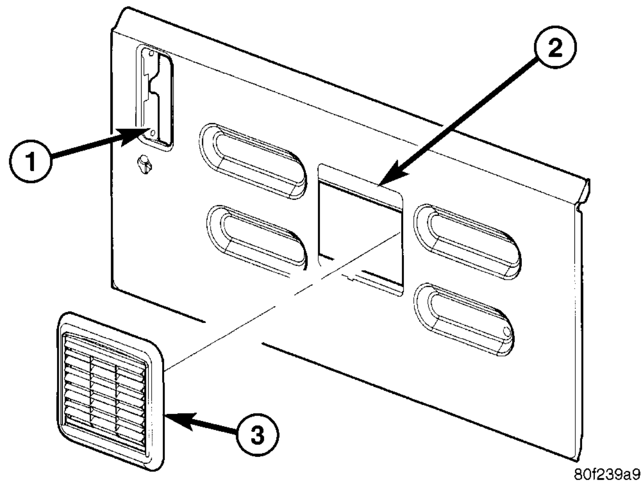

Fig. 8 BODY EXHAUSTER

1 - TAILGATE HANDLE
2 - EXHAUSTER OPENING
3 - EXHAUSTER

INSTALLATION

(1) Install the exhauster and seat fully.

(2) Install the spare tire carrier. (Refer to 22 - TIRES/WHEELS/TIRES/SPARE TIRE CARRIER - INSTALLATION)

BODY SIDE GUARD

REMOVAL

(1) Remove the bolts from the lower support tabs. (Fig. 9)

(2) Remove the side bolts and remove the side guard. (Fig. 10)

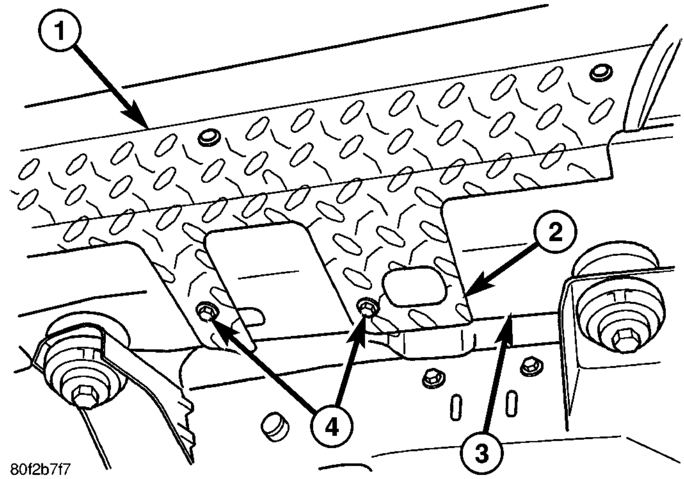

Fig. 9 SIDE GUARD - LOWER

1 - BODY SIDE GUARD
2 - SUPPORT TABS (5)
3 - BODY FLOOR SILL
4 - BOLTS (5)

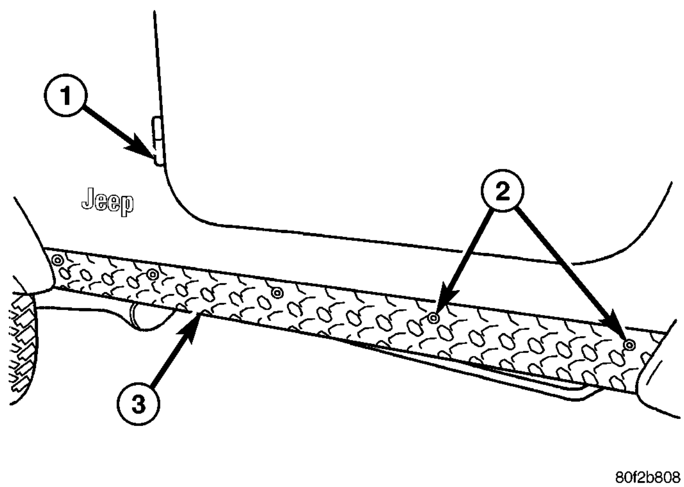

Fig. 10 SIDE GUARD - UPPER

1 - DOOR
2 - SIDE GUARD BOLTS (5)
3 - BODY SIDE GUARD

INSTALLATION

(1) Install the body side guard and install the side bolts.

(2) Tighten the bolts to 5 N·m (45 in. lbs.).

(3) Install the support tab bolts and tighten to 11 N·m (8 ft. lbs.).

SIDE STEP

REMOVAL

(1) Remove the bolts that attach the side step to the frame (Fig. 11).

(2) Tilt the step down and disengage the tabs from the frame slots.

SIDE STEP (Continued)

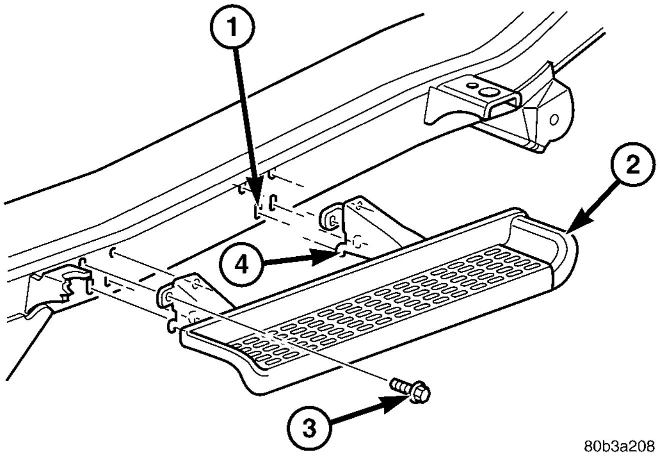

Fig. 11 SIDE STEP

1 - FRAME SLOTS
2 - SIDE STEP
3 - BOLTS
4 - STEP MOUNTING TABS

INSTALLATION

(1) Position the side step on the frame and engage the mounting tabs into the frame slots.

(2) Install the bolts that attach the side step to the frame and tighten to 21 N·m (15 ft. lbs.).

LICENSE PLATE BRACKET

REMOVAL

(1) If installed, remove the license plate.

(2) Remove the four screws attaching the license plate bracket to the body (Fig. 12).

(3) On export models remove the bolts and nuts. (Fig. 13)

(4) Separate the bracket from the body.

(5) Disconnect the electrical connectors, if equipped.

INSTALLATION

(1) Connect the electrical connectors, if equipped.

(2) Position the bracket on the body.

(3) Install the four screws attaching the license plate bracket to the body.

(4) On export models, install the six bolts and four nuts.

(5) If removed, install the license plate.

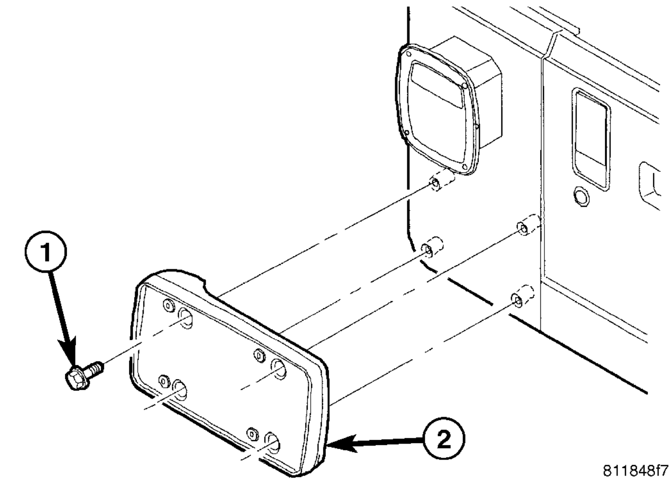

Fig. 12 LICENSE PLATE BRACKET

1 - BOLTS (4)
2 - BRACKET

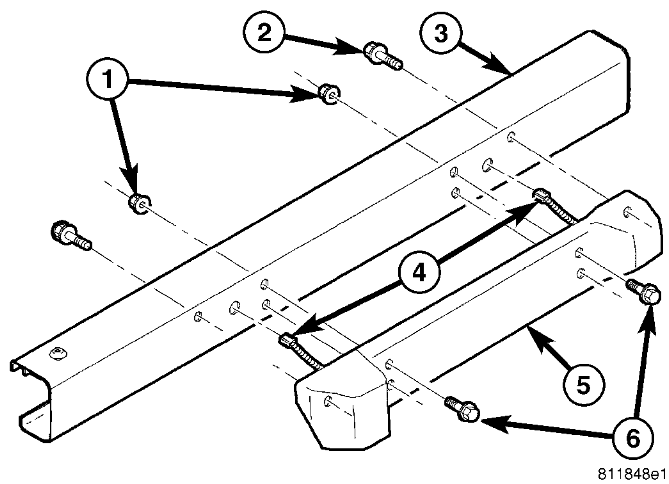

Fig. 13 LICENSE PLATE BRACKET - EXPORT

1 - NUTS (4)
2 - BOLTS (2)
3 - BUMPER
4 - ELECTRICAL CONNECTORS
5 - LICENSE PLATE BRACKET
6 - BOLTS (4)

HOOD

TABLE OF CONTENTS

HINGE

REMOVAL

(1) Remove the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

(2) Remove the cowl panel and screen. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL)

(3) Remove the bolts attaching the hinge to the cowl.

(4) Using a wax pencil, mark the position of the hinge on the hood for installation alignment reference.

(5) Remove the screws attaching the hinge to the hood (Fig. 1).

(6) Separate the hinge from the hood.

INSTALLATION

(1) Prepare and paint the replacement hinge to match the body paint color.

(2) Align the hinge with the installation reference marks on the hood

(3) Install the screws attaching the hinge to the hood and cowl and tighten the to 24 N·m (18 ft. lbs.).

(4) Install the bolts attaching the hinge to the cowl.

(5) Install the cowl panel and screen. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - INSTALLATION)

(6) Install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

HOOD

REMOVAL

(1) Raise and support the hood.

(2) Disconnect the underhood lamp wire harness connector.

(3) Disconnect the windshield washer nozzles.

(4) Disconnect the ground strap.

(5) Mark the position of the hinges on the hood for installation alignment reference.

(6) Remove the screws attaching the hood to the hinge and remove the hood (Fig. 1).

(7) If the hood must be replaced, remove and transfer the insulator panel, hinges, latches, bumpers, brackets, footman loop, hood lamp, support rod, and safety latch to the replacement hood (Fig. 1).

INSTALLATION

(1) Position the hood on the vehicle and install the screws attaching the hinge to the hood.

(2) Align the hinges with the installation reference marks on the hood and tighten the hinge screws to 24 N·m (18 ft. lbs.).

(3) Connect the underhood lamp wire harness connector.

(4) Connect the windshield washer nozzles.

(5) Connect the ground strap.

ADJUSTMENTS

ADJUSTMENT

The hood hinge screw holes are oversized to facilitate hood adjustment movement.

(1) Loosen the screws.

(2) Move the hood in the direction(s) required for correct alignment.

(3) Tighten the screws.

HOOD (Continued)

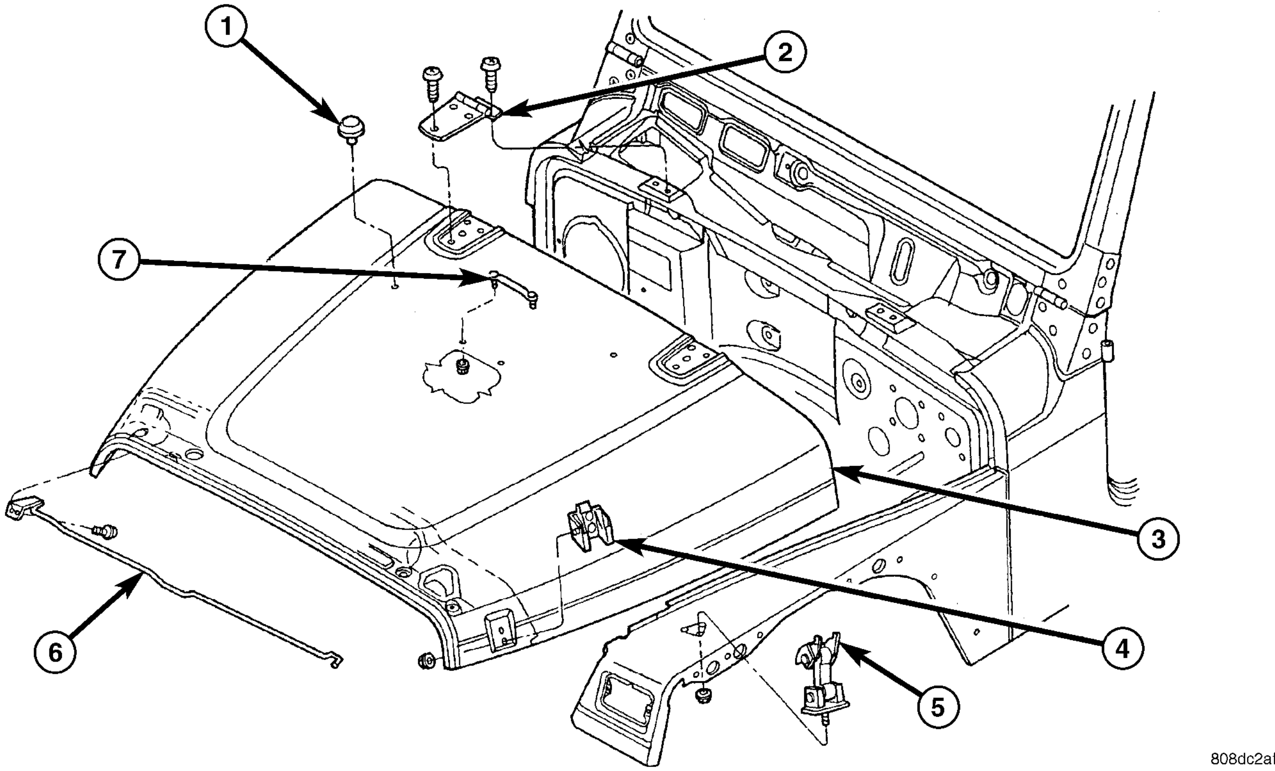

Fig. 1 HOOD COMPONENTS

1 - WINDSHIELD REST BUMPER
2 - HOOD HINGE
3 - HOOD
4 - HOOD CATCH BRACKET
5 - HOOD CATCH
6 - PROP ROD
7 - WINDSHIELD HOOD DOWN LOOP

HOOD SAFETY LATCH

REMOVAL

(1) Raise and support the hood.

(2) Remove the bolt attaching the safety latch to the hood (Fig. 2).

(3) Remove the latch from the hood.

INSTALLATION

(1) Position the latch on the hood.

(2) Install the bolt attaching the safety latch to the hood and tighten to 9 N·m (80 in. lbs.).

(3) Remove the support rod and close the hood.

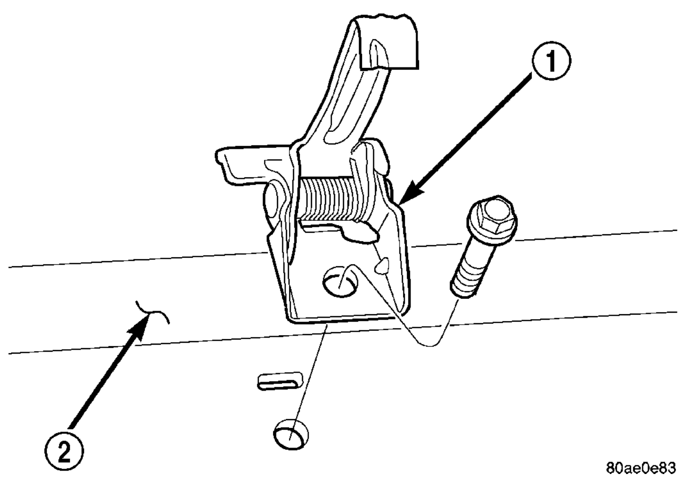

Fig. 2 HOOD SAFETY LATCH

1 - SAFETY LATCH
2 - HOOD

INSTRUMENT PANEL

TABLE OF CONTENTS

ACCESSORY SWITCH BEZEL

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CENTER BEZEL - REMOVAL).

(3) Remove the four screws that secure the accessory switch bezel to the instrument panel (Fig. 1).

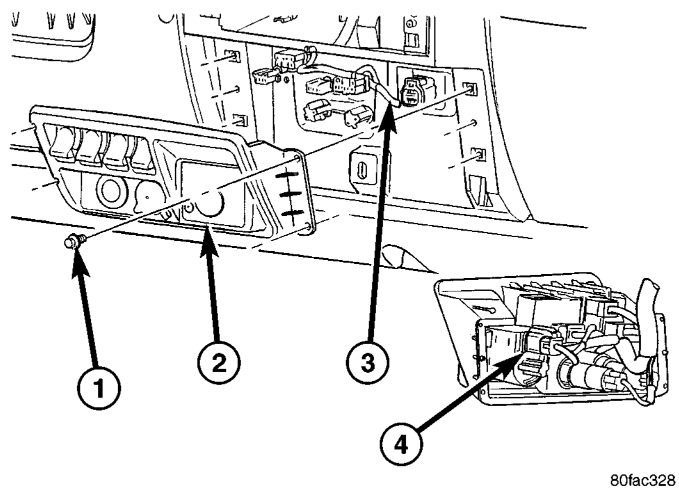

Fig. 1 ACCESSORY SWITCH BEZEL

1 - BEZEL SCREWS (4)
2 - BEZEL
3 - WIRE HARNESS
4 - ELECTRICAL CONNECTORS (7)

ACCESSORY SWITCH BEZEL (Continued)

(4) Pull the accessory switch bezel away from the instrument panel far enough to access the instrument panel wire harness connectors.

(5) Disconnect the instrument panel wire harness connectors from the connector receptacles for the accessory switches and the cigar lighter/power outlet on the back of the accessory switch bezel.

(6) Remove the accessory switch bezel from the instrument panel.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the accessory switch bezel to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors to the connector receptacles for the accessory switches and the cigar lighter/power outlet on the back of the accessory switch bezel.

(3) Position the accessory switch bezel onto the instrument panel.

(4) Install and tighten the four screws that secure the accessory switch bezel to the instrument panel. Tighten the screws to 2 N·m (20 in. lbs.).

(5) Reinstall the center bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CENTER BEZEL - INSTALLATION).

(6) Reconnect the battery negative cable.

AXLE LOCK SWITCH

DESCRIPTION

If equipped, the Axle Lock switch is located in the Accessory Switch Bezel, below the HVAC controls. The switch will activate the Rear Axle locker and Rear/Front Axle locker. The switch is a double-action momentary rocker type. The Axle Lock Switch is secured by a snap fit within the bezel. The axle Lock Switch cannot be repaired and, if faulty or damaged, the entire switch must be replaced.

OPERATION

The Axle Lock switch receives battery current on a fused B(+) circuit from a fuse in the Power Distribution Center (PDC). The switch is grounded at all times. The Axle Lock switch is only operational when the instrument cluster sends an activation signal to the switch logic.

With the transfer case in the 4WD Low Range and the vehicle speed below 10 MPH (16kph), a momentary push to the lower portion of the rocker switch to Lock:

- 1st Push: Rear Axle Locked
- 2nd Push: Rear and Front Axle Locked

Momentary pushes, will toggle between Rear Axle Locked or Rear/Front Axle Locked. A momentary push to the upper portion of the rocker switch to “OFF”, (both axles unlocked).

DIAGNOSIS AND TESTING - AXLE LOCK SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to step 2. If not, repair the shorted circuit or component required and replace the fuse.

(2) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to step 3. If not, repair the open B(+) circuit to the fuse.

(3) Turn the ignition to the off position. Disconnect and isolate the negative battery cable. Remove the Axle Lock switch. Disconnect the switch harness connector. Check for continuity between the fuse cavity in the PDC and the Fused B(+) circuit in the switch harness connector. If OK got to step 4. If not OK, repair the open Fused B(+) circuit.

(4) Turn the ignition to the off position. Disconnect and isolate the negative battery cable. Remove the Axle Lock switch. disconnect the switch harness connector. check for continuity between the switch ground and a known good ground. If OK got to step 5. If not OK, repair open ground circuit.

AXLE LOCK SWITCH (Continued)

(5) Turn the ignition to the OFF position. Disconnect and isolate the negative battery cable. Remove the Instrument Cluster. Disconnect the cluster harness connectors C1 and C2. Check for continuity between each of the Enable circuits and each of the request circuits between the switch harness connector and the cluster harness connectors. If OK go to step 6. If not OK, repair the circuits as required.

(6) Turn the ignition to the OFF position. Disconnect and isolate the negative battery cable. Remove the axle Lock switch. Disconnect the switch harness connector. Check for continuity between each of the Request circuits, between the switch harness connector and each of the Locker relays in the PDC. If OK, refer to Axle Lock Indicator Problems in the Instrument Cluster section of the appropriate Body Manual or the Chassis Diagnostic Manual and perform the appropriate symptom. If not OK, repair the circuit(s) as required.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the accessory switch bezel from the instrument panel center bezel from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL)

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the latch tabs at the top and bottom of the axle lock switch on the back of the accessory switch bezel far enough to disengage the snap features on the switch housing then pull the switch out of the receptacle (Fig. 2).

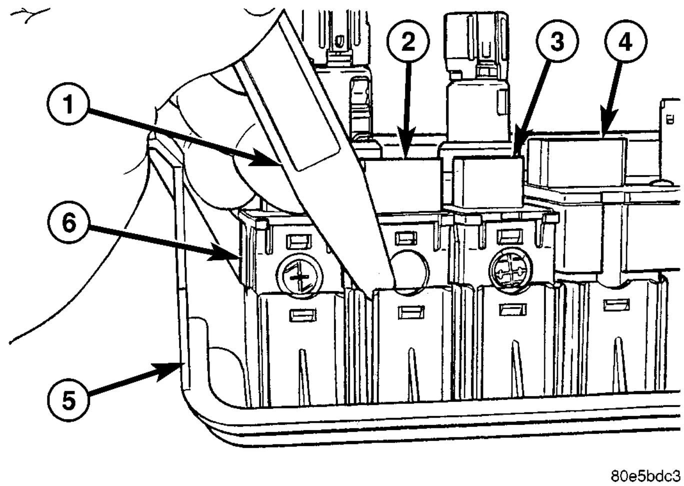

Fig. 2 ACCESSORY SWITCH REMOVE

1 - TRIM STICK
2 - REAR WIPER/WASHER SWITCH
3 - OVERDRIVE-OFF SWITCH
4 - AXLE LOCKER SWITCH
5 - ACCESSORY SWITCH BEZEL
6 - REAR WINDOW DEFOGGER SWITCH

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the axle lock switch over the proper receptacle on the back of the accessory switch bezel (Fig. 2).

(2) Evenly push the axle lock switch into the receptacle until the snap features on the top and bottom of the switch housing are fully engaged to the receptacle.

(3) Reinstall the accessory switch bezel onto the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION).

(4) Reconnect the battery negative cable.

BASE TRIM

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(3) Remove the accessory switch bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL).

(4) Remove the grab handle bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE BEZEL - REMOVAL).

(5) Remove the speakers from the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL).

(6) Remove the radio from the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).

(7) Remove the heater-A/C control from the instrument panel. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C-HEATER CONTROL - REMOVAL).

(8) Remove the outboard heater-A/C panel outlet barrels from the instrument panel. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/PANEL OUTLET BARRELS - REMOVAL).

(9) Remove the instrument panel from the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(10) Place the instrument panel on a suitable work surface. Be certain to take the proper precautions to protect the instrument panel from any possible cosmetic damage.

(11) Remove the passenger airbag door from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG DOOR - REMOVAL).

(12) Remove the two screws that secure the 16-way data link connector to the instrument panel.

(13) Remove all of the screws around the perimeter of the instrument panel that secure the base trim to the structural support.

(14) Remove the base trim from the instrument panel structural support.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the base trim onto the instrument panel structural support.

(2) Install and tighten all of the screws around the perimeter of the instrument panel that secure the base trim to the structural support. Tighten the screws to 2 N·m (20 in. lbs.).

(3) Install and tighten the two screws that secure the 16-way data link connector to the instrument panel. Tighten the screws to 2 N·m (20 in. lbs.).

(4) Reinstall the passenger airbag door into the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG DOOR - INSTALLATION).

(5) Reinstall the instrument panel into the vehicle. (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

(6) Reinstall the outboard heater-A/C panel outlet barrels into the instrument panel. (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/PANEL OUTLET BARRELS - INSTALLATION).

(7) Reinstall the heater-A/C control into the instrument panel. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C-HEATER CONTROL - INSTALLATION).

(8) Reinstall the radio into the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).

(9) Reinstall the speakers into the instrument panel. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).

BASE TRIM (Continued)

(10) Reinstall the grab handle bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE BEZEL - INSTALLATION).

(11) Reinstall the accessory switch bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION).

(12) Reinstall the instrument cluster into the instrument panel. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

(13) Reconnect the battery negative cable.

CENTER BEZEL

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - REMOVAL).

(3) Remove the two screws that secure the top of the center bezel to the top of the instrument panel structural support. (Fig. 3)

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the lower edge of the center bezel away from the instrument panel.

(5) Pull the lower edge of the center bezel away from the instrument panel far enough to disengage the four snap clip retainers that secure it to the receptacles in the instrument panel base trim.

(6) Remove the center bezel from the instrument panel.

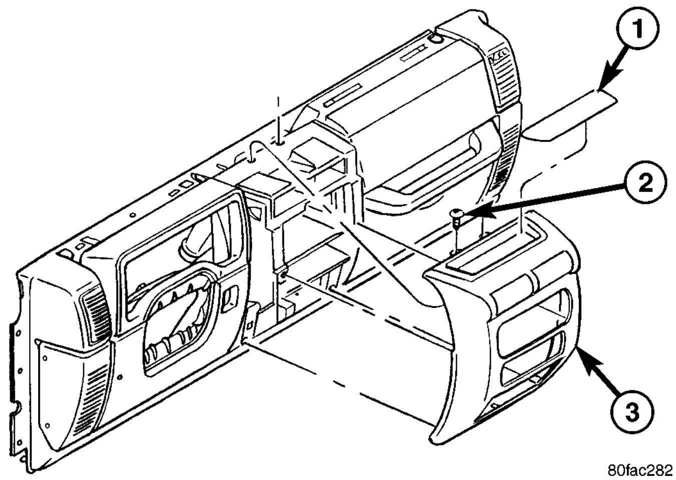

Fig. 3 CENTER BEZEL

1 - BEZEL MAT
2 - TOP SCREWS (2)
3 - CENTER BEZEL

INSTALLATION

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(1) Position the center bezel onto the instrument panel.

(2) Align the snap clips on the center bezel with the receptacles in the instrument panel base trim.

(3) Using hand pressure, press firmly on the center bezel over each of the snap clip locations until each of the snap clips is fully engaged in its receptacle in the instrument panel base trim.

(4) Install and tighten the two screws that secure the top of the center bezel to the top of the instrument panel structural support. Tighten the screws to 2 N·m (20 in. lbs.).

(5) Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - INSTALLATION).

(6) Reconnect the battery negative cable.

CLUSTER BEZEL

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - REMOVAL).

(4) Remove the two screws that secure the lower mounting tabs of the cluster bezel to the instrument panel (Fig. 4).

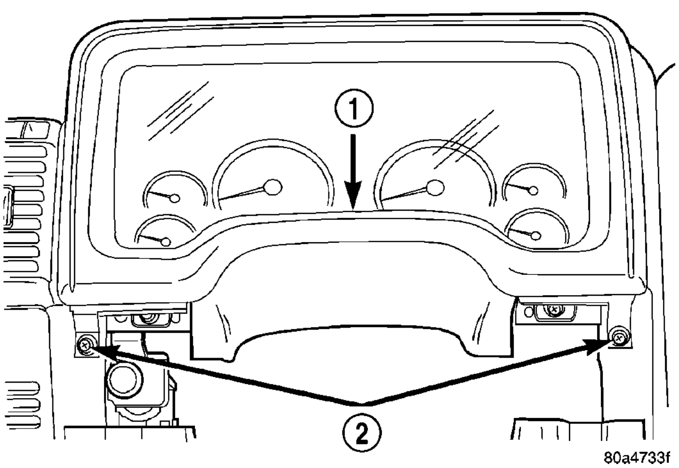

Fig. 4 CLUSTER BEZEL LOWER SCREWS REMOVE/INSTALL

1 - CLUSTER BEZEL
2 - SCREW (2)

(5) Remove the three screws that secure the upper mounting flange of the cluster bezel to the top of the instrument panel (Fig. 5).

(6) Remove the cluster bezel from the instrument panel.

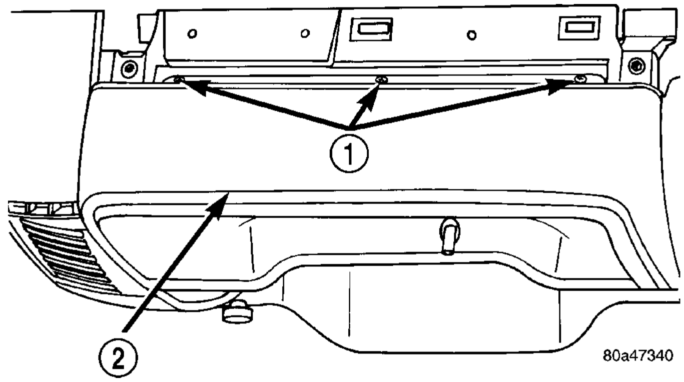

Fig. 5 CLUSTER BEZEL UPPER SCREWS REMOVE/INSTALL

1 - SCREW (3)
2 - CLUSTER BEZEL

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the cluster bezel onto the instrument panel.

(2) Install and tighten the three screws that secure the upper mounting flange of the cluster bezel to the top of the instrument panel (Fig. 5). Tighten the screws to 2 N·m (20 in. lbs.).

(3) Install and tighten the two screws that secure the lower mounting tabs of the cluster bezel to the instrument panel (Fig. 4). Tighten the screws to 2 N·m (20 in. lbs.).

(4) Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - INSTALLATION).

(5) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(6) Reconnect the battery negative cable.

GLOVE BOX

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Release the glove box latch and open the glove box door.

(3) While supporting the glove box door with one hand, grasp the check strap as close to the glove box door as possible and slide the rolled end of the check strap out of the slot in the edge of the door (Fig. 6).

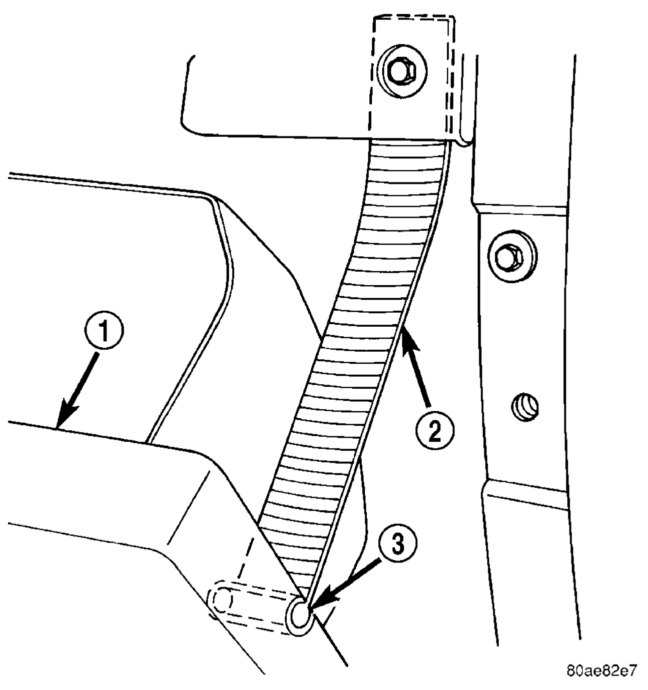

Fig. 6 GLOVE BOX REMOVE/INSTALL

1 - GLOVE BOX DOOR
2 - CHECK STRAP
3 - SLOT

(4) Lower the glove box door far enough to disengage the hinge hook formations on the lower edge of the door from the hinge pins on the lower edge of the instrument panel.

(5) Remove the glove box from the instrument panel.

DISASSEMBLY

Some of the components of the glove box used in this vehicle are serviced individually. The serviced components include the glove box latch and handle unit, and the glove box lock cylinder (Fig. 7). Following are the procedures for disassembling these components from the glove box.

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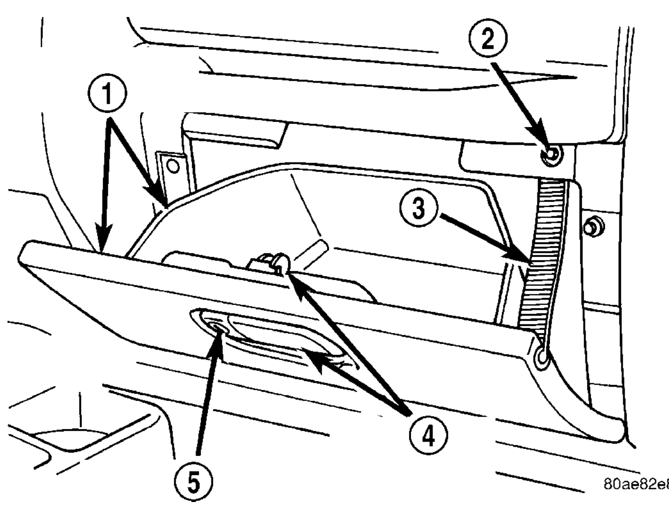

Fig. 7 GLOVE BOX COMPONENTS

1 - GLOVE BOX DOOR AND BIN
2 - SCREW
3 - CHECK STRAP
4 - LATCH AND HANDLE
5 - LOCK CYLINDER

GLOVE BOX LATCH AND HANDLE

(1) Disconnect and isolate the battery negative cable.

GLOVE BOX (Continued)

(2) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - REMOVAL).

(3) Remove the four screws that secure the glove box latch and handle to the glove box door from the inside of the glove box.

(4) Remove the latch and handle from the inside of the glove box door.

GLOVE BOX LOCK CYLINDER

(1) Remove the glove box latch and handle unit from the glove box. Refer to GLOVE BOX LATCH AND HANDLE.

(2) Insert the key into the glove box lock cylinder.

(3) Insert a small screwdriver into the retaining tumbler release slot and depress the retaining tumbler (Fig. 8).

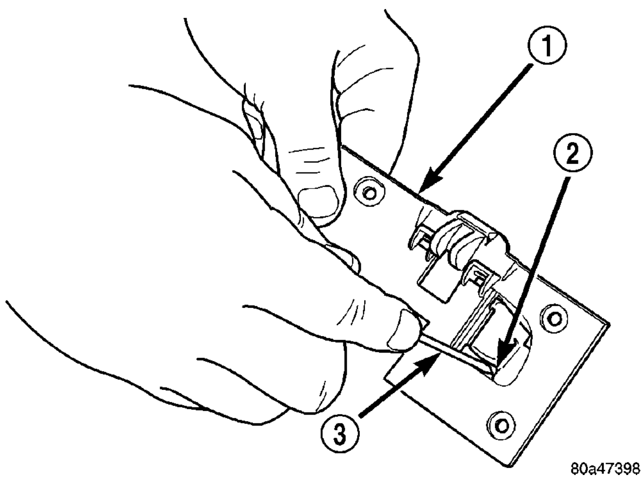

Fig. 8 GLOVE BOX LOCK CYLINDER REMOVE/ INSTALL

1 - GLOVE BOX LATCH
2 - RELEASE SLOT
3 - SMALL SCREWDRIVER

(4) Using a gentle twisting and pulling action with the key, pull the lock cylinder out of the glove box latch and handle unit.

ASSEMBLY

Some of the components of the glove box used in this vehicle are serviced individually. The serviced components include the glove box latch and handle unit, and the glove box lock cylinder (Fig. 7). Following are the procedures for assembling these components onto the glove box.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

GLOVE BOX LATCH AND HANDLE

(1) Position the latch and handle onto the inside of the glove box door.

(2) Install and tighten the four screws that secure the glove box latch and handle to the glove box door from the inside of the glove box. Tighten the screws to 2 N·m (20 in. lbs.).

(3) Reinstall the glove box onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - INSTALLATION).

(4) Reconnect the battery negative cable.

GLOVE BOX LOCK CYLINDER

(1) Insert the key into the glove box lock cylinder.

(2) Using a gentle twisting and pushing action on the key, push the lock cylinder into the glove box latch and handle unit.

(3) Reinstall the glove box latch and handle onto the glove box. Refer to GLOVE BOX LATCH AND HANDLE.

INSTALLATION

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(1) Position the glove box to the instrument panel.

(2) Engage the hinge hook formations on the lower edge of the glove box door with the hinge pins on the lower edge of the instrument panel.

(3) Tilt the upper edge of the glove box door up toward the instrument panel far enough to engage the check strap with the door (Fig. 6).

GLOVE BOX (Continued)

(4) While supporting the glove box door with one hand, grasp the check strap as close to the glove box door as possible and slide the rolled end of the check strap into the slot in the edge of the door.
(5) Close and latch the glove box door.
(6) Reconnect the battery negative cable.

GLOVE BOX CHECK STRAP

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.
(2) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).
(3) Remove the screw that secures the glove box check strap to the instrument panel on the upper glove box opening reinforcement (Fig. 9).

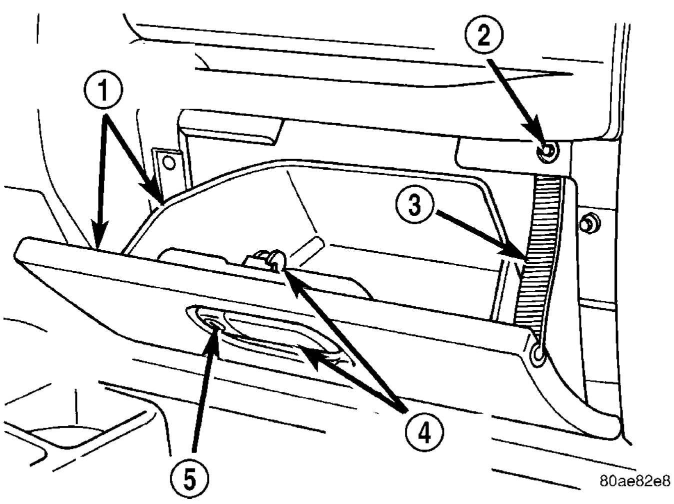

Fig. 9 GLOVE BOX CHECK STRAP

1 - GLOVE BOX DOOR AND BIN
2 - SCREW
3 - CHECK STRAP
4 - LATCH AND HANDLE
5 - LOCK CYLINDER

(4) Remove the check strap from the upper glove box opening reinforcement.

INSTALLATION

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(1) Position the check strap to the upper glove box opening reinforcement (Fig. 9).
(2) Install and tighten the screw that secures the glove box check strap to the upper glove box opening reinforcement. Tighten the screw to 2 N·m (20 in. lbs.).
(3) Reinstall the glove box onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).
(4) Reconnect the battery negative cable.

GLOVE BOX LATCH STRIKER

REMOVAL

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(1) Disconnect and isolate the battery negative cable.
(2) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

GLOVE BOX LATCH STRIKER (Continued)

(3) Remove the two screws that secure the latch striker to the upper glove box opening reinforcement (Fig. 10).

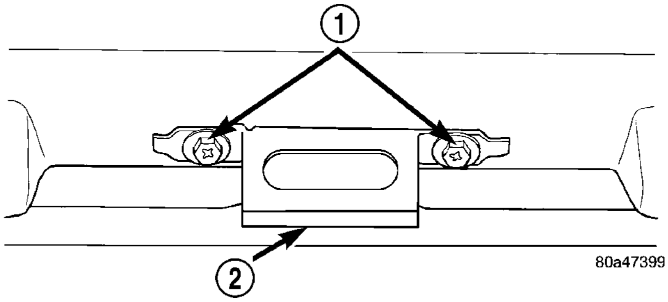

Fig. 10 GLOVE BOX LATCH STRIKER REMOVE/ INSTALL

1 - SCREW (2)
2 - LATCH STRIKER

(4) Remove the latch striker from the upper glove box opening reinforcement.

INSTALLATION

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(1) Position the latch striker onto the upper glove box opening reinforcement (Fig. 10).
(2) Install and tighten the two screws that secure the latch striker to the upper glove box opening reinforcement. Tighten the screws to 2 N·m (20 in. lbs.).
(3) Reinstall the glove box onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - INSTALLATION).
(4) Reconnect the battery negative cable.

GRAB HANDLE

REMOVAL

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(1) Disconnect and isolate the battery negative cable.
(2) Remove the glove box from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ GLOVE BOX - REMOVAL).
(3) Reach through and above the glove box opening to access and remove the two nuts that secure the stud on each end of the grab handle to the instrument panel structural support (Fig. 11). Discard the used grab handle mounting nuts.

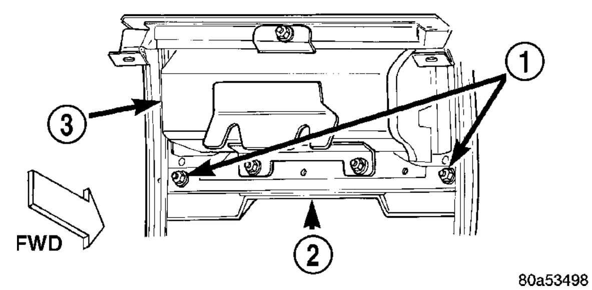

Fig. 11 GRAB HANDLE REMOVE/INSTALL

1 - NUT (2)
2 - GLOVE BOX OPENING
3 - PASSENGER AIRBAG

(4) Remove the grab handle from the face of the instrument panel.

INSTALLATION

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GRAB HANDLE (Continued)

(1) Position the grab handle onto the face of the instrument panel.

NOTE: Always use new fasteners to install the grab handle. The removed grab handle fasteners should be discarded.

(2) Reach through and above the glove box opening to install and tighten two new nuts to secure the stud on each end of the grab handle to the instrument panel structural support (Fig. 11). Tighten the nuts to 6 N·m (50 in. lbs.).

(3) Reinstall the glove box into the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(4) Reconnect the battery negative cable.

GRAB HANDLE BEZEL

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Remove the grab handle from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE - REMOVAL).

(3) Remove the glove box latch striker from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX LATCH STRIKER - REMOVAL).

(4) Remove the two screws that secure the grab handle bezel to the upper glove box opening reinforcement (Fig. 12).

(5) Remove the grab handle bezel from the instrument panel.

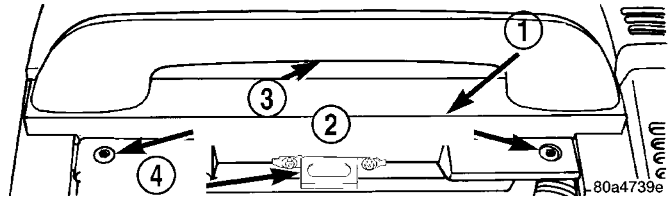

Fig. 12 GRAB HANDLE BEZEL REMOVE/INSTALL

1 - GRAB HANDLE BEZEL
2 - SCREW (2)
3 - GRAB HANDLE
4 - LATCH STRIKER

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the grab handle bezel onto the instrument panel (Fig. 12).

(2) Install and tighten the two screws that secure the grab handle bezel to the upper glove box opening reinforcement. Tighten the screws to 2 N·m (20 in. lbs.).

(3) Reinstall the glove box latch striker onto the glove box opening upper reinforcement (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX LATCH STRIKER - INSTALLATION).

(4) Reinstall the grab handle onto the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GRAB HANDLE - INSTALLATION).

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL ASSEMBLY

REMOVAL

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NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(3) Remove the steering column from the vehicle, but do not remove the driver airbag, the steering wheel, or the switches from the steering column. Be certain that the steering wheel is locked and secured from rotation to prevent the loss of clockspring centering. (Refer to 19 - STEERING/COLUMN - REMOVAL).

(4) From beneath the driver side end of the instrument panel, perform the following:

(a) Disconnect the instrument panel wire harness connectors from the 100-way cross body wire harness connector near the left cowl side inner panel.

(b) Disconnect the driver side window demister hose at the heater-A/C housing demister/defroster duct.

(5) Remove the glove box from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(6) Reach through the instrument panel glove box opening to perform the following:

(a) Disconnect the heater-A/C control vacuum harness connector from the heater-A/C housing vacuum harness connector.

(b) Disconnect the instrument panel wire harness connector from the heater-A/C housing wire harness connector.

(c) Disconnect the cross body wire harness connector from the passenger airbag pigtail wire connector.

(d) Disconnect the passenger side window demister hose at the heater-A/C housing demister/defroster duct.

(e) Disconnect the two halves of the radio antenna coaxial cable connector.

(f) Remove the two nuts that secure the passenger airbag lower bracket to the studs on the dash panel (Fig. 13).

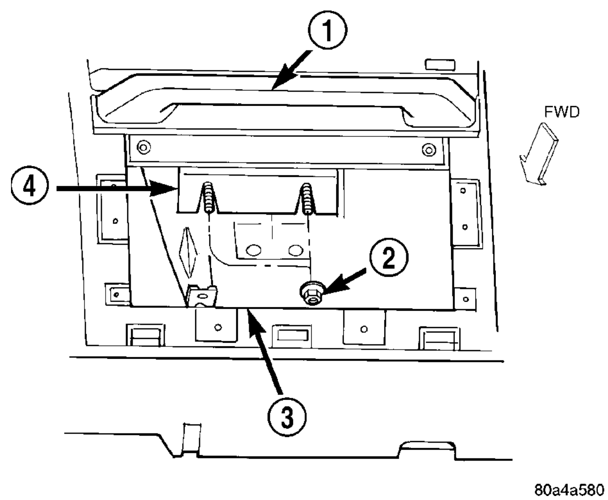

Fig. 13 PASSENGER AIRBAG LOWER BRACKET NUTS REMOVE/INSTALL

1 - GRAB HANDLE
2 - NUT (2)
3 - GLOVE BOX OPENING
4 - PASSENGER AIRBAG LOWER BRACKET

(7) Remove the top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - REMOVAL).

(8) Remove the three screws that secure each end of the instrument panel structural support to the cowl side inner panels at the front of each door opening (Fig. 14).

(9) Remove the four nuts that secure the top of the instrument panel structural support to the studs on the top of the dash panel.

(10) With the aid of an assistant, lift the instrument panel off of the dash panel studs and remove it from the vehicle.

INSTRUMENT PANEL ASSEMBLY (Continued)

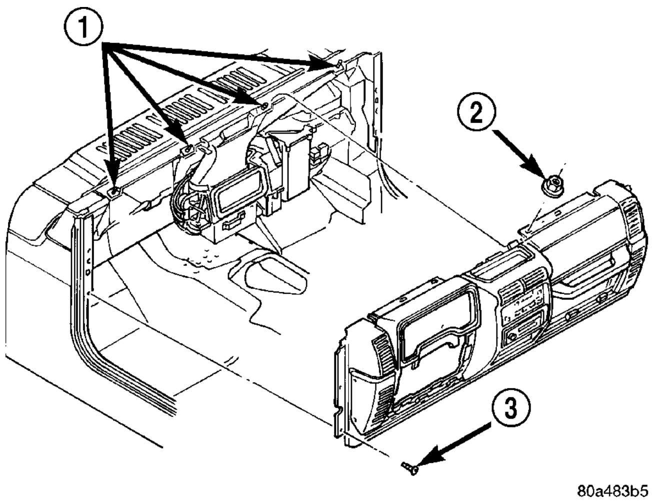

Fig. 14 INSTRUMENT PANEL REMOVE/INSTALL

1 - STUD (4)
2 - NUT (4)
3 - SCREW (6)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) With the aid of an assistant, position the instrument panel into the vehicle and onto the dash panel studs (Fig. 14).

(2) Install and tighten the four nuts that secure the top of the instrument panel structural support to the studs on the top of the dash panel. Tighten the nuts to 12 N·m (105 in. lbs.).

(3) Install and tighten the three screws that secure each end of the instrument panel structural support to the cowl side inner panels at the front of each door opening. Tighten the screws to 12 N·m (105 in. lbs.).

(4) Reinstall the top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - INSTALLATION).

(5) Reach through the instrument panel glove box opening to perform the following:

(a) Install and tighten the two nuts that secure the lower passenger airbag bracket to the studs on the dash panel (Fig. 13). Tighten the nuts to 28 N·m (21 ft. lbs.).

(b) Reconnect the two halves of the radio antenna coaxial cable connector.

(c) Reconnect the passenger side window demister hose to the heater-A/C housing demister/defroster duct.

(d) Reconnect the cross body wire harness connector to the passenger airbag pigtail wire connector.

(e) Reconnect the instrument panel wire harness connector to the heater-A/C housing wire harness connector.

(f) Reconnect the heater-A/C control vacuum harness connector to the heater-A/C housing vacuum harness connector.

(6) Reinstall the glove box onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(7) From beneath the driver side of the instrument panel, perform the following:

(a) Reconnect the driver side window demister hose to the heater-A/C housing demister/defroster duct.

(b) Reconnect the instrument panel wire harness connectors to the 100-way cross body wire harness connector near the left cowl side inner panel.

(8) Reinstall the steering column into the vehicle. Be certain that the steering wheel is locked and secured from rotation to prevent the loss of clockspring centering. (Refer to 19 - STEERING/COLUMN - INSTALLATION).

(9) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(10) Reconnect the battery negative cable.

STEERING COLUMN OPENING COVER

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, move the tilt steering column to the fully raised position.

(3) Remove the two screws that secure the steering column opening cover to the instrument panel structural support (Fig. 15).

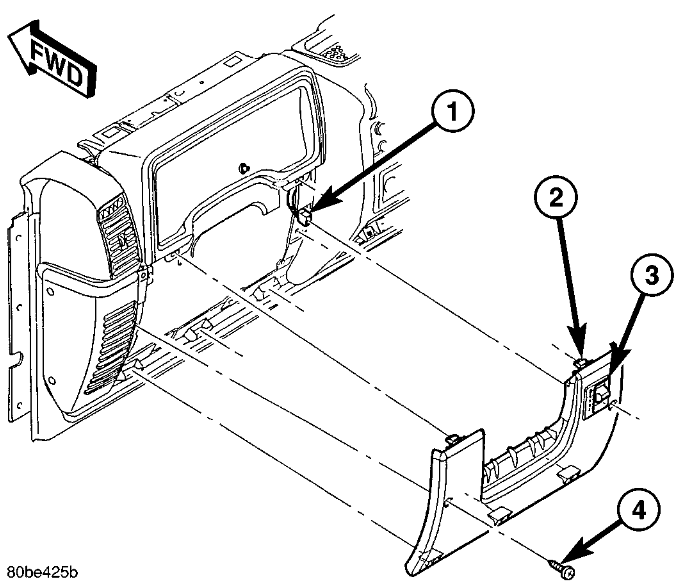

Fig. 15 STEERING COLUMN OPENING COVER REMOVE/INSTALL

1 - WIRE HARNESS CONNECTOR
2 - STEERING COLUMN OPENING COVER
3 - HEADLAMP LEVELING SWITCH
4 - SCREW (2)

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the top of the steering column opening cover away from the instrument panel on each side of the steering column far enough to disengage the two snap clip retainers from their receptacles in the instrument panel base trim.

(5) If the vehicle is so equipped, roll the top of the steering column opening cover downward far enough to access and disconnect the wire harness connector for the headlamp leveling switch from the switch connector receptacle.

(6) Pull the top of the steering column opening cover rearward far enough to disengage the hinge hook formations on the lower edge of the cover from the hinge pins on the lower edge of the instrument panel.

(7) Remove the steering column opening cover from the instrument panel.

INSTALLATION

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(1) Position the steering column opening cover to the instrument panel.

(2) Engage the hinge hook formations on the lower edge of the steering column opening cover with the hinge pins on the lower edge of the instrument panel (Fig. 15).

(3) If the vehicle is so equipped, roll the top of the steering column opening cover upward far enough to reconnect the wire harness connector for the headlamp leveling switch to the switch connector receptacle.

(4) Tilt the upper edge of the steering column opening cover up and align the two snap clip retainers on the cover with their receptacles in the instrument panel base trim.

(5) Using hand pressure, press firmly on the steering column opening cover over each of the snap clip locations until each of the snap clips is fully engaged in its receptacle in the instrument panel base trim.

STEERING COLUMN OPENING COVER (Continued)

(6) Install and tighten the two screws that secure the steering column opening cover to the instrument panel structural support. Tighten the screws to 2 N·m (20 in. lbs.).

(7) Reconnect the battery negative cable.

TOP COVER

REMOVAL

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(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the instrument panel top cover up and away from the instrument panel far enough to disengage the five snap clip retainers from their receptacles in the instrument panel structural support (Fig. 16).

(3) Remove the top cover from the instrument panel.

INSTALLATION

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(1) Position the top cover onto the instrument panel (Fig. 16).

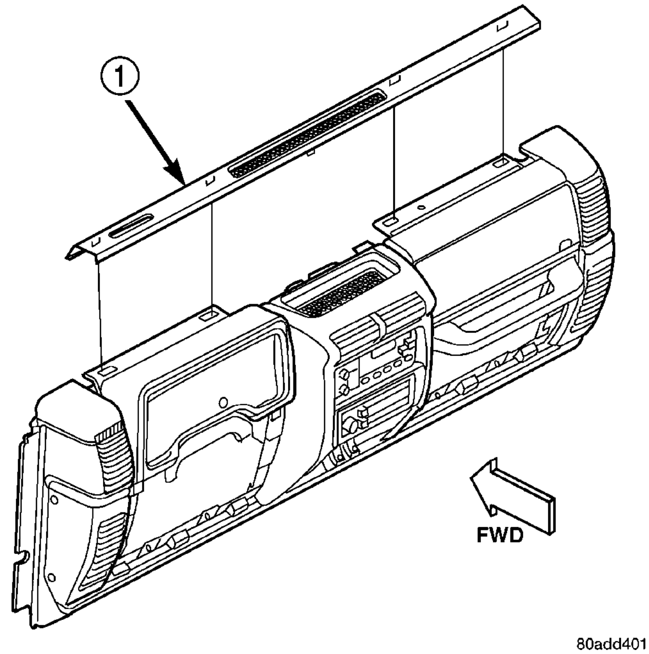

Fig. 16 TOP COVER REMOVE/INSTALL

1 - TOP COVER

(2) Align the snap clips on the top cover with the snap clip receptacles in the instrument panel structural support.

(3) Using hand pressure, press firmly downward on the top cover over each of the snap clip locations until each of the snap clips is fully seated in its receptacle in the instrument panel structural support.

(4) Reconnect the battery negative cable.

INTERIOR

TABLE OF CONTENTS

ADD-A-TRUNK

REMOVAL

(1) Release latches under trunk panel and lift panel up.

(2) Remove bolts attaching trunk to inner body panel (Fig. 1).

(3) Separate trunk from vehicle.

INSTALLATION

(1) Position the trunk in the cargo space.

(2) Install the bolts.

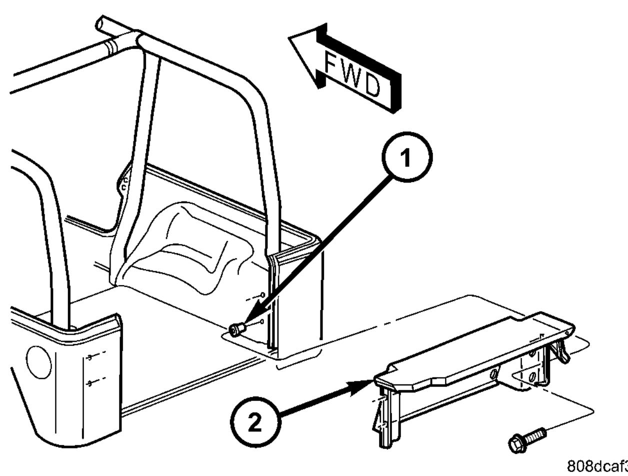

Fig. 1 ADD-A-TRUNK

1 - SCREW
2 - ADD-A-TRUNK PANEL

FRONT CARPET

REMOVAL

(1) If necessary, remove the center console. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - REMOVAL)

(2) Remove the retainers attaching the carpet to the dash panel (Fig. 2).

(3) Disengage the snaps under front seats.

(4) Remove carpet from the vehicle

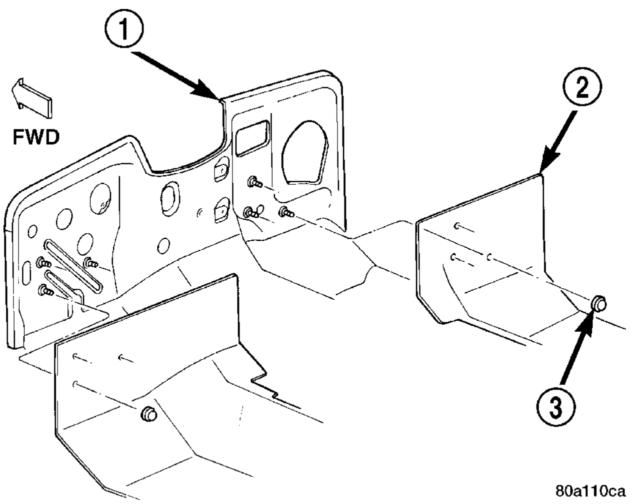

Fig. 2 FRONT CARPET

1 - DASH PANEL
2 - CARPET
3 - PUSH ON RETAINER

INSTALLATION

(1) Position the carpet in the vehicle

(2) Engage the snaps around under front seats.

(3) Install the retainers attaching the carpet to the dash panel.

(4) If previously removed, install the center console. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE - INSTALLATION)

CENTER CARPET

REMOVAL

(1) Disengage the snaps under front seats.

(2) Remove the carpet.

INSTALLATION

(1) Position the carpet in the vehicle.

(2) Engage the snaps under front seats.

CARGO AREA CARPET

REMOVAL

(1) Position the rear seat in the fold and tumbled position.

(2) Pull the carpet from under the rear seat.

(3) Remove the Add-A-Trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - REMOVAL)

(4) Route the rear seat belt buckles through the cargo area carpet.

(5) Separate the carpet from the vehicle (Fig. 3).

INSTALLATION

(1) Position the carpet in the vehicle.

(2) Route the rear seat belt buckles through the cargo area carpet.

(3) Install the Add-A-Trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - INSTALLATION)

(4) Return the rear seat to the full rearward position.

WHEELHOUSE CARPET

REMOVAL

(1) Position the rear seat in the full forward position.

(2) Remove the Add-A-trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - REMOVAL)

(3) Grasp wheelhouse carpet and remove from vehicle (Fig. 3).

INSTALLATION

(1) Position wheelhouse carpet in vehicle and adjust as necessary.

(2) Install the Add-A-trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - INSTALLATION)

(3) Return the rear seat to the full rearward position.

WHEELHOUSE CARPET (Continued)

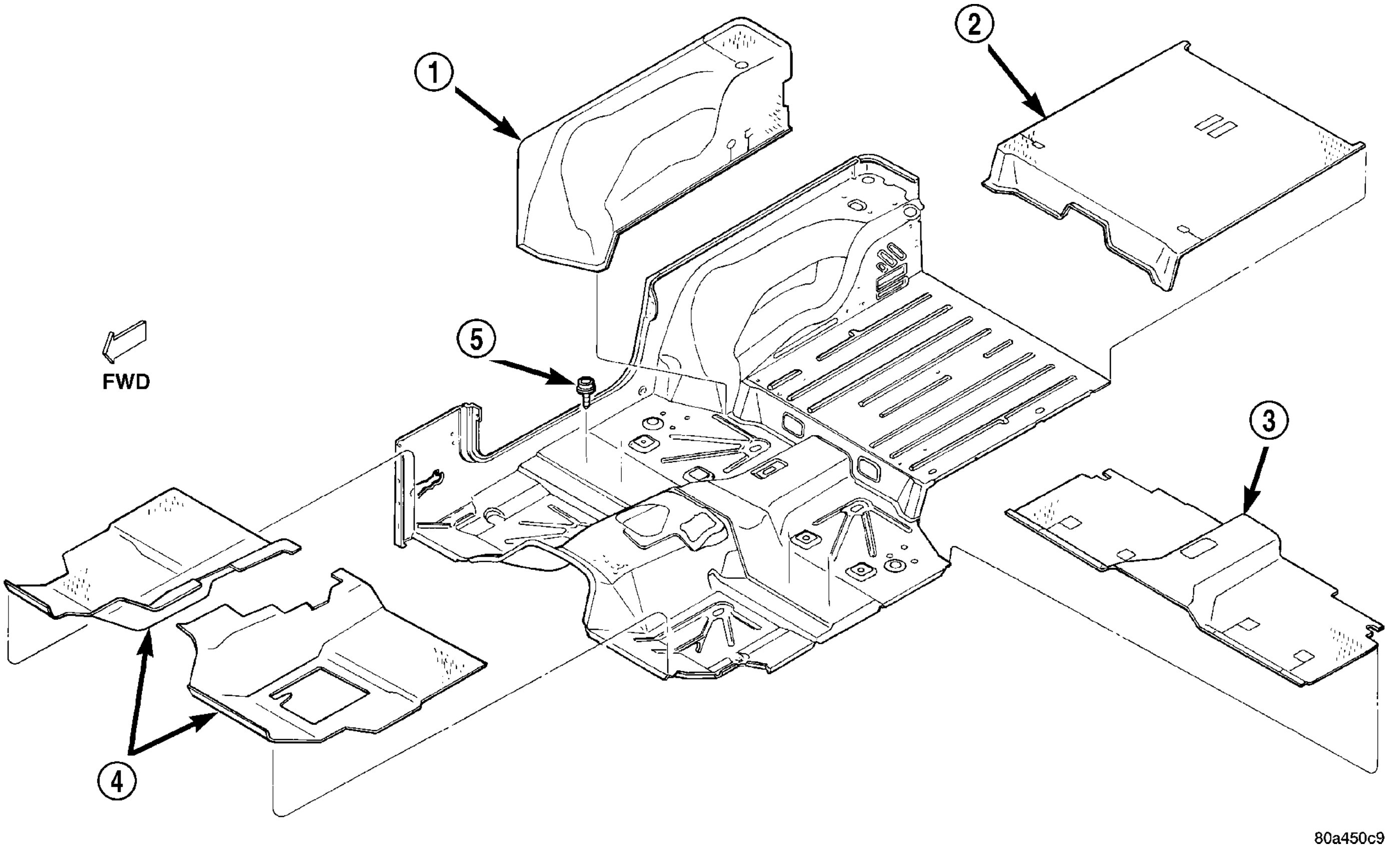

Fig. 3 VEHICLE CARPET

1 - WHEEL HOUSE CARPET
2 - CARGO AREA CARPET
3 - CENTER FLOOR CARPET
4 - FRONT FLOOR CARPET
5 - SNAP

REAR VIEW MIRROR

REMOVAL

(1) Disconnect the electrical connector, if equipped. (Fig. 4)

(2) Loosen the mirror set screw.

(3) Slide the mirror up and off the support button (bracket).

INSTALLATION

(1) Slide the mirror onto the support button (bracket).

CAUTION: Do not over-tighten the setscrew because glass chipping and/or breakage could result.

(2) Tighten the mirror set screw to 1 N·m (9 in. lbs.).

(3) Connect the electrical connector, if equipped.

REAR VIEW MIRROR SUPPORT BRACKET

INSTALLATION

(1) Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.

(2) Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.

(3) Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.

(4) Apply accelerator to the surface on the bracket according to the following instructions:

- Crush the vial to saturate the felt applicator.
- Remove the paper sleeve.
- Apply accelerator to the contact surface on the bracket.
- Allow the accelerator to dry for five minutes.
- Do not touch the bracket contact surface after the accelerator has been applied.

REAR VIEW MIRROR SUPPORT BRACKET (Continued)

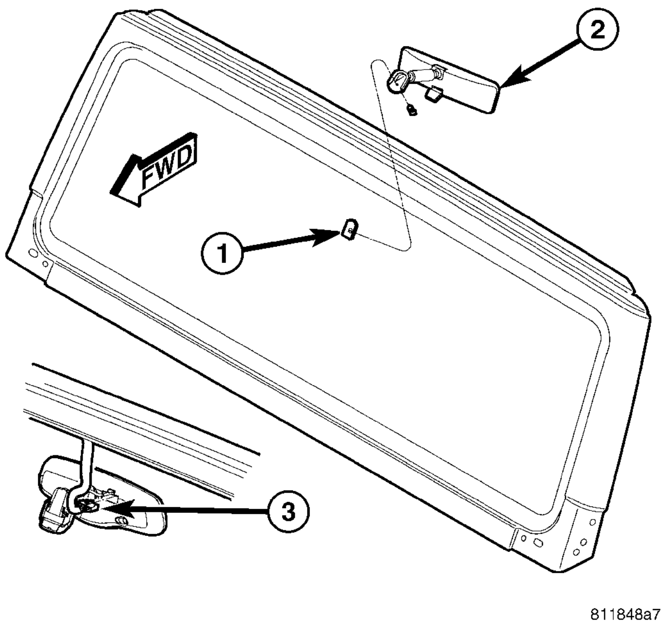

Fig. 4 REAR VIEW MIRROR

1 - SUPPORT BRACKET
2 - MIRROR ASSEMBLY
3 - ELECTRICAL CONNECTOR

(5) Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass contact surface after the accelerator has been applied.

(6) Install the bracket according to the following instructions:

• Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.

• Apply an even coat of adhesive to the contact surface on the bracket.

• Align the bracket with the marked position on the windshield glass.

• Press and hold the bracket in place for at least one minute.

NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

(7) Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.

(8) Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

SUNVISOR

REMOVAL

(1) Remove the screws that attach the sunvisor arm support brackets to the windshield frame (Fig. 5).

(2) Remove the sunvisor from the windshield frame.

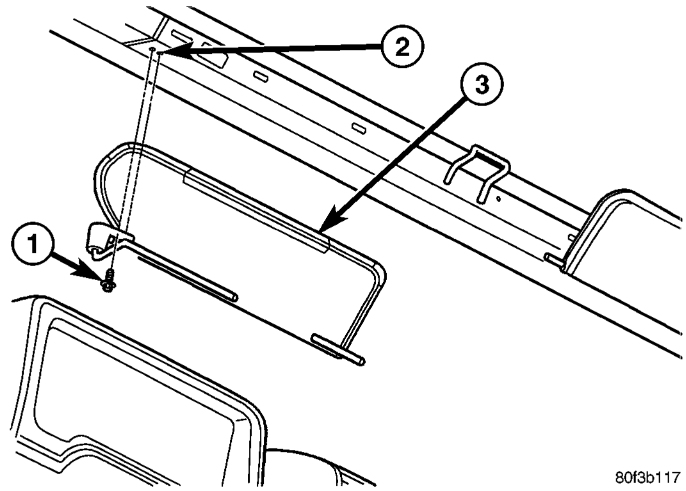

Fig. 5 SUNVISOR

1 - SCREWS (2)
2 - WINDSHIELD FRAME
3 - VISOR

INSTALLATION

(1) Position the sunvisor on the windshield frame and align the arm support bracket holes with the frame.

(2) Install the screws that attach the sunvisor arm support brackets to the frame. Tighten the screws securely.

SHIFT BEZEL - AUTOMATIC TRANSMISSION

REMOVAL

(1) Pull shift lever handle off of shift lever (Fig. 6).

(2) Using a trim stick C-4755 or equivalent, remove the shift bezel.

(3) Twist and remove the bezel light.

INSTALLATION

(1) Connect the shift bezel light by twisting into socket on the bezel.

(2) Position the shift bezel over the shift lever and install onto the console.

SHIFT BEZEL - AUTOMATIC TRANSMISSION (Continued)

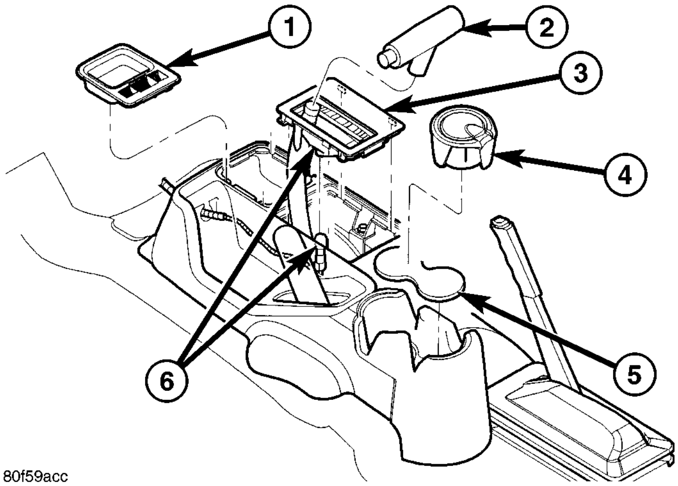

Fig. 6 SHIFT BEZEL

1 - COIN TRAY
2 - TRANSMISSION SHIFT LEVER HANDLE
3 - SHIFT BEZEL
4 - ASH RECEIVER (IF EQUIPPED)
5 - CUP HOLDER MAT
6 - SHIFT BEZEL LIGHT/SOCKET

(3) Align the shifter handle keyways and push handle onto the shifter until fully seated.

SHIFT BOOT

REMOVAL

(1) Using a trim stick C-4755 or equivalent, pry the shift boot from the bezel.

(2) Using a small flat blade, pry the shift pattern insert from the shift knob.

(3) Remove the nut attaching the shift knob to the shift lever (Fig. 7).

(4) Remove the knob and slide the shift boot from the shift lever.

INSTALLATION

(1) Slide the shift boot over the shift lever.

(2) Snap the shift boot into place in the center console.

(3) Position the shift knob on the lever, install the nut and tighten to 34 N·m (25 ft. lbs.).

(4) Position the shift pattern insert on the knob and press into place.

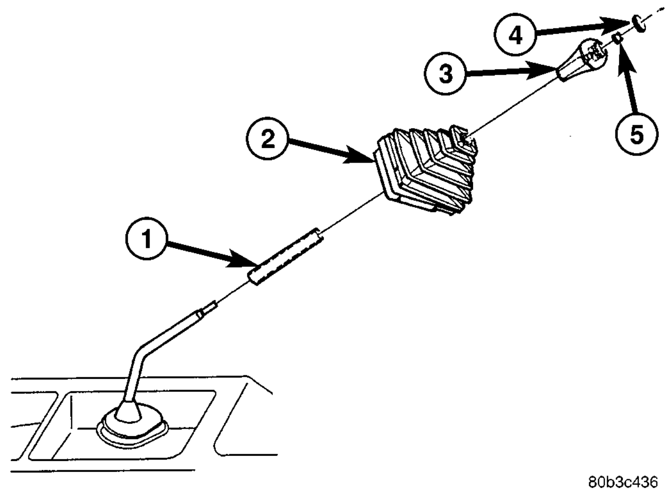

Fig. 7 SHIFT BOOT

1 - BOOT SUPPORT TUBE
2 - SHIFT BOOT
3 - SHIFT KNOB
4 - SHIFT PATTERN CAP
5 - NUT

CENTER CONSOLE

REMOVAL

(1) Remove the cup holder, if equipped. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE CUP-HOLDER ASSEMBLY - REMOVAL)

(2) On full console models remove the trim disc from the bottom of the cup holder (Fig. 10).

(3) Remove the automatic transmission shift bezel, if equipped. (Refer to 23 - BODY/INTERIOR/SHIFT BEZEL - REMOVAL)

(4) Using a trim stick C-4755 or equivalent, remove the air bag deactivation switch and disconnect the electrical connector, if equipped.

(5) Remove the bolt(s) attaching the console to the floor pan (Fig. 8) and (Fig. 9).

(6) Shift transfer case to four low position.

(7) Shift transmission to L (2nd gear for manual transmission) and remove the console assembly.

INSTALLATION

(1) Connect the electrical connector and install console tower assembly over the park brake lever, if equipped.

(2) Install the tower bolts.

(3) Install the mini console assembly over the transmission and transfer case shifters.

(4) Install the console bolts.

(5) Connect the air bag deactivation switch electrical connector and install the switch, if equipped.

(6) Connect the air bag deactivation switch electrical connector and install the switch, if equipped.

CENTER CONSOLE (Continued)

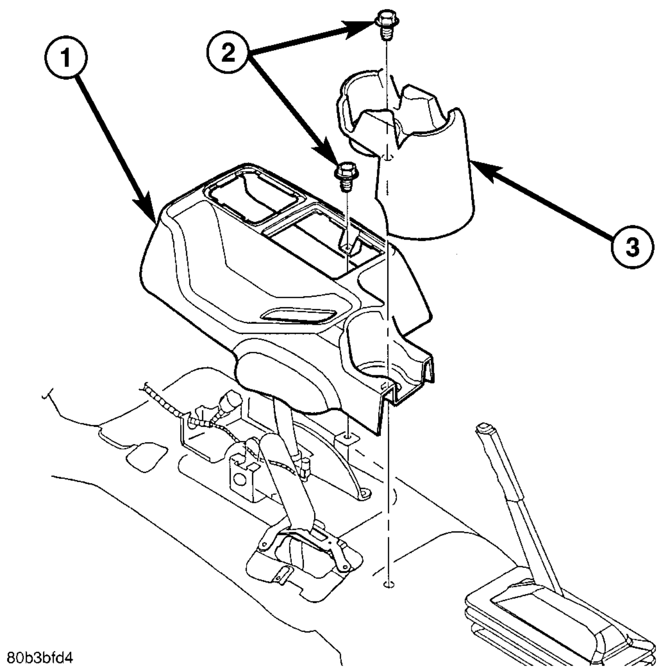

Fig. 8 MINI CONSOLE

1 - MINI CONSOLE
2 - BOLTS
3 - CUPHOLDER

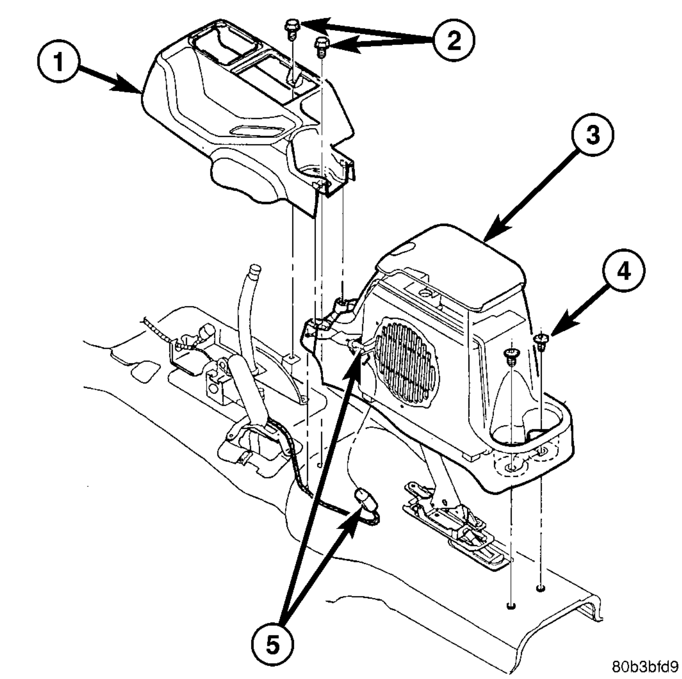

Fig. 9 FULL CONSOLE

1 - FRONT CONSOLE
2 - BOLTS
3 - REAR TOWER
4 - BOLTS (2)
5 - ELECTRICAL CONNECTOR

(7) Install the auto transmission shift bezel, if equipped. (Refer to 23 - BODY/INTERIOR/SHIFT BEZEL - INSTALLATION)

(8) Install the manual transmission shift boot, if equipped. (Refer to 23 - BODY/INTERIOR/SHIFT BOOT - INSTALLATION)

(9) Install the cup holder and trim disc, if equipped. (Refer to 23 - BODY/INTERIOR/CENTER CONSOLE CUPHOLDER ASSEMBLY - INSTALLATION)

CENTER CONSOLE CUP HOLDER

REMOVAL

(1) Using a trim stick C-4755 or equivalent, remove the cup holder insert. (Fig. 10) and (Fig. 8)

(2) On mini console equipped models remove the bolt and remove the cup holder. (Fig. 8)

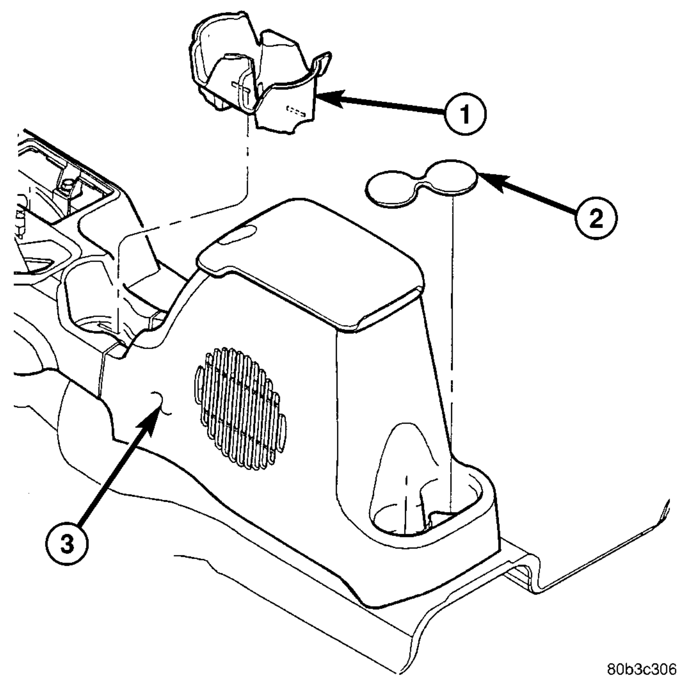

Fig. 10 FULL CONSOLE CUP HOLDER

1 - FULL CONSOLE CUP HOLDER
2 - TRIM PIECE
3 - CONSOLE TOWER

INSTALLATION

(1) On mini console equipped models install the cup holder and install the bolt.

(2) Tighten the bolt to 4 N·m (35 in lbs.).

(3) Install the cup holder insert.

CONSOLE LOCK CYLINDER

REMOVAL

(1) Open the console cover.

(2) Remove the screw that attaches the retainer to the lock and then remove the retainer from the lock (Fig. 11).

(3) Remove the lock cylinder from the console cover.

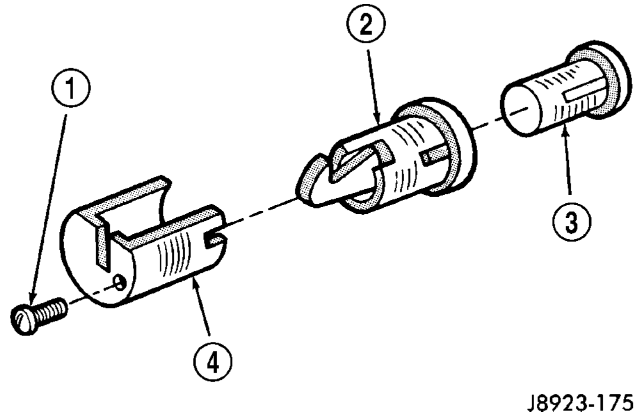

Fig. 11 CONSOLE LOCK CYLINDER

1 - ATTACHING SCREW
2 - LOCK
3 - LOCK CYLINDER
4 - RETAINER

INSTALLATION

(1) Insert the assembled lock in the console cover hole and position the retainer on the lock and install the screw.

SPORT BAR

REMOVAL

(1) Remove hard top and/or soft top. (Refer to 23 - BODY/REMOVEABLE TOP/HARD TOP - REMOVAL) or (Refer to 23 - BODY/REMOVEABLE TOP/SOFT TOP - REMOVAL).

(2) Remove the door opening frames. (Refer to 23 - BODY/INTERIOR/DOOR OPENING FRAME - REMOVAL)

(3) Remove the sunvisors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL)

(4) Remove the a-pillar weatherstrips.

(5) Remove the speaker pods. (Refer to 23 - BODY/INTERIOR/SPORT BAR - SPEAKER POD - REMOVAL)

(6) Disengage center support bar cover zipper.

(7) Remove the bolts attaching the sport bars to the center support bar (Fig. 12).

(8) Remove the bolts attaching the side support bars to the windshield frame.

(9) Remove the bolts attaching the side support bars to the sport bars.

(10) Separate the side support bars from the vehicle.

(11) Pull back the center section of the carpet and remove the bolts attaching the sport bar to the cargo floor panel.

(12) Remove the bolt attaching the sport bar to the brackets behind the door strikers.

(13) Lower the rear seat and lift rear seat to the full forward position.

(14) Pull back wheelhouse carpet and remove bolts attaching the sport bars to the wheelhouse.

(15) Remove the bolts attaching the seatbelt anchors to the wheelhouse.

(16) Carefully lift the sport bar upward and remove it from the vehicle.

(17) If necessary, remove the pads and covers from the sport bar.

INSTALLATION

(1) If necessary, transfer all attached components.

(2) Clean the base plate contact surface areas on the floor and wheelhouse panels.

(3) Apply epoxy chromate primer to the attaching hole edges for protection against corrosion.

(4) Position the sport bar base plates on the floor and wheelhouse panels with the holes aligned.

NOTE: To prevent water seepage, apply 3M Drip-Chek Sealant (or an equivalent product) to the underside of the sport bar base flanges and all the bolt heads before installation.

(5) Position the center support bar into the sport bars correctly with the large horizontal slots facing rearward and hole/slot facing downward.

(6) Install the bolts attaching the seatbelt anchors to the wheelhouse.

(7) Install the bolts attaching the sport bars to the wheelhouse and install the wheelhouse carpet. Tighten the bolts to 40 N·m (30 ft. lbs.).

(8) Return seat back to upright position.

(9) Install the bolts attaching the sport bar to the cargo floor panel and install the center carpet. Tighten the bolts to 40 N·m (30 ft. lbs.).

(10) Install the bolts attaching the sport bar to the brackets behind the door strikers and tighten to 68 N·m (50 ft. lbs.).

(11) Position side supports at the windshield and install the bolts attaching the side support bars to the windshield frame. Tighten the bolts to 32 N·m (24 ft. lbs.).

(12) Install the bolts attaching the side support bars to the sport bars and tighten to 20 N·m (15 ft. lbs.).

SPORT BAR (Continued)

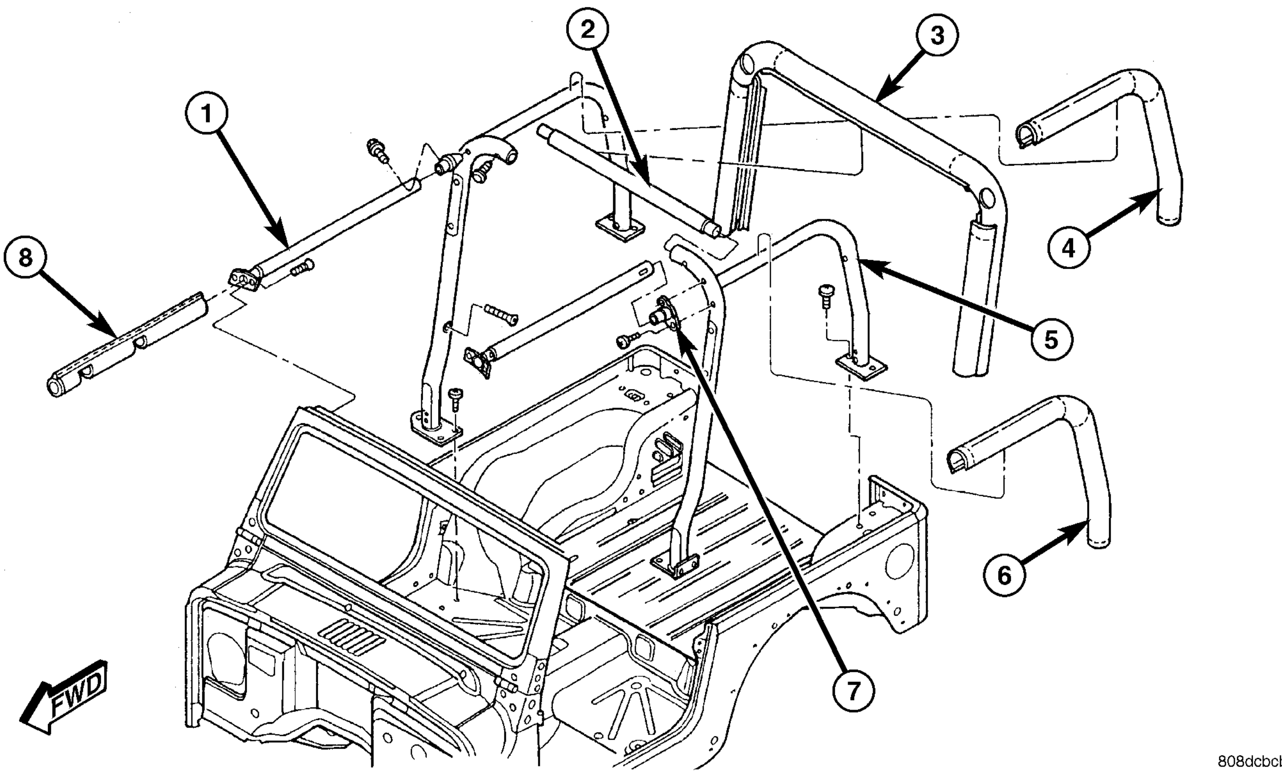

Fig. 12 SPORT BAR

1 - SIDE SUPPORT BAR
2 - CENTER SUPPORT BAR
3 - COVER
4 - COVER
5 - SPORT BAR
6 - COVER
7 - BRACKET
8 - COVER

(13) Install the bolts attaching the center support bar to the sport bar and tighten to 68 N·m (50 ft. lbs.).

(14) Engage center support bar cover zipper.

(15) Install the speaker pods. (Refer to 23 - BODY/INTERIOR/SPORT BAR - SPEAKER POD - INSTALLATION)

(16) Install the a-pillar weatherstrips.

(17) Install the sun visors(Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION)

(18) Install the door opening frames. (Refer to 23 - BODY/INTERIOR/DOOR OPENING FRAME - INSTALLATION)

(19) Install hard top and/or soft top. (Refer to 23 - BODY/REMOVEABLE TOP/HARD TOP - INSTALLATION) or (Refer to 23 - BODY/REMOVEABLE TOP/SOFT TOP - INSTALLATION).

A-PILLAR TRIM

REMOVAL

(1) Remove the a-pillar trim screws. (Fig. 13)

(2) Starting at the bottom, pull off the trim and remove.

INSTALLATION

(1) Install the trim over the sports bar and position into the top.

(2) Press the bottom into place and install the screws.

REAR HEADER TRIM

REMOVAL

(1) Disconnect the rear window defogger electrical connectors, if equipped.

(2) Remove the wiper motor cover and disconnect the wiper motor electrical connector and washer hose. (Fig. 14)

(3) Using a trim stick C-4755 or equivalent, separate the header trim and retainer clips from the top. (Fig. 15)

(4) Pull the wire harnesses and washer hose through the trim panel and remove.

INSTALLATION

(1) Route the wire harnesses and washer hose through the trim panel.

REAR HEADER TRIM (Continued)

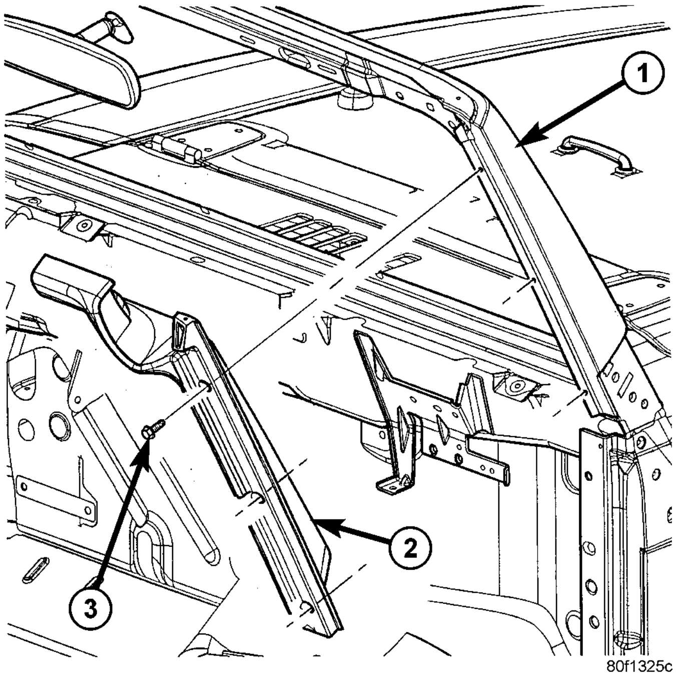

Fig. 13 A-PILLAR TRIM

1 - WINDSHIELD FRAME
2 - A-PILLAR TRIM
3 - SCREWS (3)

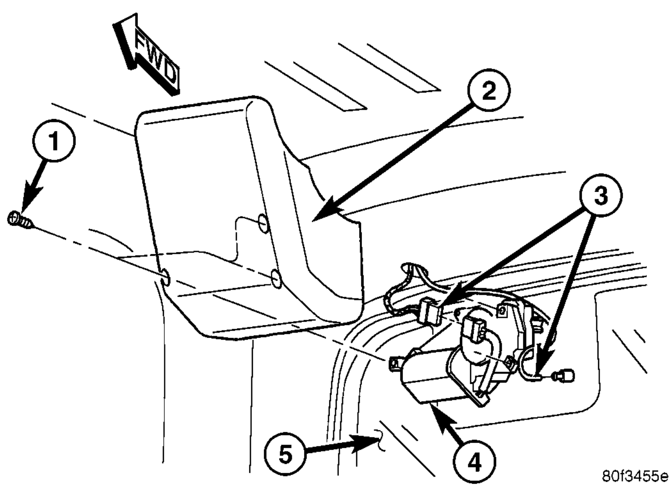

Fig. 14 REAR WIPER MOTOR TRIM COVER REMOVE/INSTALL

1 - SCREW (3)
2 - TRIM COVER
3 - ELECTRICAL & WASHER HOSE CONNECTIONS
4 - WIPER MOTOR
5 - LIFTGATE GLASS

(2) Install the header trim and seat the retaining clips fully.

(3) Connect the wiper motor electrical and the washer hose connection.

(4) Connect the rear window defogger electrical connectors, if equipped.

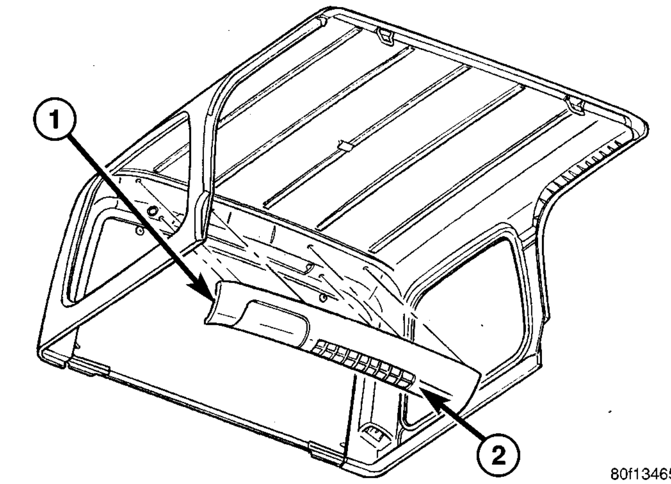

Fig. 15 REAR HEADER TRIM

1 - REAR HEADER TRIM
2 - WIRE OPENINGS (2)

WINDSHIELD HEADER

REMOVAL

(1) Position both sun visors out.

(2) Using a trim stick C-4755 or equivalent, separate the retaining clips and remove the trim from behind the a-pillar trim panels. (Fig. 16)

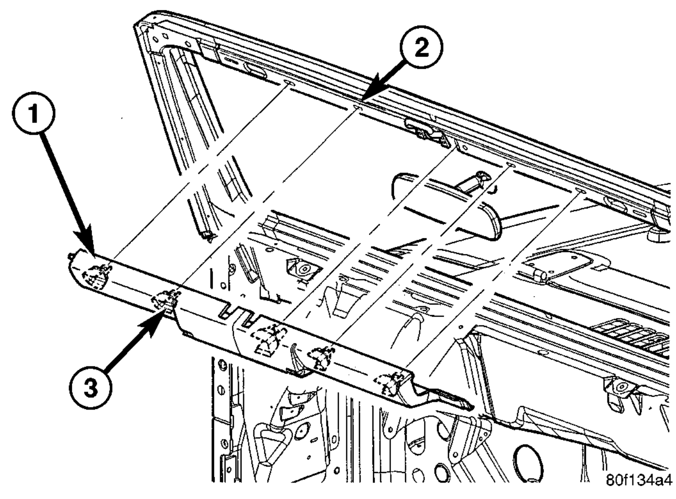

Fig. 16 WINDSHIELD HEADER MOLDING

1 - WINDSHIELD HEADER TRIM
2 - WINDSHIELD FRAME
3 - SPRING CLIPS (4)

INSTALLATION

(1) Install the windshield header trim and position the end tabs behind the a-pillar trim.

(2) Seat the retaining clips fully.

SPORT BAR - SPEAKER POD

REMOVAL

(1) On vehicles equipped with a soft top, unzip the side panel next to the pod.

(2) On vehicles equipped with a hard top, unclip the windshield clamps.

(3) Remove the bolts on side of the top next to the pod and loosen the opposite side bolts. (Refer to 23 - BODY/REMOVEABLE TOP/HARD TOP - REMOVAL)

(4) Lift up the side of the top to gain access to the pod bolts and support with a block of wood or similar.

(5) Remove the two bolts securing the pod to the sport bar.

(6) Separate the pod guide pin from the sport bar and disconnect the electrical connector.

INSTALLATION

(1) Connect the pod electrical connector and install the pod onto the guide pin.

(2) Install the bolts and tighten to 68 N·m (50 ft. lbs.).

(3) On vehicles equipped with a hard top, install the hard top. (Refer to 23 - BODY/REMOVABLE TOP/HARD TOP - INSTALLATION)

(4) On vehicles equipped with a soft top, zip up the side panel.

PAINT

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PAINT

SPECIFICATIONS - PAINT CODES

NOTE: Because of late model changes to the available paint colors (Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION) or (Refer to VEHICLE DATA/VEHICLE INFORMATION/BODY CODE PLATE - DESCRIPTION) for the correct paint codes for each vehicle. (Refer to 23 - BODY/PAINT/PAINT CODE - DESCRIPTION)

EXTERIOR COLORS

EXTERIOR COLOR	DAIMLERCHRYSLER CODE
Sienna Pearlcoat	WU7
Flame Red Clearcoat	PR4
Solar Yellow Clearcoat	VYH
Light Khaki Metallic Clearcoat	AJC
Electric Lime Green Pearlcoat	BGL
Shale Green Metallic Clearcoat	XGR
Moss Green Pearlcoat	RJN
Patriot Blue Pearlcoat	WBT
Bright Silver Metallic Clearcoat	WSB
Black Clearcoat	DX8
Stone White	SW1

INTERIOR COLORS

INTERIOR COLOR	DAIMLERCHRYSLER CODE
Dark Slate Gray	DV
Khaki	J3

EXTERIOR HARD AND SOFT TOP COLORS

EXTERIOR HARD TOP COLORS	DAIMLERCHRYSLER CODE
Black	SX9
Dark Khaki	ZJ8
Dark Green	AJ7

PAINT CODE

DESCRIPTION

Exterior vehicle body colors are identified on the Vehicle Certification Label (Refer to VEHICLE DATA/VEHICLE INFORMATION/VEHICLE CERTIFICATION LABEL - DESCRIPTION) or the Body Code Plate (Refer to VEHICLE DATA/VEHICLE INFORMATION/BODY CODE PLATE - DESCRIPTION). The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat. The color names provided in the Paint and Trim Code Description chart are the color names used on most repair product containers. (Refer to 23 - BODY/PAINT - SPECIFICATIONS)

BASECOAT/CLEARCOAT FINISH

DESCRIPTION

On most vehicles a two-stage paint application (basecoat/clearcoat) is used. Color that is applied to primer is called basecoat. The clearcoat protects the basecoat from ultraviolet light and provides a durable high-gloss finish.

PAINT TOUCH-UP

STANDARD PROCEDURE - PAINT TOUCH-UP

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Topcoat. Refer to Introduction group of this manual for Body Code Plate information.

WARNING: USE AN OSHA APPROVED RESPIRATOR AND SAFETY GLASSES WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.

(3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the scratch or chip without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clearcoat, apply clear topcoat to touch-up paint with the same technique as described in Step 4. Allow clear topcoat to dry hard. If desired, Step 5 can be performed on clear topcoat.

WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT. AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

FINESSE SANDING, BUFFING & POLISHING

DESCRIPTION

CAUTION: Do not remove more than .5 mils of clearcoat finish, if equipped. Basecoat paint must retain clearcoat for durability.
Use a Paint Thickness Gauge #PR-ETG-2X or equivalent to determine film thickness before and after the repair.

Minor acid etching, orange peel, or smudging in clearcoat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

REMOVEABLE TOP

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REMOVEABLE TOP

STANDARD PROCEDURE

HARD TOP REPAIR

NOTE: The hard top is manufactured from a sheet molded compound (SMC).
SMC is constructed using short fiberglass strands usually less than 5.08 cm (2 inches) long. Sheet stock of glass impregnated resin matting is placed into the mold and pressed under heat to flow material throughout the mold. Tooling is shear edge designed to mold to net (i.e. no trimming at periphery required).
SMC is repairable in accordance with established procedures described within this manual. (Refer to 23 - BODY - STANDARD PROCEDURE - PLASTIC BODY PANEL REPAIR)

Hard Top Locators

There are two hard top locator devices positioned approximately 150 mm (6 in.) from the most forward attachment holes. If the locator device is missing or damaged it must be replaced, as it will assist in placing the hard top back into the correct position for top re-attachment.

If the locator device is missing just make sure that the attachment holes are clear and simply insert the new locator (part is orientated by hole size and inserts from the bottom of the rail before the hard top is re-attached to the vehicle).

If the locator device is damaged, cut off the locking tabs, remove and replace as described above.

HARD TOP REPAIR

If it has been determined that the hard top can be repaired. The following required materials and procedures are to be used.

(1) Use a grinder to remove the paint and outline the damaged area. Use a grade 150 grit disc for paint removal.

(2) Grind the outlined surface area again with a 240 grit disc to prevent coarse scratches from appearing in the final finish.

(3) If cracks extend from the hole, it will be necessary to stop-drill the crack(s) with a 3-mm (1/8-in) diameter drill bit. This will prevent the crack from spreading and allow repair material to be effective.

(4) Position a fiberglass mat or cloth on the repair surface area. Cut the mat 2.5 cm (1 in.) larger than repair area but smaller than the outline area. Make the outline area larger if required.

(5) Clean the outlined area.

(6) Place the fiberglass cloth on aluminum foil.

(7) Pour the fiberglass resin into a clean container.

(8) Mix the appropriate amount of hardener and resin. Follow the manufacturers instructions.

(9) Apply the hardener/resin mixture to both sides of the fiberglass cloth.

(10) Place the fiberglass cloth over the repair area. Next, place the aluminum foil over the cloth using a plastic spreader to smooth-out the cloth and resin. Use firm pressure to remove air bubbles and to smooth-out the cloth. Remove the aluminum foil.

(11) Allow the resin to cure.

(12) Smooth-out the surface area to the contour of the hard top with a 150-grit disc.

(13) Apply plastic filler to complete the repair. Finish smoothing the surface area with 240-320 grit paper.

REMOVEABLE TOP (Continued)

(14) Repeat the previous steps on the inside area of the hard top.
(15) Featheredge the repaired surface area.
(16) Prime the repaired surface area with PPG® Epoxy Primer, or an equivalent product.
(17) Apply surface primer to the surface area.
(18) Prime the surface area for the color coat.
(19) Apply color coat to the repaired surface area.

HARD TOP FRACTURE REPAIR

If it has been determined that the hard top can be repaired. The following required materials and procedures are to be used.
(1) Use a grinder to remove the paint and outline the damaged area. Use a grade 150 grit disc for paint removal.
(2) Grind the outlined surface area again with a 240 grit disc to prevent coarse scratches from appearing in the final finish.
(3) If cracks extend from the damaged area, it will be necessary to stop drill the cracks with a 3-mm (1/8-in) diameter drill bit. This will prevent the crack and/or fracture from spreading and allow repair material to be effective.
(4) Bevel the edges of the crack/fracture on both sides with a rotary file.

NOTE: The edges should be beveled on the inside and outside of the top to ensure sufficient surface area for good bonding.

(5) Complete the repairs with fiberglass cloth and resin as described in the hard top hole repair procedure. (Refer to 23 - BODY/REMOVABLE TOP - STANDARD PROCEDURE)

HARD TOP SAG REPAIR

Inspect the roof/hard top assembly for the presence of sag, or if the customer complains of water accumulation on the roof. Perform the following procedure to repair.
(1) Disengage latches at windshield frame (Fig. 1).

NOTE: The two forward bolts/nuts are not captured. Do not lose the nuts when removing.

(2) Remove the six bolts that attach the hard top to the body (Fig. 2).
(3) Depress tab on rear wiper motor connector and pull downward to disengage (Fig. 3).
(4) Make two marks on the inside of the hard top 6 cm (2.5 in.) on both sides of the center roof rib, directly above the sport bar.
(5) Move the hard top back about 10 cm (4 in.) to expose the inner rib section.
(6) Clean the roof area with isopropyl alcohol.
(7) Install the foam repair blocks by removing the protective backing tape from the adhesive side. The foam blocks must be centered above the sport bar pad.
(8) Move the hard top assembly back into position and centered at the windshield frame.
(9) Inspect the hard top seals for damage and replace, if necessary.
(10) Inspect the windshield header seal and make sure it is clean, undamaged, and free of debris.
(11) Carefully position the hard top assembly on the vehicle making sure that the latches are not pinched between the windshield frame and top.

CAUTION: Do not over tighten the top bolts. Over tightening can cause cracking of the hardtop assembly.

(12) Loosely install the six bolts. Ensure that the top is centered on the vehicle and locators are in place in the body side slots and tighten the bolts to 17 N·m (150 in. lbs.).
(13) Connect the wire wiper motor harness connector.
(14) Connect the rear washer fluid hose.
(15) Engage the latches at windshield frame and snap the clamps home.

HARD TOP

REMOVAL

(1) Disengage latches at windshield frame (Fig. 1).

NOTE: The two forward bolts/nuts are not captured. Do not lose the nuts when removing.

(2) Remove the six bolts that attach the hard top to the body (Fig. 2).
(3) Depress tab on rear wiper motor connector and pull downward to disengage (Fig. 3).
(4) Disconnect the rear washer fluid hose. Cap the hose to prevent washer fluid leakage (Fig. 4).

CAUTION: Protect the lower edges of the top from potential damage, cracks, paint chips, gouges and scratches that are not covered under warranty.

(5) Carefully remove the hard top assembly from the vehicle.

INSTALLATION

(1) Inspect the hard top seals for damage and replace, if necessary.
(2) Inspect the windshield header seal and make sure it is clean, undamaged, and free of debris.

HARD TOP (Continued)

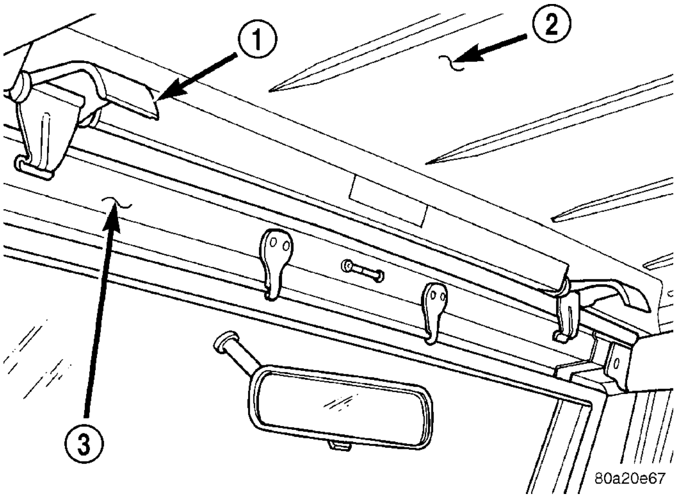

Fig. 1 HARD TOP LATCH

1 - LATCH
2 - HARD TOP
3 - WINDSHIELD FRAME

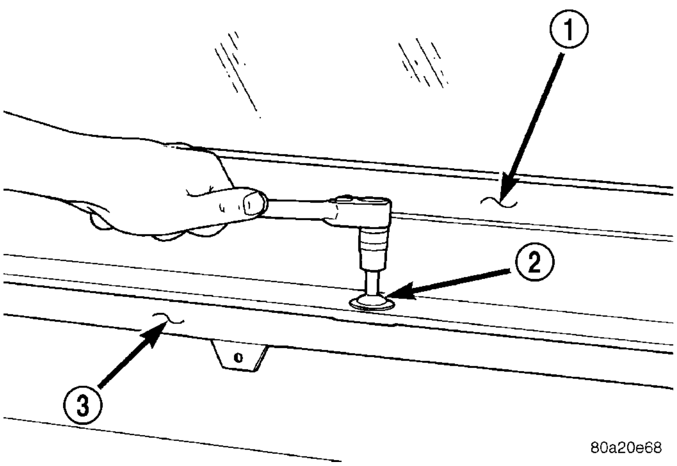

Fig. 2 HARD TOP REMOVAL

1 - HARD TOP
2 - HOLD DOWN BOLT
3 - BODY RAIL

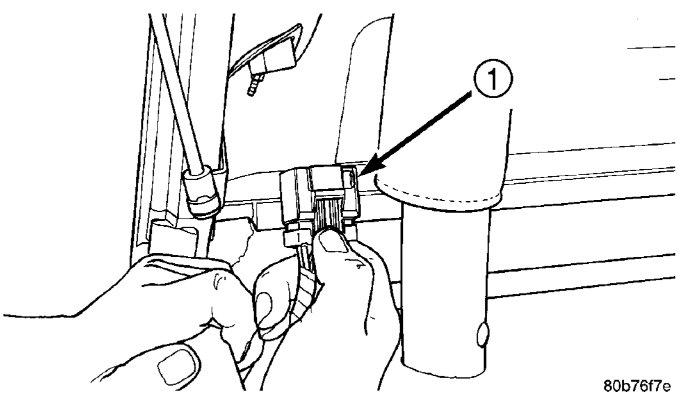

Fig. 3 REAR WIPER WIRE HARNESS CONNECTOR

1 - WIPER MOTOR CONNECTOR

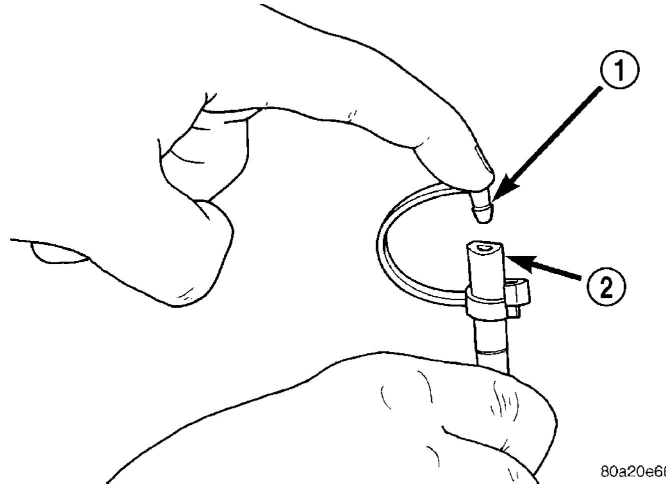

Fig. 4 REAR WASHER FLUID TUBE

1 - WASHER HOSE CAP
2 - REAR WASHER SUPPLY HOSE - BODY HALF

(3) Carefully position the hard top assembly on the vehicle making sure that the latches are not pinched between the windshield frame and top.

CAUTION: Do not over tighten the top bolts. Over tightening can cause cracking of the hardtop assembly.

(4) Loosely install the six bolts. Ensure that the top is centered on the vehicle and tighten the bolts to 17 N·m (150 in. lbs.).
(5) Connect the wire wiper motor harness connector.
(6) Connect the rear washer fluid hose.
(7) Engage the latches at windshield frame and snap the clamps home.

SOFT TOP

REMOVAL

(1) Disengage the retainers attaching the rear window to the body.
(2) Remove rear window, unzipping from right to left.
(3) Disengage J-straps at soft top rear corners (Fig. 5).
(4) Unzip quarter windows, disengage J-strap and remove quarter windows.
(5) Starting at the rear of the upper door opening frame and working forward, disengage drip rail retainers attaching the soft top to the door opening frame.
(6) Unlatch top at windshield frame.
(7) Lower the top to the rearward position.
(8) Remove the screws attaching the roof bows to the pivot bracket (Fig. 6).

SOFT TOP (Continued)

(9) Lift up bows at pivot bracket to disengage from pivot bracket.

(10) Remove the top (Fig. 7).

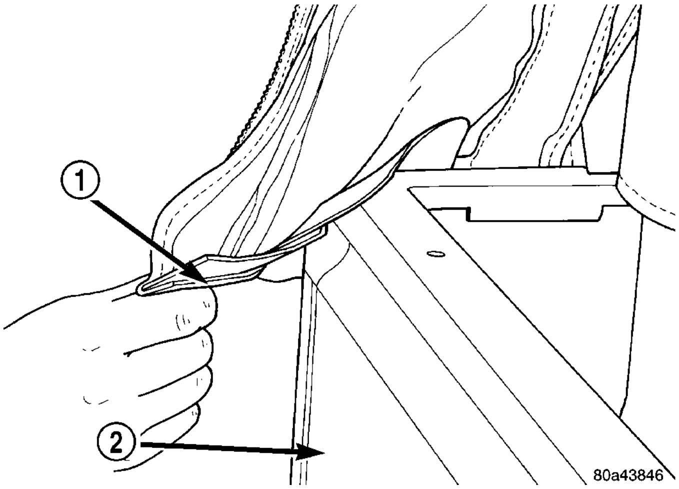

Fig. 5 SOFT TOP J-STRAPS

1 - SOFT TOP CORNER J-STRAP
2 - QUARTER PANEL

INSTALLATION

(1) Position the top on the vehicle.

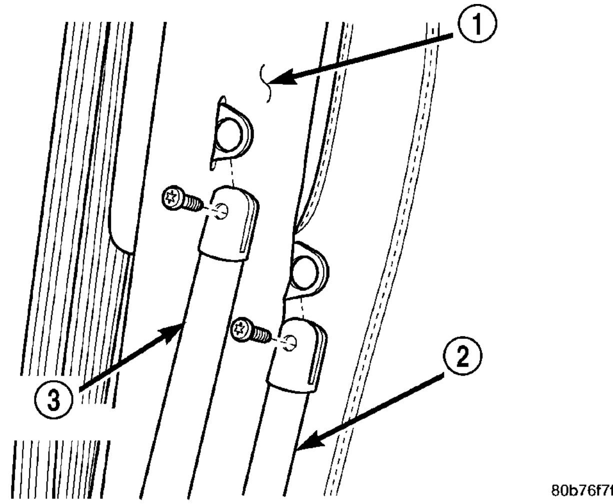

Fig. 6 ROOF BOW REMOVAL

1 - SPORT BAR
2 - REAR ROOF BOW
3 - SIDE ROOF BOW

(2) Install the screws attaching the roof bows to the pivot bracket. (The front bow is attached to the pivot bracket on the upper outward location).

(3) Raise the top.

(4) Position latch in windshield frame.

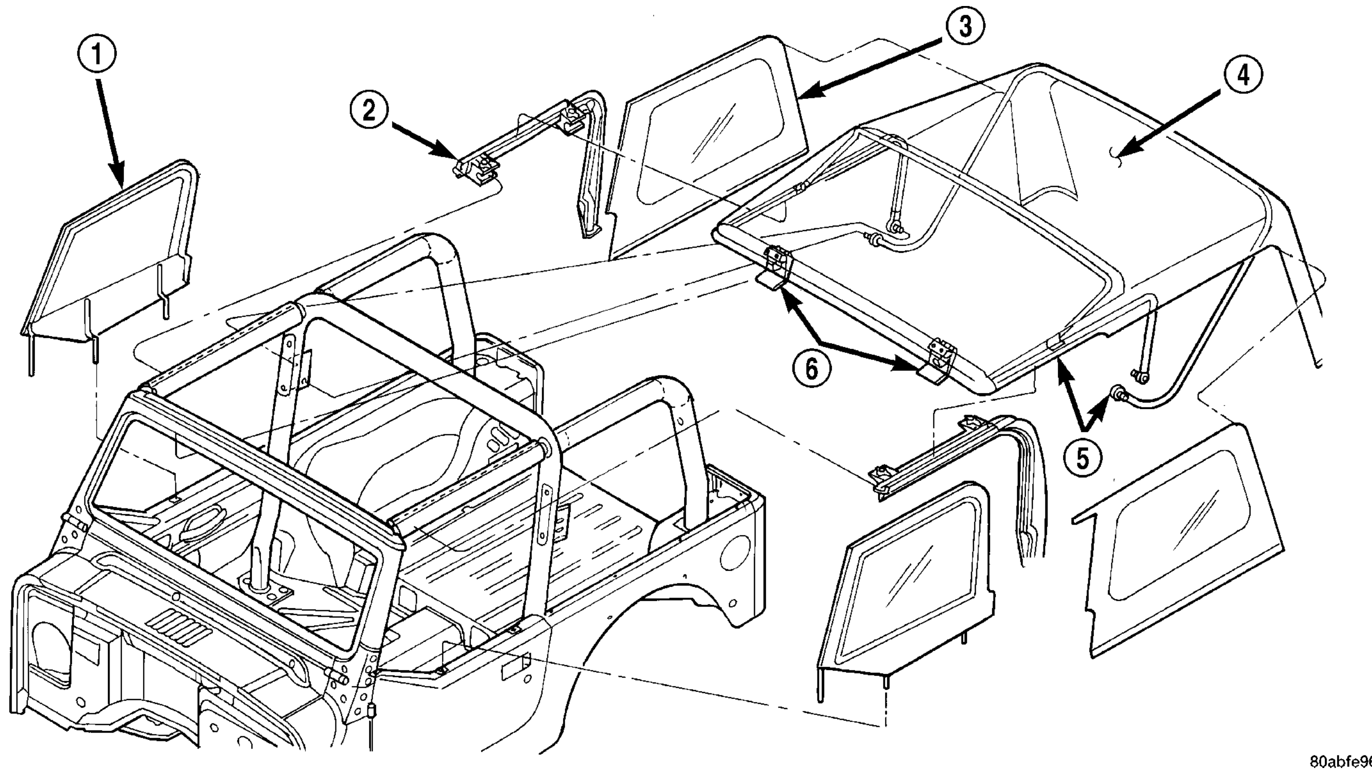

Fig. 7 SOFT TOP

1 - HALF DOOR WINDOW
2 - DOOR OPENING FRAME
3 - QUARTER WINDOW
4 - SOFT TOP
5 - ROOF BOW
6 - LATCH REINFORCEMENT

SOFT TOP (Continued)

(5) Install the quarter windows.

(6) Working from front to rear, engage the J-straps attaching the quarter window to the body.

(7) Install rear window.

(8) Engage drip rail retainers above door opening frame.

(9) Working from front to rear, engage J-straps at soft top rear corners.

(10) Engage the retainers attaching the rear window to the body.

(11) Close latch at windshield frame.

SOFT TOP FABRIC

REMOVAL

(1) Disengage the snaps attaching the soft top fabric to the rear roof bow.

(2) Disengage the hook and loop fastener attaching soft top fabric to the center roof bow.

(3) Lower the soft top.

(4) Remove the screws attaching the soft top fabric to the front roof bow and fold back fabric.

(5) Separate the soft top fabric from the frame.

INSTALLATION

(1) Position the soft top fabric on the frame.

(2) Install the screws attaching the soft top fabric to the front roof bow.

(3) Engage the hook and loop fastener attaching soft top fabric to the center roof bow.

(4) Engage the snaps attaching the soft top fabric to the rear roof bow.

(5) Raise and secure the soft top.

DOOR OPENING FRAME

REMOVAL

Vehicles equipped with a soft top require a door opening frame to complete the seal for the soft top door assembly.

(1) Lower the top to the rearward position.

(2) Turn the knobs located on top of the door opening frame counter clockwise and remove completely (Fig. 8).

(3) Pull door opening frame outward and up. Separate from vehicle.

INSTALLATION

Vehicles equipped with a soft top require a door opening frame to complete the seal for the soft top door assembly.

(1) Install the alignment pin at the base of the door opening frame into the hole at the top of the quarter panel.

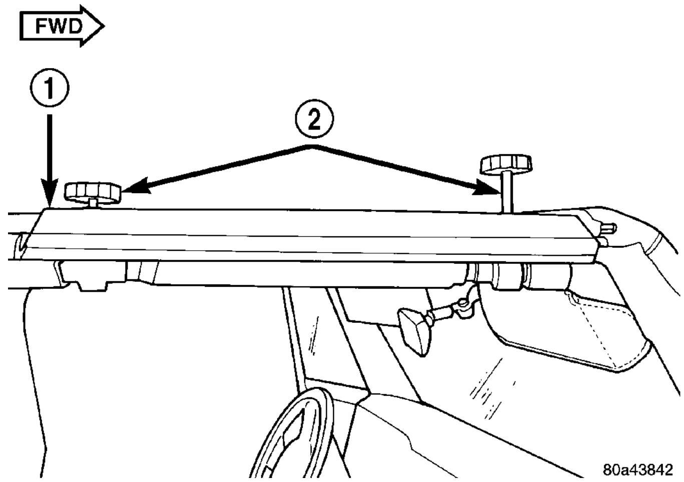

Fig. 8 DOOR OPENING FRAME

1 - DOOR OPENING FRAME
2 - KNOBS

(2) Position the door opening frame on the side support bar and install the knobs.

(3) Raise and secure the top.

HARD/SOFT TOP LATCH

REMOVAL

(1) Unlatch the top (Fig. 9).

(2) Using a grease pencil or equivalent, mark the position of the latch on the top.

(3) Remove the screws attaching the latch to the top.

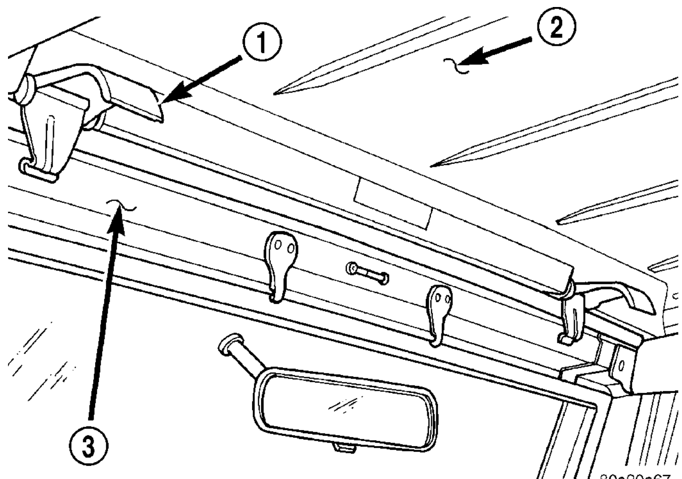

Fig. 9 HARD/SOFT TOP LATCH

1 - LATCH
2 - HARD TOP
3 - WINDSHIELD FRAME

INSTALLATION

(1) Position the latch on the top and install the screws.

SEATS

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FRONT SEAT

REMOVAL

(1) Disengage seat belt electrical connector (Fig. 1).

(2) Remove the bolts attaching the seat adjuster to the floor panel (Fig. 2).

(3) Remove the seat from the vehicle.

INSTALLATION

(1) Position the seat in the vehicle.

(2) Install the bolts attaching the rear of seat frame to the floor panel. Tighten outboard bolt to 33 N·m (25 ft. lbs.). Tighten inboard bolt to 74 N·m (55 ft. lbs.).

(3) Install the bolts attaching the front of seat frame to the floor panel and tighten bolts to 33 N·m (25 ft. lbs.).

(4) Engage seat belt electrical connector.

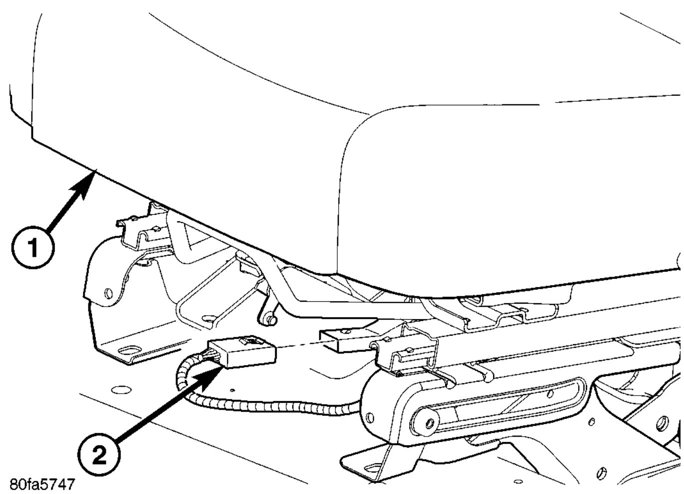

Fig. 1 SEAT BELT ELECTRICAL

1 - FRONT SEAT
2 - SEAT BELT ELECTRICAL CONNECTOR

FRONT SEAT (Continued)

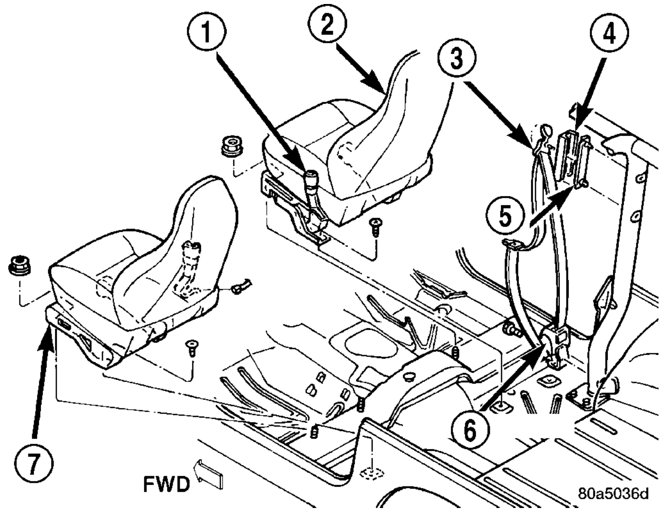

Fig. 2 BUCKET SEAT REMOVAL

1 - BUCKLE
2 - SEAT
3 - TURNING LOOP
4 - COVER
5 - ADJUSTER
6 - RETRACTOR
7 - MOUNTING BRACKET

FRONT SEAT BACK

REMOVAL

(1) Remove seat. (Refer to 23 - BODY/SEATS/ FRONT SEAT - REMOVAL)

(2) Disengage the j-straps at the lower edge of the seat back and position the seat back cover aside.

(3) Using a small flat bladed tool, release the hinge cover retaining tab and remove. (Fig. 3)

(4) Disconnect the recliner cables. (Fig. 4)

(5) Remove the upper recliner bolts and remove the seat back

INSTALLATION

(1) Position the seatback on the seat cushion.

(2) Passenger seat and driver dumping seat:

(a) Engage seat dump cable to clip on recliner.

(3) Install the bolts attaching the recliner to the seat cushion frame.

(4) Engage the seat cushion corner cover j-retainers.

(5) Engage the retainers attaching the cushion cover to the outboard seat cushion frame.

(6) Install seat. (Refer to 23 - BODY/SEATS/ FRONT SEAT - INSTALLATION)

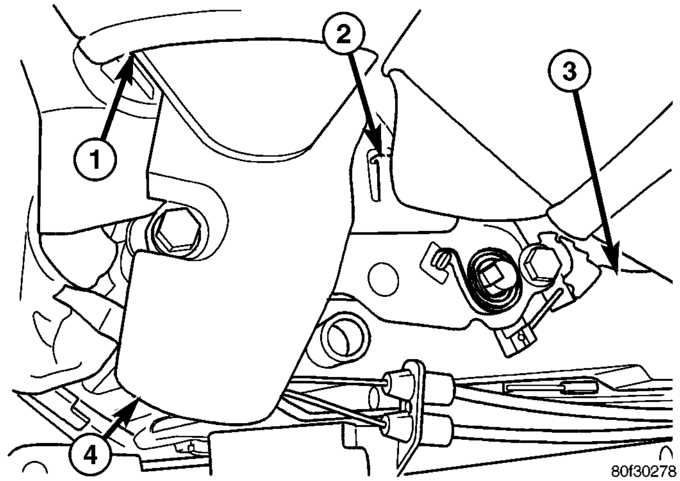

Fig. 3 SEAT BACK HINGE COVER

1 - SEAT BACK COVER
2 - RECLINER COVER RETAINING TAB
3 - SEAT CUSHION FRAME
4 - RECLINER COVER

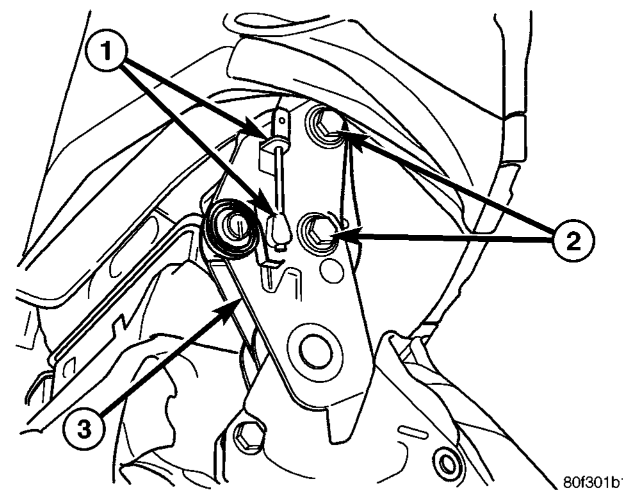

Fig. 4 SEAT BACK HINGE

1 - DUMP CABLE CONNECTIONS
2 - SEAT BACK BOLTS (4)
3 - SEAT BACK RECLINER

FRONT SEAT BACK COVER

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/ SEAT - REMOVAL)

(2) Disconnect the j-straps at the bottom of the seat back.

(3) Remove the bottom hog rings.

(4) Remove the upper hog rings.

(5) Remove the support rods from the seat back.

(6) Using a trim stick C-4755 or equivalent, remove and discard the seat release handle knob. (Fig. 5)

FRONT SEAT BACK COVER (Continued)

(7) Remove the screw and remove the release handle bezel.
(8) Remove the seat cover and cushion.

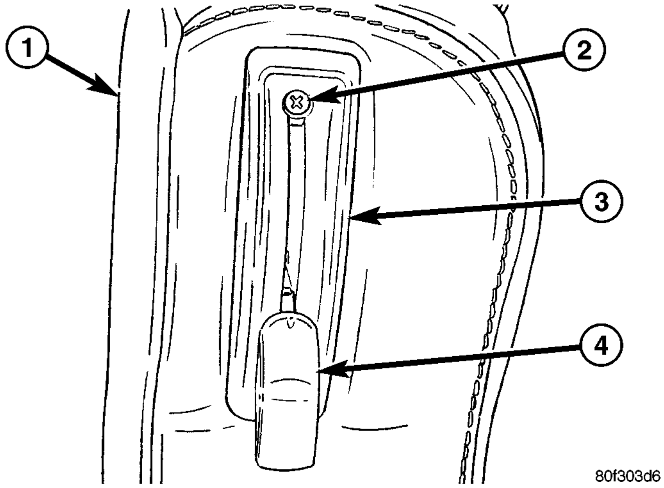

Fig. 5 FORWARD FOLDING SEAT RELEASE HANDLE

1 - SEAT BACK
2 - BEZEL SCREW
3 - RELEASE HANDLE BEZEL
4 - RELEASE HANDLE KNOB

INSTALLATION

(1) Position cover and cushion on seatback.
(2) Install the release handle bezel and install the screw.
(3) Install a new release handle knob.
(4) Install the support rods.
(5) Install the upper hog rings.
(6) Install the bottom hog rings.
(7) Connect the j-straps at the bottom of the seat back.
(8) Install seat back. (Refer to 23 - BODY/SEATS/ FRONT SEAT BACK - INSTALLATION)

FRONT SEAT CUSHION COVER

REMOVAL

(1) Remove seat back. (Refer to 23 - BODY/SEATS/ FRONT SEAT BACK - REMOVAL)
(2) Disengage inboard j-strap.
(3) Disengage front j-strap.
(4) Disengage rear j-strap
(5) Roll cover up to access hog rings.
(6) Disengage inboard and outboard hog rings.
(7) Separate cover from cushion.

INSTALLATION

(1) Position cover on cushion and align seams.
(2) Engage inboard and outboard hog rings.
(3) Roll cover over cushion edges.
(4) Engage inboard j-strap.
(5) Engage front j-strap.
(6) Engage rear j-strap
(7) Install seat back. (Refer to 23 - BODY/SEATS/ FRONT SEAT BACK - INSTALLATION)

FRONT SEAT BACK RECLINER/ COVER

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/ FRONT SEAT - REMOVAL)
(2) Disconnect the j-straps at the lower edge of the seat back and position aside.
(3) Disconnect the rear j-straps of the cushion and position aside.
(4) Using a small flat bladed tool, release the recliner cover retaining tab and remove. (Fig. 3)
(5) Disconnect the seat back dump cables. (Fig. 4)
(6) Remove the two seat back bolts.
(7) Remove the two seat cushion frame bolts.
(8) Disconnect the recliner cable.
(9) For the inboard recliner, disconnect the forward folding cable assembly, if equipped.

INSTALLATION

(1) Connect the forward folding cable assembly, if equipped.
(2) Connect the recliner cable.
(3) Install the two seat cushion frame bolts.
(4) Install the two seat back bolts.
(5) Connect the seat back dump cables.
(6) Install the recliner cover.
(7) Connect the rear j-straps of the cushion.
(8) Connect the j-straps at the lower edge of the seat back.
(9) Install the seat. (Refer to 23 - BODY/SEATS/ SEAT - INSTALLATION)

FRONT SEAT BACK RECLINER CABLE

REMOVAL

(1) Remove seat cushion cover. (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - REMOVAL)
(2) Disengage cable from recliner release handle. (Fig. 6) and (Fig. 7)
(3) Route cable through seat cushion pad.
(4) Disengage cable from mounting bracket.

FRONT SEAT BACK RECLINER CABLE (Continued)

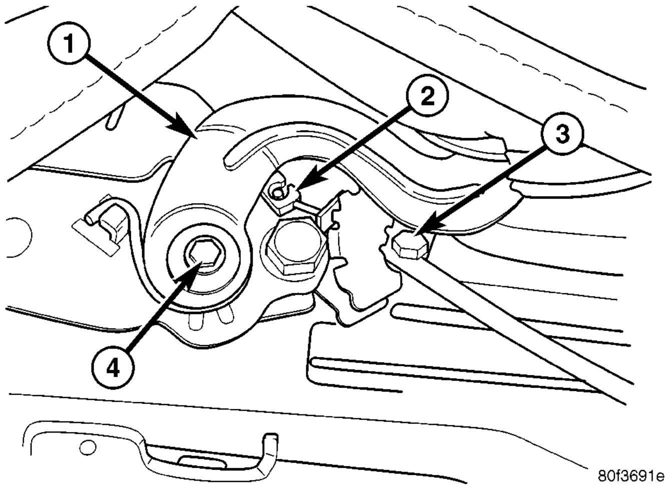

Fig. 6 RECLINER HANDLE/CABLE

1 - RECLINER HANDLE
2 - RECLINER CABLE END
3 - RECLINER CABLE
4 - RECLINER HANDLE BOLT

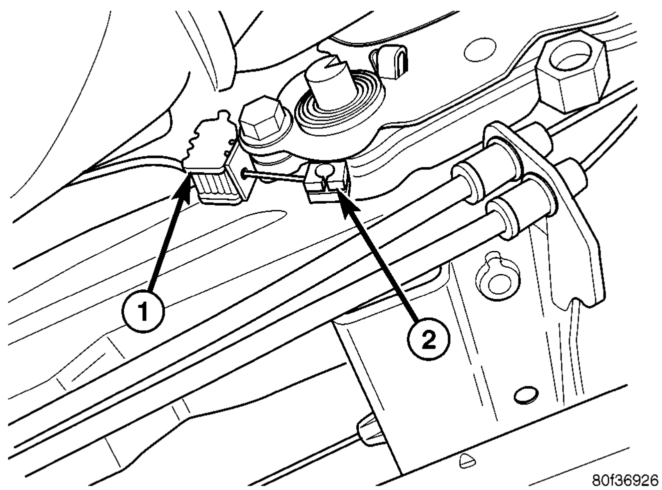

Fig. 7 RECLINER CABLE END

1 - RECLINER CABLE
2 - RECLINER CABLE END

INSTALLATION

(1) Engage cable to mounting bracket.

(2) Route cable through seat cushion pad.

(3) Engage cable to recliner release.

(4) Install seat back cover. (Refer to 23 - BODY/SEATS/FRONT SEAT BACK COVER - INSTALLATION)

FRONT SEAT FOLDING RELEASE CABLE

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/SEAT - REMOVAL)

(2) Disconnect the release cable folding end. (Fig. 8)

(3) Remove the inboard recliner. (Refer to 23 - BODY/SEATS/SEAT BACK RECLINER - REMOVAL)

(4) Disconnect the release cable assembly at the inboard recliner, from the support bracket. (Fig. 9)

(5) Disconnect the cable assembly at the slider and remove. (Fig. 10)

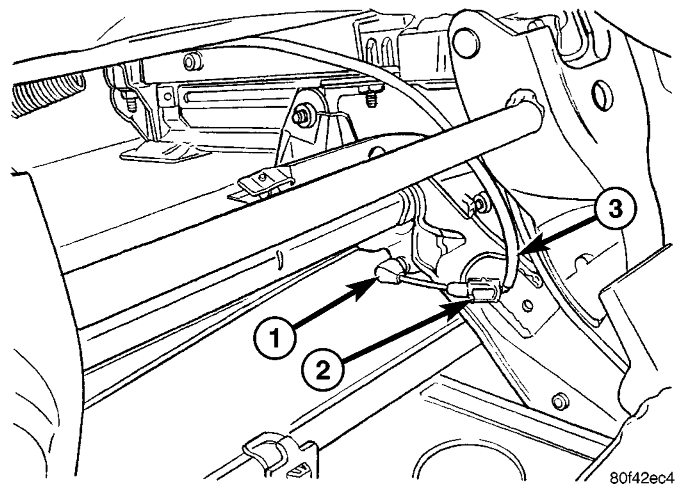

Fig. 8 RELEASE CABLE/FOLDING END

1 - CABLE END CLIP
2 - CABLE HOUSING
3 - CABLE ASSEMBLY

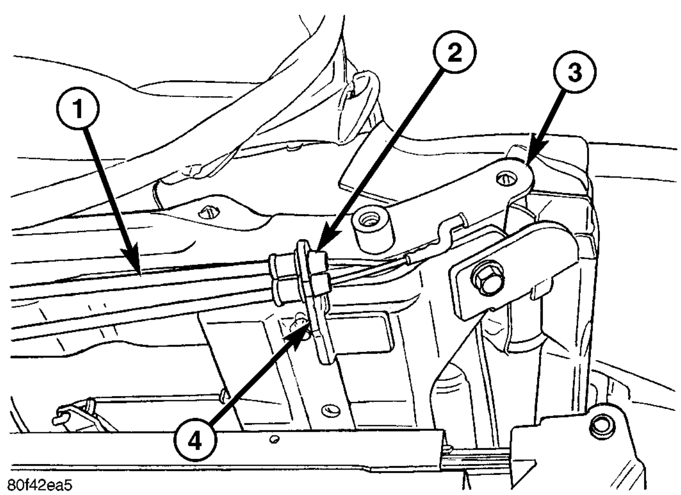

Fig. 9 RELEASE CABLE/RECLINER END

1 - CABLE ASSEMBLY
2 - CABLE HOUSING
3 - SEAT CUSHION FRAME
4 - CABLE SUPPORT BRACKET

FRONT SEAT FOLDING RELEASE CABLE (Continued)

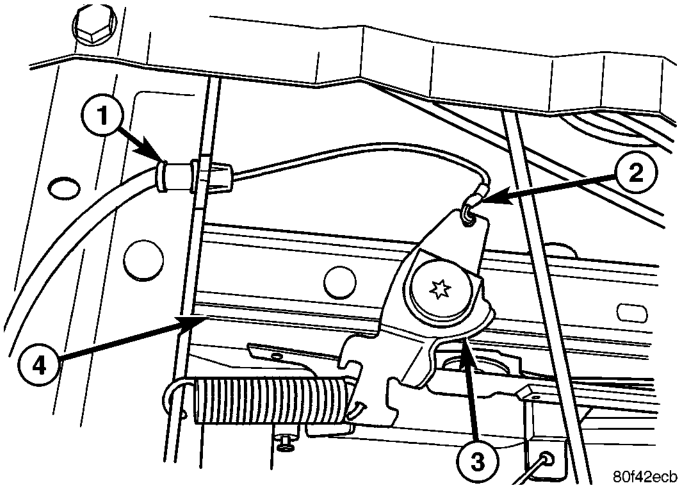

Fig. 10 RELEASE CABLE/SLIDER END

1 - CABLE HOUSING
2 - CABLE END
3 - SLIDER
4 - SEAT CUSHION FRAME

INSTALLATION

(1) Connect the cable assembly at the slider.

(2) Connect the inboard release cable assembly to the support bracket at the recliner.

(3) Install the inboard recliner. (Refer to 23 - BODY/SEATS/SEAT BACK RECLINER - INSTALLATION)

(4) Connect the folding end of the release cable assembly.

(5) Install the seat. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)

FRONT SEAT BACK DUMP CABLE

REMOVAL

(1) Remove the seat back cover. (Refer to 23 - BODY/SEATS/FRONT SEAT BACK COVER - REMOVAL)

(2) Disconnect the dump cables from the recliners. (Fig. 4)

(3) Remove the two dump handle assembly screws and remove the release cable assembly.

INSTALLATION

(1) Install the dump handle assembly and install the two screws.

(2) Connect the dump cables at the recliners.

(3) Install the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - INSTALLATION)

FRONT SEAT TRACK ADJUSTER

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/SEAT - REMOVAL)

(2) Position aside the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - REMOVAL)

(3) Remove the recliner covers. (Refer to 23 - BODY/SEATS/SEAT BACK RECLINER - REMOVAL)

(4) Position aside the seat cushion cover. (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - REMOVAL)

(5) Disconnect the recliner cable ends. (Fig. 11) and (Fig. 12)

(6) Remove the seat cushion to hinge bolts. (Fig. 11) and (Fig. 12)

(7) Disconnect the folding release cable from the seat back recliner, if equipped. (Fig. 11)

(8) Remove the seat back assembly.

(9) Remove the two bolts on either side of the seat cushion and remove the seat track assembly. (Fig. 13)

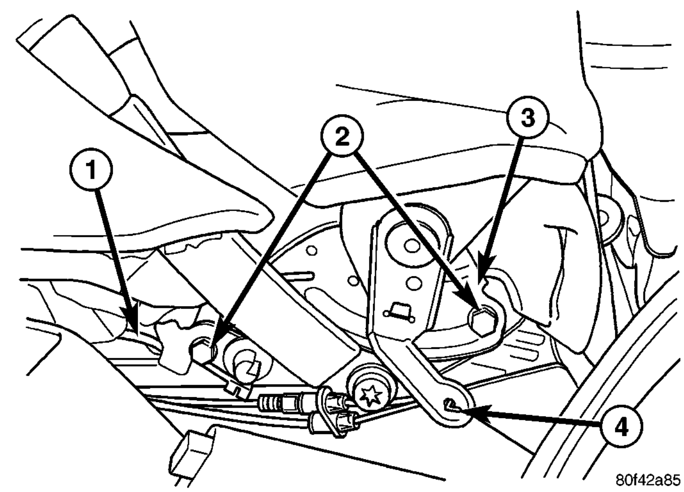

Fig. 11 INBOARD SEAT CUSHION AND HINGE

1 - RECLINER CABLE
2 - SEAT CUSHION FRAME BOLTS
3 - SEAT CUSHION FRAME
4 - FOLDING RELEASE CABLE ASSEMBLY END

INSTALLATION

(1) Install the seat track assembly and install the two front bolts.

(2) Install the seat back assembly.

(3) Connect the folding release cable assembly end to the seat back recliner.

(4) Install the seat back assembly bolts.

(5) Tighten the seat track bolts to 50 N·m (37 ft. lbs.)

(6) Connect the recliner cables.

FRONT SEAT TRACK ADJUSTER (Continued)

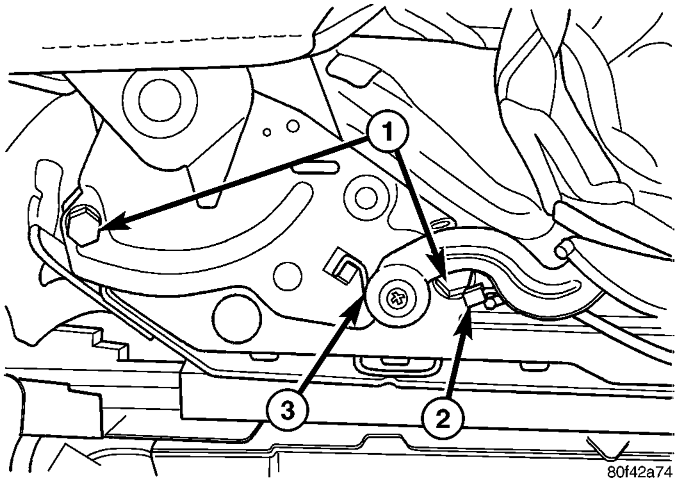

Fig. 12 SEAT CUSHION AND HINGE

1 - SEAT CUSHION FRAME BOLTS
2 - RECLINER CABLE END
3 - RECLINER HANDLE

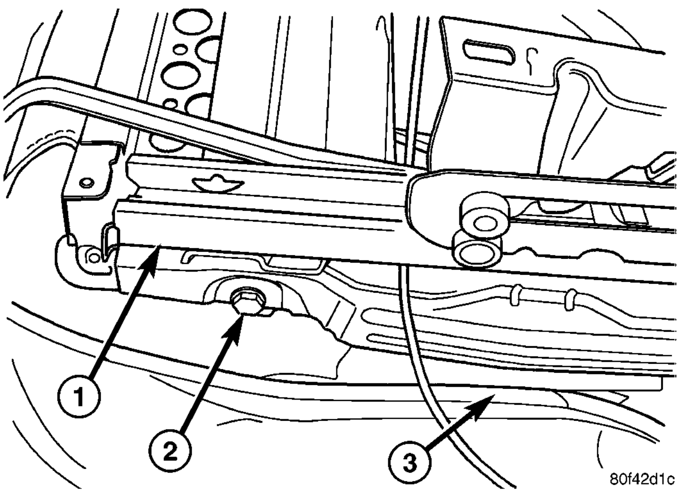

Fig. 13 FRONT SEAT CUSHION BOLTS

1 - SEAT TRACK
2 - SEAT CUSHION FRAME BOLT
3 - SEAT CUSHION

(7) Install the seat cushion cover. (Refer to 23 - BODY/SEATS/SEAT CUSHION COVER - INSTALLATION)

(8) Install the recliner covers. (Refer to 23 - BODY/SEATS/SEAT BACK RECLINER - INSTALLATION)

(9) Install the seat back cover. (Refer to 23 - BODY/SEATS/SEAT BACK COVER - INSTALLATION)

(10) Install the seat. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)

REAR SEAT

REMOVAL

(1) Remove the add-a-trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - REMOVAL)

(2) Using the latch handle, fold the seat back down and tip the seat assembly forward. (Fig. 14)

(3) Squeeze the release bar and disengage the front latches. (Fig. 15)

(4) Remove the seat through tailgate opening.

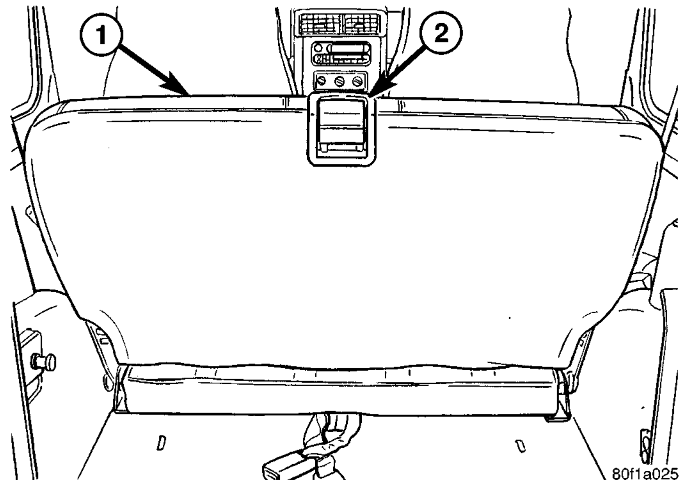

Fig. 14 REAR SEAT BACK

1 - REAR SEAT BACK
2 - RELEASE HANDLE

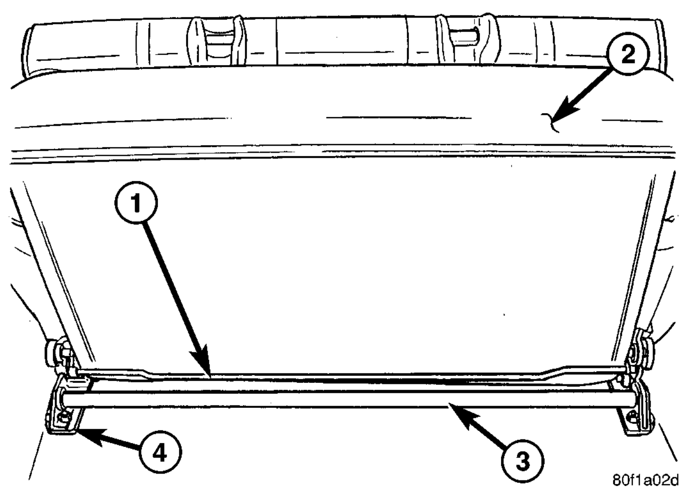

Fig. 15 REAR SEAT RELEASE LATCH ROD

1 - RELEASE LATCH ROD
2 - REAR SEAT CUSHION
3 - REAR SEAT LATCH ASSEMBLY
4 - REAR SEAT LATCH STRIKER (4)

INSTALLATION

(1) Position the seat on the rear floor panel and engage the seat frame release latch with the front strikers.

REAR SEAT (Continued)

(2) Roll seat back and engage the rear latches with the rear strikers.

(3) Return the seat back to the up position.

(4) Install the add-a-trunk, if equipped. (Refer to 23 - BODY/INTERIOR/ADD-A-TRUNK - INSTALLATION)

REAR SEAT BACK

REMOVAL

(1) Remove rear seat. (Refer to 23 - BODY/SEATS/ REAR SEAT - REMOVAL)

(2) Remove the bolts attaching the seat back assembly to the seat cushion and remove the seat back. (Fig. 16)

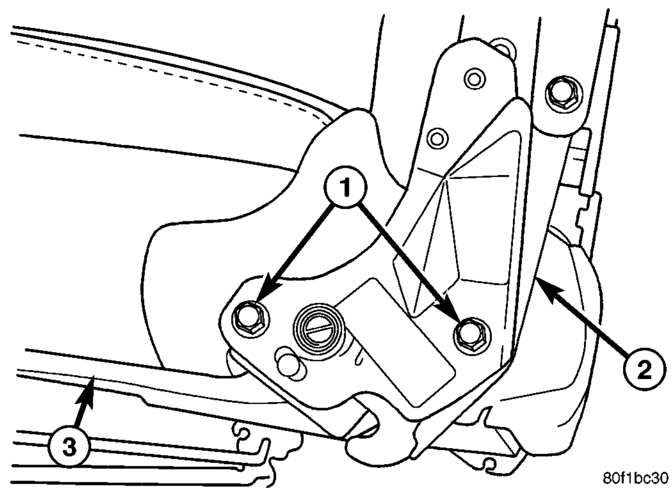

Fig. 16 REAR SEAT BACK HINGE

1 - SEAT CUSHION BOLTS
2 - SEAT BACK HINGE
3 - SEAT CUSHION

INSTALLATION

(1) Position the seat back on the seat cushion and install the bolts.

(2) Tighten the bolts to 50 N·m (37 ft. lbs.).

(3) Install rear seat. (Refer to 23 - BODY/SEATS/ REAR SEAT - INSTALLATION)

REAR SEAT BACK HINGE

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/ REAR SEAT - REMOVAL)

(2) Remove the lower hinge bolts. (Fig. 16)

(3) Disconnect the lower j-straps of the seat back and position aside the seat back cover.

(4) Disconnect the release cable. (Fig. 17)

(5) Remove the bolts and remove the hinge.

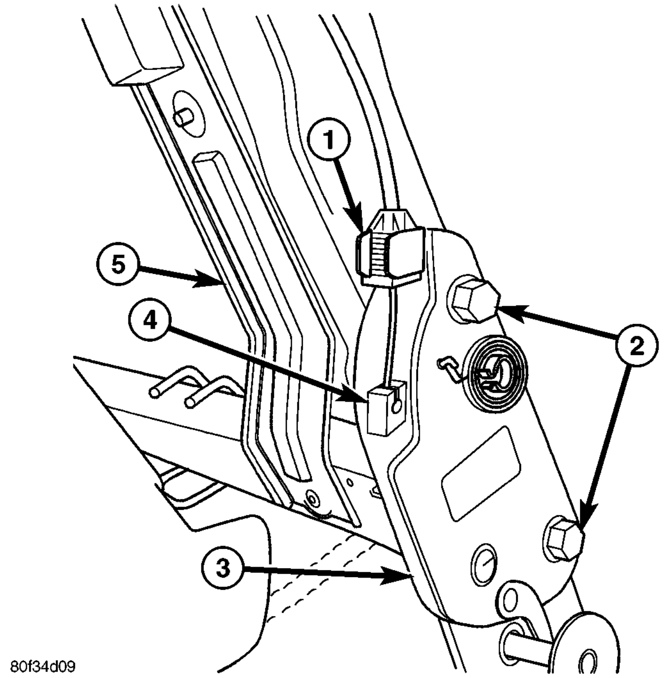

Fig. 17 REAR SEAT BACK HINGE

1 - RELEASE CABLE GUIDE
2 - BOLTS
3 - SEAT BACK HINGE
4 - RELEASE CABLE CONNECTION
5 - SEAT BACK FRAME

INSTALLATION

(1) Install the hinge and install the bolts.

(2) Tighten the bolts to 50 N·m (37 ft. lbs.).

(3) Connect the release cable.

(4) Connect the lower j-straps of the seat back.

(5) Install the lower hinge bolts and tighten to 50 N·m (37 ft. lbs.).

(6) Install the seat. (Refer to 23 - BODY/SEATS/ REAR SEAT - INSTALLATION)

REAR SEAT BACK COVER

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/ SEAT - REMOVAL)

(2) Remove the screws and remove the seat back release handle bezel. (Fig. 18)

(3) Release the j-clips at the bottom of the seat back and remove the seat cover.

(4) Remove the hog rings and remove the seat cushion. (Fig. 19)

INSTALLATION

(1) Position the cushion onto the seat back frame and install new hog ring fasteners.

(2) Install the cover over the seat back frame and cushion.

REAR SEAT BACK COVER (Continued)

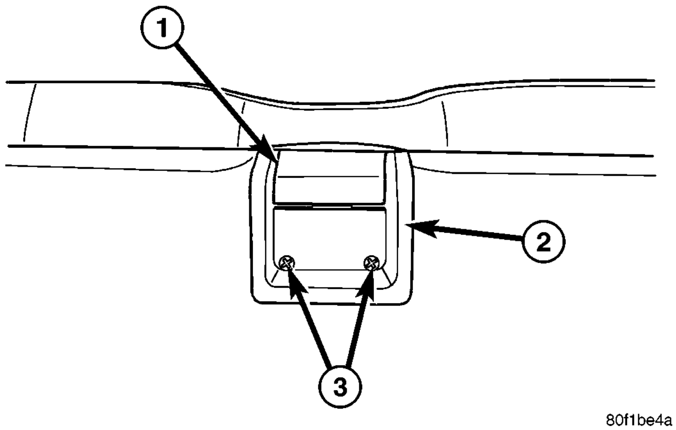

Fig. 18 RELEASE HANDLE

1 - RELEASE HANDLE
2 - BEZEL
3 - SCREWS (2)

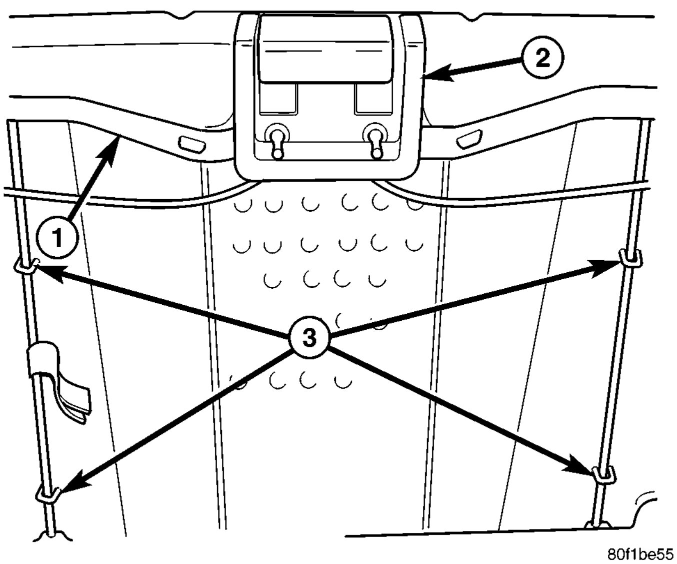

Fig. 19 SEAT BACK CUSHION

1 - SEAT BACK FRAME
2 - SEAT BACK RELEASE HANDLE
3 - HOG RINGS (4)

(3) Connect the bottom j-clips.
(4) Install the release handle bezel and install the screws.
(5) Install the rear seat back. (Refer to 23 - BODY/SEATS/REAR SEAT BACK - INSTALLATION)

REAR SEAT CUSHION COVER

REMOVAL

(1) Remove the rear seat back. (Refer to 23 - BODY/SEATS/REAR SEAT BACK - REMOVAL)
(2) Un-zip the cover. (Fig. 20)
(3) Release the J-clips. (Fig. 21)
(4) Roll the cover from seat cushion and separate from the seat cushion frame.
(5) Remove the hogrings from the foam to cover.

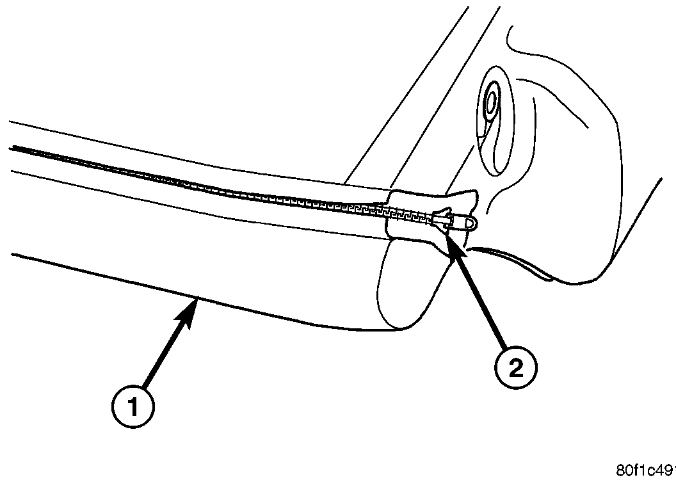

Fig. 20 SEAT CUSHION COVER

1 - SEAT CUSHION
2 - COVER ZIPPER

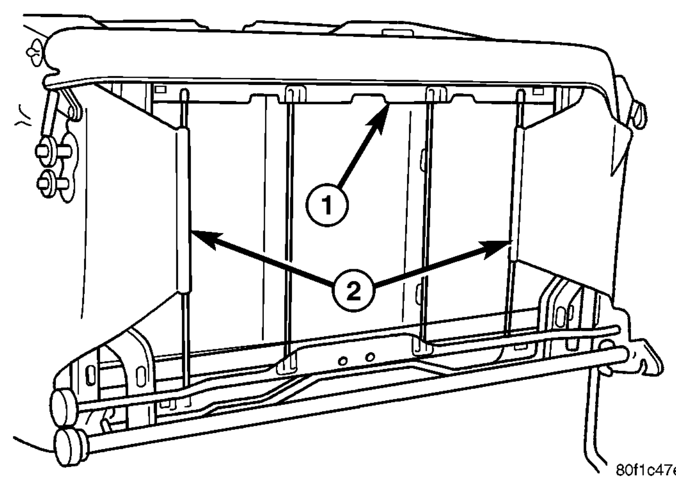

Fig. 21 SEAT CUSHION

1 - SEAT CUSHION FRAME
2 - J-STRAPS

INSTALLATION

(1) Position the cover on the cushion, install new hogrings to foam, and roll cover downward over the corners.
(2) Connect the J-clips to the seat cushion frame.

REAR SEAT CUSHION COVER (Continued)

(3) Close the cover zipper and tuck the zipper ends into the cover.

(4) Install the rear seat back. (Refer to 23 - BODY/SEATS/REAR SEAT BACK - INSTALLATION)

REAR SEAT RELEASE CABLE

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/REAR SEAT - REMOVAL)

(2) Remove the screws and remove the seat back release handle bezel. (Fig. 18)

(3) Release the j-clips at the bottom of the seat back and remove the seat cover.

(4) Disconnect the cables at the seat back hinges. (Fig. 17)

(5) Position the seat back cushion aside and remove the screws. (Fig. 22)

(6) Remove the seat back release cable assembly.

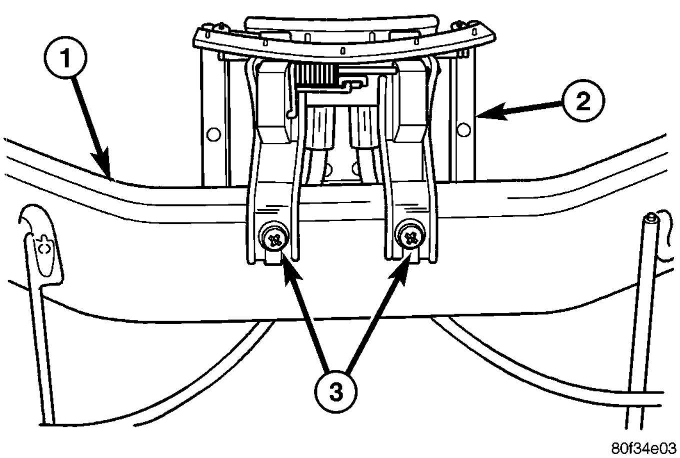

Fig. 22 RELEASE CABLE ASSEMBLY

1 - SEAT BACK FRAME
2 - RELEASE CABLE ASSEMBLY HANDLE
3 - SCREWS

INSTALLATION

(1) Install the seat back release cable assembly and install the screws.

(2) Connect the cables at the seat back hinges.

(3) Install the seat cover and engage the j-clips at the bottom of the seat back.

(4) Install the handle bezel and install the screws.

(5) Install the seat. (Refer to 23 - BODY/SEATS/REAR SEAT - INSTALLATION)

REAR SEAT STRIKERS

REMOVAL

Rear Strikers

(1) Release the seat back and fold seat assembly forward.

(2) Remove the bolts and remove the striker. (Fig. 23)

Front Strikers

(1) Remove the seat. (Refer to 23 - BODY/SEATS/REAR SEAT - REMOVAL)

(2) Remove the bolts and remove the striker. (Fig. 23)

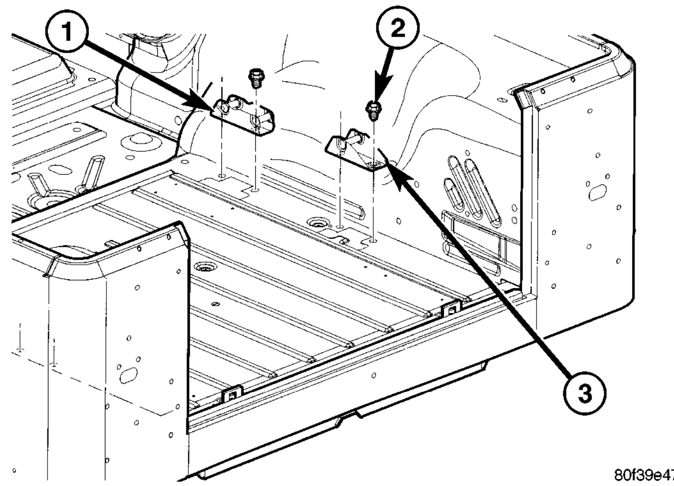

Fig. 23 REAR SEAT STRIKERS

1 - FRONT STRIKER
2 - BOLTS (2 PER STRIKER)
3 - REAR STRIKER

INSTALLATION

Front Strikers

(1) Install the striker and install the bolts.

(2) Tighten the bolts to 61 N·m (45 ft. lbs.).

(3) Install the seat. (Refer to 23 - BODY/SEATS/REAR SEAT - INSTALLATION)

Rear Strikers

(1) Install the striker and install the bolts.

(2) Tighten the bolts to 61 N·m (45 ft. lbs.).

(3) Return the seat to the down position.

STATIONARY GLASS

TABLE OF CONTENTS

STATIONARY GLASS

DESCRIPTION

WINDSHIELD SAFETY PRECAUTIONS

DESCRIPTION

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.

- **URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCH WELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.**
- **DAIMLERCHRYSLER DOES NOT RECOMMEND GLASS ADHESIVE BY BRAND. TECHNICIANS SHOULD REVIEW PRODUCT LABELS AND TECHNICAL DATA SHEETS, AND USE ONLY ADHESIVES THAT THEIR MANUFACTURES WARRANT WILL RESTORE A VEHICLE TO THE REQUIREMENTS OF FMVSS 212. TECHNICIANS SHOULD ALSO INSURE THAT PRIMERS AND CLEANERS ARE COMPATIBLE WITH THE PARTICULAR ADHESIVE USED.**
- **BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.**
- **VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.**
- **SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.**
- **ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.**

CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers. Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

OPERATION

The windshield is attached to the window frame with urethane adhesive. The urethane adhesive is applied cold and seals the surface area between the window opening and the glass. The primer adheres the urethane adhesive to the windshield.

It is difficult to salvage a windshield during the removal operation. The windshield is part of the structural support for the roof. The urethane bonding used to secure the windshield to the fence is difficult to cut or clean from any surface. If the moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and moldings from the parts supplier.

QUARTER GLASS

REMOVAL

(1) Cover surface areas with protective covering to avoid paint damage and extra clean-up time.

(2) Using a razor knife, slide the blade between the quarter glass and the inboard edge of the reveal molding.

(3) Cut around the interior perimeter of the reveal molding and sever the cap of the reveal molding.

QUARTER GLASS (Continued)

(4) Using a cold knife, cut the urethane around the perimeter of the quarter glass.

(5) Remove the quarter glass from the opening (Fig. 1).

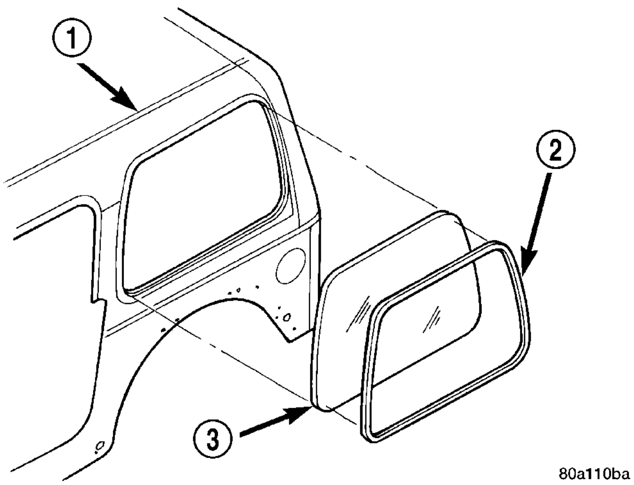

Fig. 1 HARD TOP QUARTER GLASS

1 - HARD TOP
2 - QUARTER GLASS REVEAL MOLDING
3 - QUARTER GLASS

INSTALLATION

(1) Trim the urethane from the quarter glass opening fence. Leave a 3 mm (0.1 in.) level base of urethane on the quarter glass opening fence.

(2) Place replacement quarter glass into quarter glass opening and position glass in the center of the opening against fence.

(3) Verify the glass lays evenly against the fence at the sides, top and bottom of the replacement quarter glass. Next, make alignment marks on glass and top with a grease pencil.

(4) Remove replacement quarter glass from opening.

(5) Position the quarter glass inside up on a suitable work surface.

WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN QUARTER GLASS BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.

(6) Clean inside of quarter glass with ammonia based glass cleaner and lint-free cloth.

(7) Clean the outer edge of the window glass with naphtha or a similar product.

(8) Apply molding to perimeter of quarter glass. The butt weld of the molding should be centered at the bottom edge of the quarter glass.

(9) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of the quarter glass and wipe with clean/dry lint-free cloth until no streaks are visible.

(10) Apply Glass Primer 25 mm (1 in.) wide around perimeter of quarter glass. Allow at least three minutes drying time.

(11) Apply Pinchweld primer 15 mm (0.75 in.) wide around the quarter glass fence. Allow at least three minutes drying time.

(12) Apply a 10 mm (0.4 in.) diameter bead of urethane to the center of the quarter glass fence surface area.

CAUTION: Be prepared to install the quarter glass immediately after applying the adhesive. The adhesive begins to cure within 10-15 minutes.

(13) Align the quarter glass with the grease pencil marks and position quarter glass on fence.

(14) Push the quarter glass inward until the reveal molding is seated on the hardtop. Use care to avoid excessive squeeze-out of adhesive.

(15) Open windows and liftgate to prevent pressure build-up while the urethane is curing.

(16) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold quarter glass in place until urethane cures.

(17) After urethane has cured, remove tape strips and water test quarter glass to verify repair.

WINDSHIELD

REMOVAL

The windshield is positioned in the reveal molding and is bonded to the windshield frame with urethane adhesive. The windshield interior trim molding is positioned onto the inner windshield frame pinchweld.

(1) Cover body surface areas with protective covering to avoid paint damage and extra clean-up time.

(2) Remove the windshield wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

(3) Remove the rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - REMOVAL)

(4) Using a razor knife, slide the blade between the windshield glass and the inboard edge of the reveal molding.

(5) Cut around the interior perimeter of the reveal molding and sever the cap of the reveal molding.

(6) Using a cold knife, cut the urethane around the perimeter of the windshield.

(7) Remove the windshield glass from the frame (Fig. 2).

WINDSHIELD (Continued)

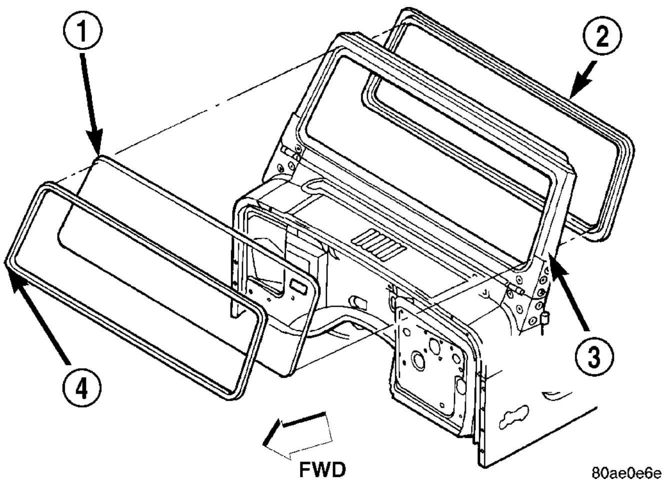

Fig. 2 WINDSHIELD

1 - WINDSHIELD
2 - INNER TRIM MOLDING
3 - WINDSHIELD FRAME
4 - WINDSHIELD MOLDING

INSTALLATION

(1) Trim the urethane from the pinchweld flanges. Leave a 3 mm (0.1 in.) level base of urethane on the pinchweld flanges.

(2) Place replacement windshield into windshield opening and position glass in the center of the opening against pinchweld flange.

(3) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement windshield. If not, the pinchweld flange must be formed to the shape of the new glass. Next, make alignment marks on glass and body with a grease pencil.

(4) Remove replacement windshield from windshield opening.

(5) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 3).

WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN WINDSHIELD BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.

(6) Clean inside of windshield with ammonia based glass cleaner and lint-free cloth.

(7) Apply molding to perimeter of windshield. The butt weld of the molding should be centered at the bottom edge of the windshield.

(8) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of windshield and wipe with clean/dry lint-free cloth until no streaks are visible.

(9) Apply Glass Primer 25 mm (1 in.) wide around perimeter of windshield. Allow at least three minutes drying time.

(10) Apply Pinchweld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(11) Apply a urethane bead (Fig. 4) on the pinchweld flange surface area 6 mm (.25 in.) from the outboard edge.

CAUTION: Be prepared to install the windshield glass immediately after applying the adhesive. The adhesive begins to cure within 10-15 minutes.

(12) Align the windshield with the grease pencil marks and position windshield on pinchweld flanges.

(13) Push the windshield glass inward until the reveal molding is seated on the windshield frame. Use care to avoid excessive squeeze-out of adhesive.

(14) Open windows and liftgate to prevent pressure build-up while the urethane is curing.

(15) Starting in each corner, apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold windshield in place until urethane cures.

(16) Install the rear view mirror support bracket. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR SUPPORT BRACKET - INSTALLATION)

(17) Install the rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - INSTALLATION)

(18) Install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

(19) After urethane has cured, remove tape strips and water test windshield to verify repair.

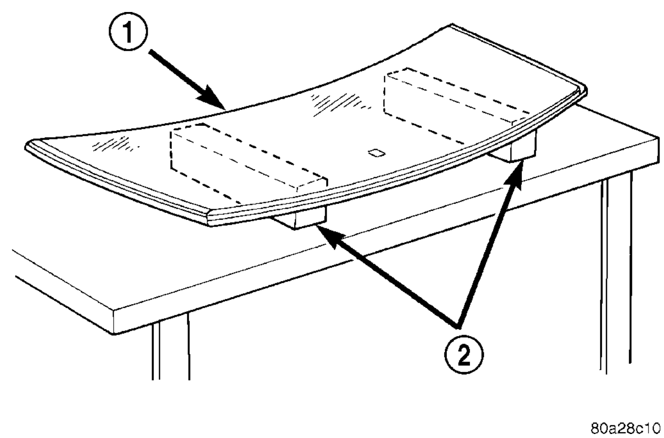

Fig. 3 WORK SURFACE SET UP AND MOLDING INSTALLATION

1 - WINDSHIELD AND MOLDINGS
2 - BLOCKS

WINDSHIELD (Continued)

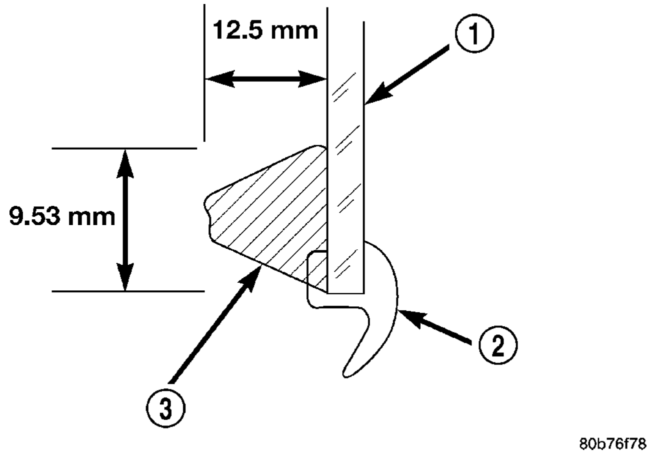

Fig. 4 URETHANE BEAD

1 - WINDSHIELD
2 - MOLDING
3 - URETHANE BEAD

WINDSHIELD HINGE

REMOVAL

NOTE: If both hinges are to be replaced, the windshield must be tilted to the full forward position. (Refer to 23 - BODY/STATIONARY GLASS/WINDSHIELD - REMOVAL)

(1) Remove door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - REMOVAL)

(2) Remove the bolts attaching the hinge to the cowl (Fig. 5).

(3) Remove the bolts attaching the hinge to the windshield frame.

(4) Separate the hinge from the vehicle.

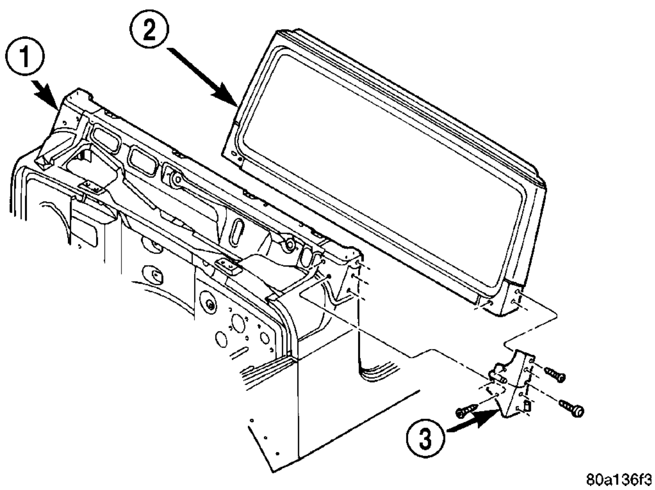

Fig. 5 WINDSHIELD HINGE

1 - COWL
2 - WINDSHIELD
3 - WINDSHIELD HINGE

INSTALLATION

(1) Paint as required.

(2) Clean the contact surface of the hinge and cowl with isopropyl alcohol or equivalent.

(3) Apply a 4 mm bead of Mopar® Vinyl Acrylic Sealant or equivalent around the perimeter of the hinge contact surface. The bead should be 10 mm inboard of the edge.

(4) Position the hinge on the vehicle.

(5) Install the bolts attaching the hinge to the windshield frame.

(6) Install the bolts attaching the hinge to the cowl.

(7) Ensure that the sealant provides complete coverage. Wipe away excess sealant.

(8) Install door. (Refer to 23 - BODY/DOOR - FRONT/DOOR - INSTALLATION)

WINDSHIELD FRAME

REMOVAL

(1) Unlatch top.

(2) Remove the bolts attaching the sport bar to the windshield frame.

(3) Remove the windshield wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

(4) Remove the torx screw closest to the hinge pivot point and tilt the windshield forward.

(5) Remove the torx screws attaching the windshield hinge to the windshield frame (Fig. 6).

(6) Separate the windshield frame from the vehicle.

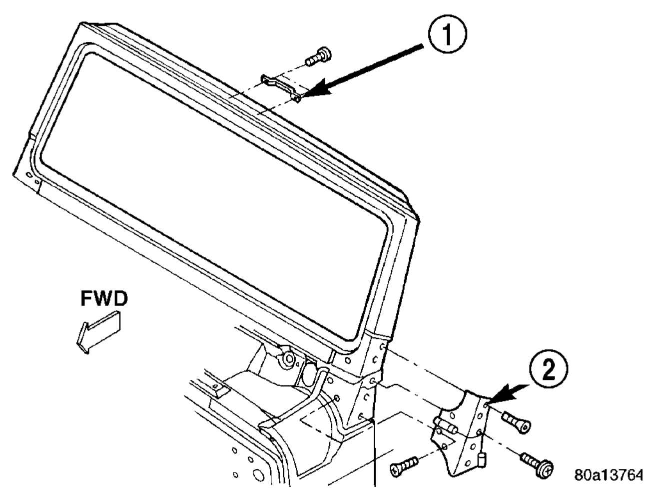

Fig. 6 WINDSHIELD FRAME

1 - WINDSHIELD HOLD DOWN LOOP
2 - WINDSHIELD HINGE

WINDSHIELD FRAME (Continued)

INSTALLATION

NOTE: Inspect windshield to cowl seal for damage and confirm correct position.

(1) Position the windshield frame on the vehicle.

(2) Install the torx screws attaching the windshield hinge to the windshield frame.

(3) Tilt the windshield rearward.

(4) Install the torx screw closest to the hinge pivot point and lock the windshield in the upright position.

(5) Install the windshield wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

(6) Install the bolts attaching the sport bar to the windshield frame.

(7) Latch top.

WEATHERSTRIP/SEALS

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HOOD TO COWL WEATHERSTRIP

REMOVAL

(1) Carefully separate the weatherstrip from the cowl flange (Fig. 1).

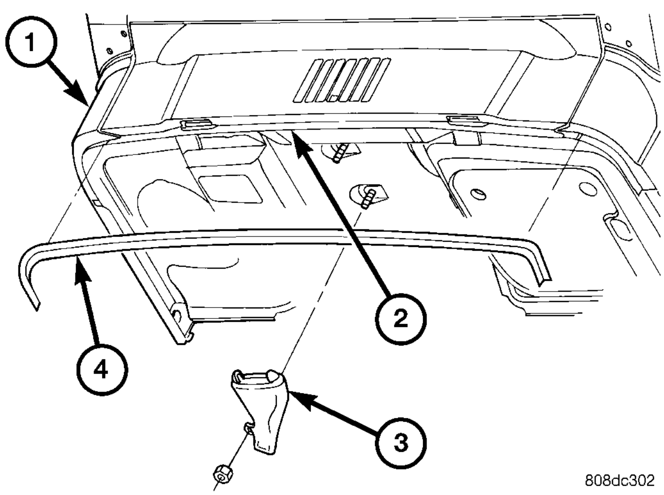

Fig. 1 HOOD TO COWL WEATHERSTRIP

1 - COWL
2 - COWL FLANGE
3 - COWL PLENUM DRAIN
4 - HOOD TO COWL WEATHERSTRIP

INSTALLATION

(1) Position the weatherstrip on the cowl flange and press it into place.

FULL DOOR INNER BELT WEATHERSTRIP

DESCRIPTION - FULL DOOR INNER BELT WEATHERSTRIP

The inner belt weatherstrip is attached to the door trim panel and is not serviceable. If the inner belt weatherstrip needs to be replaced, replace the door trim panel.

FULL DOOR OUTER BELT SEAL

REMOVAL

(1) Remove the door sail panel.
(2) Disengage the clips attaching the outer belt seal to the door (Fig. 2).
(3) Separate the seal from the door.

FULL DOOR OUTER BELT SEAL (Continued)

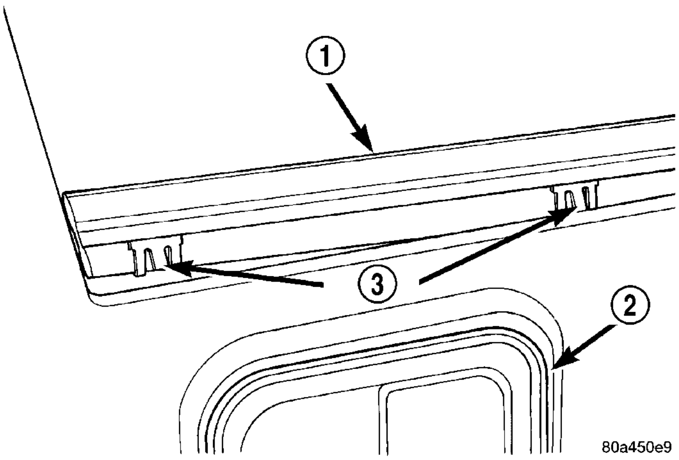

Fig. 2 FULL DOOR OUTER BELT SEAL

1 - OUTER BELTLINE WEATHERSTRIP
2 - OUTSIDE DOOR HANDLE
3 - CLIPS

INSTALLATION

(1) Position the seal on the door.

(2) Engage the clips attaching the outer belt seal to the door.

(3) Install the door sail panel.

FULL DOOR WEATHERSTRIP

REMOVAL

NOTE: The upper portion of the weatherstrip is seated into a channel around the window opening frame. The lower portion of the weatherstrip is attached to the door with push-in fasteners.

(1) Peel the weatherstrip from the channel.

(2) Remove the push-in fasteners attaching the weatherstrip to the door (Fig. 3).

INSTALLATION

(1) Position the lower part of the weatherstrip and seat the push-in fasteners fully.

(2) Install the weatherstrip in the upper weather-strip channel seat fully.

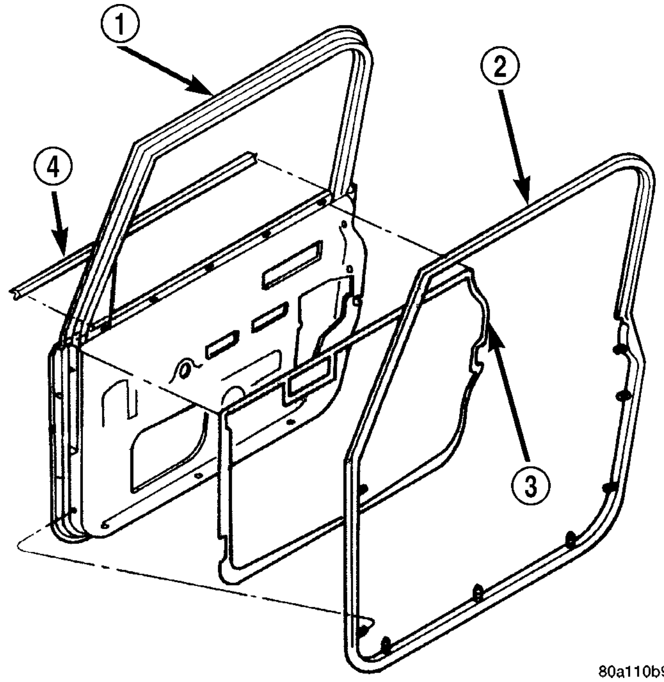

Fig. 3 FULL DOOR WEATHERSTRIP

1 - FULL DOOR
2 - WEATHERSTRIP
3 - WATERDAM
4 - OUTER DOOR BELT SEAL

HALF DOOR WEATHERSTRIP

REMOVAL

NOTE: The weatherstrip is attached to the door with push-in fasteners.

(1) Remove trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - REMOVAL)

(2) Remove window retaining sleeve.

(3) Remove the push-in fasteners attaching the weatherstrip to the door. (Fig. 4)

INSTALLATION

NOTE: The weatherstrip is attached to the door with push-in fasteners.

(1) Position the weatherstrip onto the door and seat the push-in fasteners fully.

(2) Install window retaining sleeve.

HALF DOOR WEATHERSTRIP (Continued)

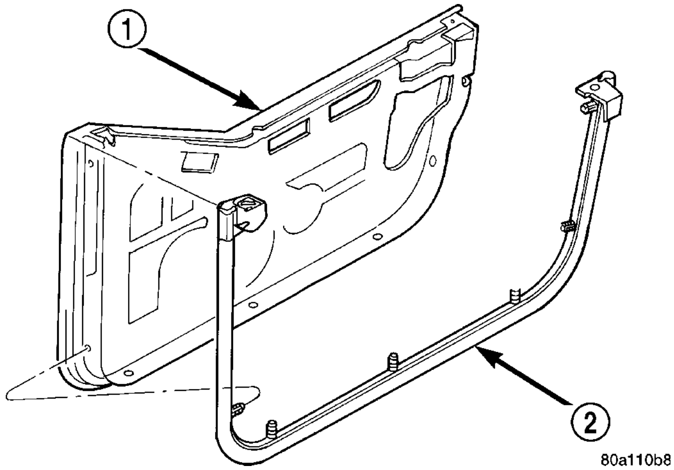

Fig. 4 HALF DOOR WEATHERSTRIP

1 - HALF DOOR
2 - WEATHERSTRIP

(3) Install trim panel. (Refer to 23 - BODY/HALF DOOR/TRIM PANEL - INSTALLATION)

TAILGATE WEATHERSTRIP AND CHANNEL

REMOVAL

(1) Open the tailgate.

(2) Remove the push-in fasteners attaching the weatherstrip to the top corners of the tailgate (Fig. 5).

(3) Peel the weatherstrip from the upper tailgate corners.

(4) Slide the weatherstrip out of the tailgate channel.

(5) If the weatherstrip channel requires replacement, peel the weatherstrip channel from the tailgate.

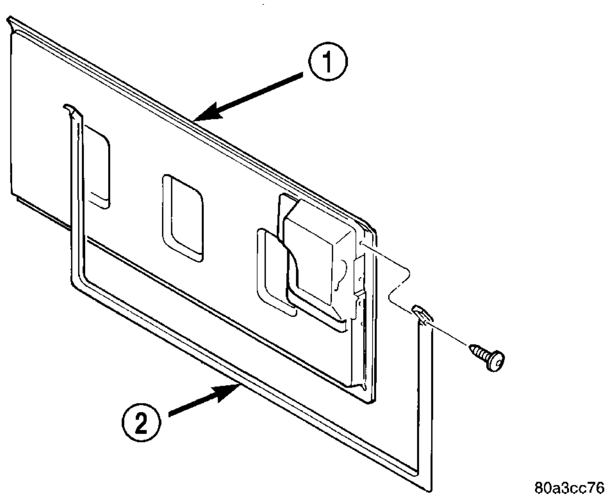

Fig. 5 TAILGATE WEATHERSTRIP

1 - TAILGATE
2 - WEATHERSTRIP

INSTALLATION

(1) If the weatherstrip channel is being replaced;

(a) Clean the channel contact surface on the tailgate with isopropyl alcohol, or equivalent.

(b) Peel the paper backing from the weatherstrip channel.

(c) Install the push pin fasteners attaching the weatherstrip to the tailgate.

(d) Position weatherstrip channel to the tailgate and press into place.

(e) Use hand pressure or a roller to wet out the tape adhesive holding the weatherstrip channel to the tailgate.

(2) Install the push pin fasteners attaching the weatherstrip to the tailgate.

(3) Slide the weatherstrip into the weatherstrip channel.

WINDSHIELD FRAME WEATHERSTRIP

REMOVAL

UPPER (Header)

(1) Disconnect the top from the windshield frame.

(2) Disengage the push-in fasteners attaching the weatherstrip to the windshield frame.

(3) Peel the weatherstrip from the frame.

LOWER

NOTE: The lower windshield frame weatherstrip can be removed with the frame tilted forward to the full horizontal position.

(1) Remove the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

(2) Disconnect the top from the windshield frame.

(3) Remove the cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - REMOVAL)

(4) Remove the torx screws on each side of the windshield frame allowing the windshield frame to tilt to the full horizontal position.

(5) Disengage the outboard push-in fasteners at the top of cowl on each hinge pillar (Fig. 6).

(6) Remove the weatherstrip from the cowl.

INSTALLATION

UPPER (Header)

(1) Clean the seal contact surface on the windshield frame with isopropyl alcohol or equivalent.

WINDSHIELD FRAME WEATHERSTRIP (Continued)

NOTE: Ensure that the contact surface is dry and free from any residue, poor adhesion will result.

(2) Position the weatherstrip on the windshield frame, align the push-in fasteners and press it into place (Fig. 6).

(3) Remove adhesive backing from the bottom of the weatherstrip.

(4) Using forceful hand pressure, seat the adhesive on the contact surface.

NOTE: If tape surface becomes contaminated, it will not adhere to the windshield frame.

(5) Connect the top to the windshield frame.

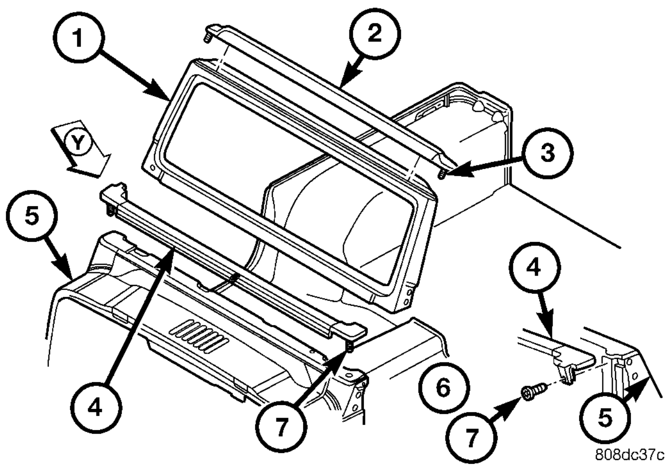

Fig. 6 WINDSHIELD FRAME WEATHERSTRIP

1 - WINDSHIELD FRAME
2 - UPPER HEADER WEATHERSTRIP
3 - PUSH-IN FASTENER
4 - WINDSHIELD TO COWL WEATHERSTRIP
5 - COWL
6 - VIEW OF ARROW Y
7 - PUSH-IN FASTENERS (2 per end)

LOWER

(1) Position the weatherstrip on the cowl.

(2) Align the outer push-in fasteners and press them into place.

(3) Tilt the windshield frame rearward to the full vertical position.

NOTE: Ensure weatherstrip outer detail mates with the a-pillar trim. Outer detail must be flush with trim surface for proper sealing performance.

(4) Install the torx screws on each side of the windshield securing the windshield frame.

(5) Connect the top to the windshield frame.

(6) Install cowl grille. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE AND SCREEN - INSTALLATION)

(7) Install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

BODY STRUCTURE

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GAP AND FLUSH

SPECIFICATIONS - GAP AND FLUSH

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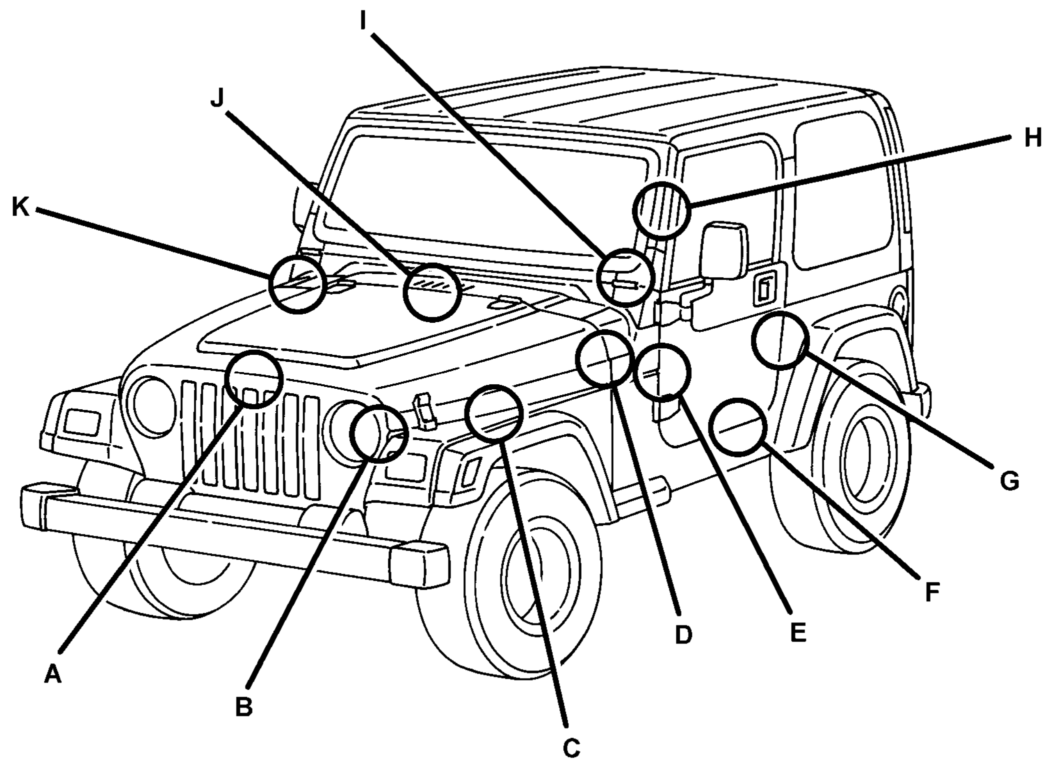
GAP AND FLUSH (Continued)



	DESCRIPTION	GAP	FLUSH
A	Hood to Radiator Guard	7.0 +/- 1.5	N/A
B	Hood to Lamp Bezel	4.0 +/- 2.0	N/A
C	Hood to Fender	7.0 +/- 1.5	N/A
D	Hood to Cowl at Side	7.0 +/- 1.5	0.0 +/- 1.5
E	Door to Cowl	5.0 +/- 1.5	0.0 +/- 1.5
F	Door to Bodyside at Bottom	5.0 +/- 1.5	0.0 +/- 1.5
G	Door to Bodyside at Rear	5.0 +/- 1.5	0.0 +/- 1.5
H	Door to Windshield Frame	5.0 +/- 1.5	0.0 +/- 2.0
I	Windshield Hinge to Windshield Frame	N/A	0.0 +/- 1.0
J	Hood to Cowl	7.0 +/- 1.5	0.0 +/- 1.5
K	Cowl Top Grille to Cowl Top End	5.0 +/- 1.5	0.0 +/- 1.5

NOTE: ALL MEASUREMENTS ARE IN MM.

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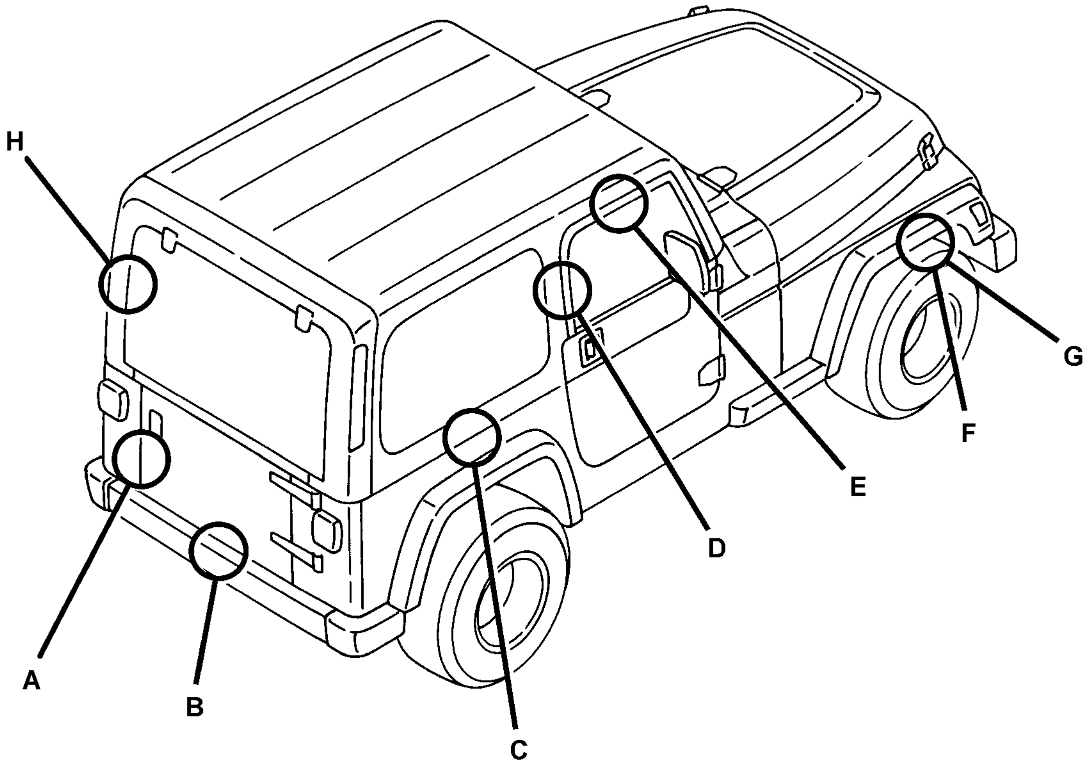
Fig. 1 FRONT/SIDE DIMENSIONS

GAP AND FLUSH (Continued)



	DESCRIPTION	GAP	FLUSH
A	Tailgate to Rear Corner Panel	5.0 +/- 1.5	0.0 +/- 1.5
B	Tailgate to Rear Center Lower	5.0 +/- 1.5	0.0 +/- 1.5
C	Hardtop to Bodyside	N/A	2.0 +/- 1.5
D	Door Header to Hardtop at Rear	4.5 +/- 1.5	0.0 +/- 2.0
E	Door to Top at Top	5.0 +/- 1.5	0.0 +/- 2.0
F	Wheelflare to Fender (Highline)	N/A	3.0 +/- 1.5
G	Wheelflare to Fender (Base Level)	N/A	14.0 +/- 1.5
H	Liftglass to Hardtop	4.5 +/- 2.0	4.0 +/- 2.0

NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf8

Fig. 2 REAR/SIDE DIMENSIONS

OPENING DIMENSIONS

SPECIFICATIONS

BODY OPENING DIMENSIONS

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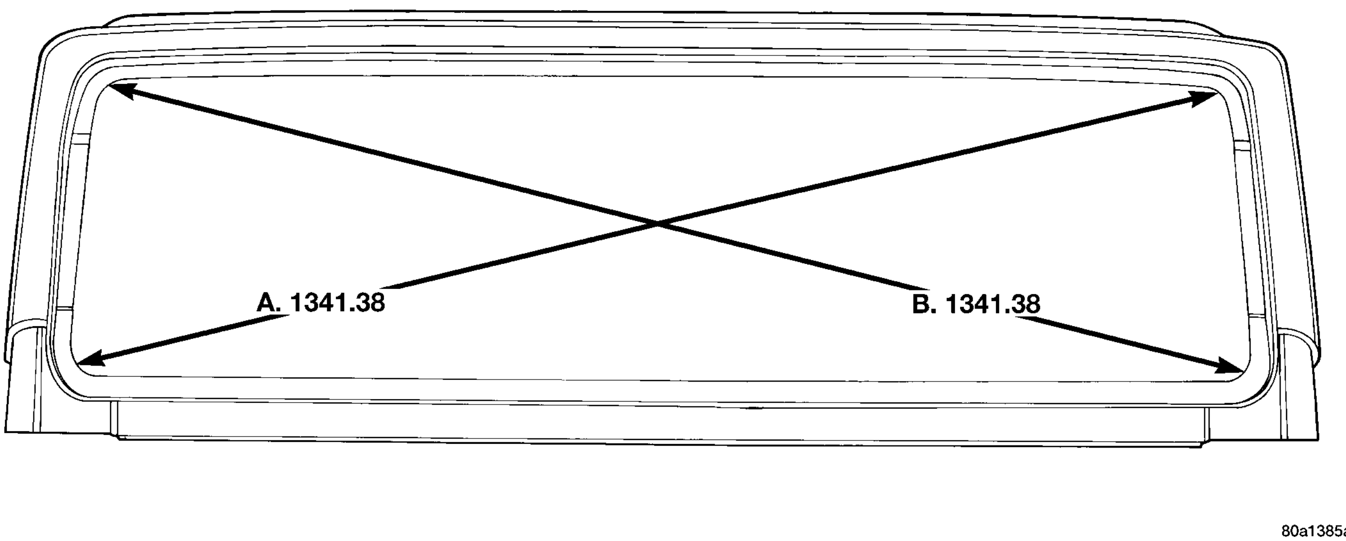

Fig. 3 WINDSHIELD OPENING

- A & B. Center of radius at bottom to center of radius top.

OPENING DIMENSIONS (Continued)

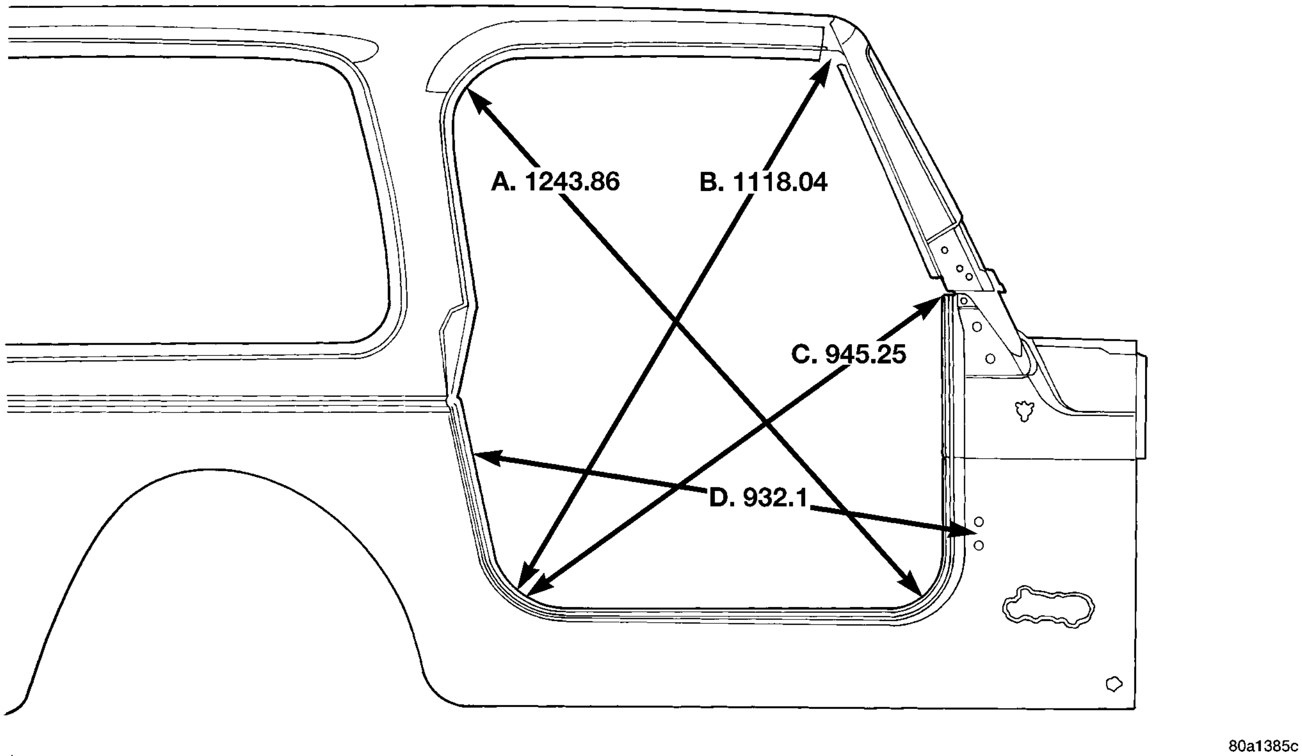

Fig. 4 DOOR OPENING

- A. Center of radius at bottom front to center of radius at top rear.
- B. Center of door lower rear corner to center of top of windshield frame.
- C. Center of door lower rear corner to top of cowl.
- D. Center of door hinge mount to center of door striker mount.

OPENING DIMENSIONS (Continued)

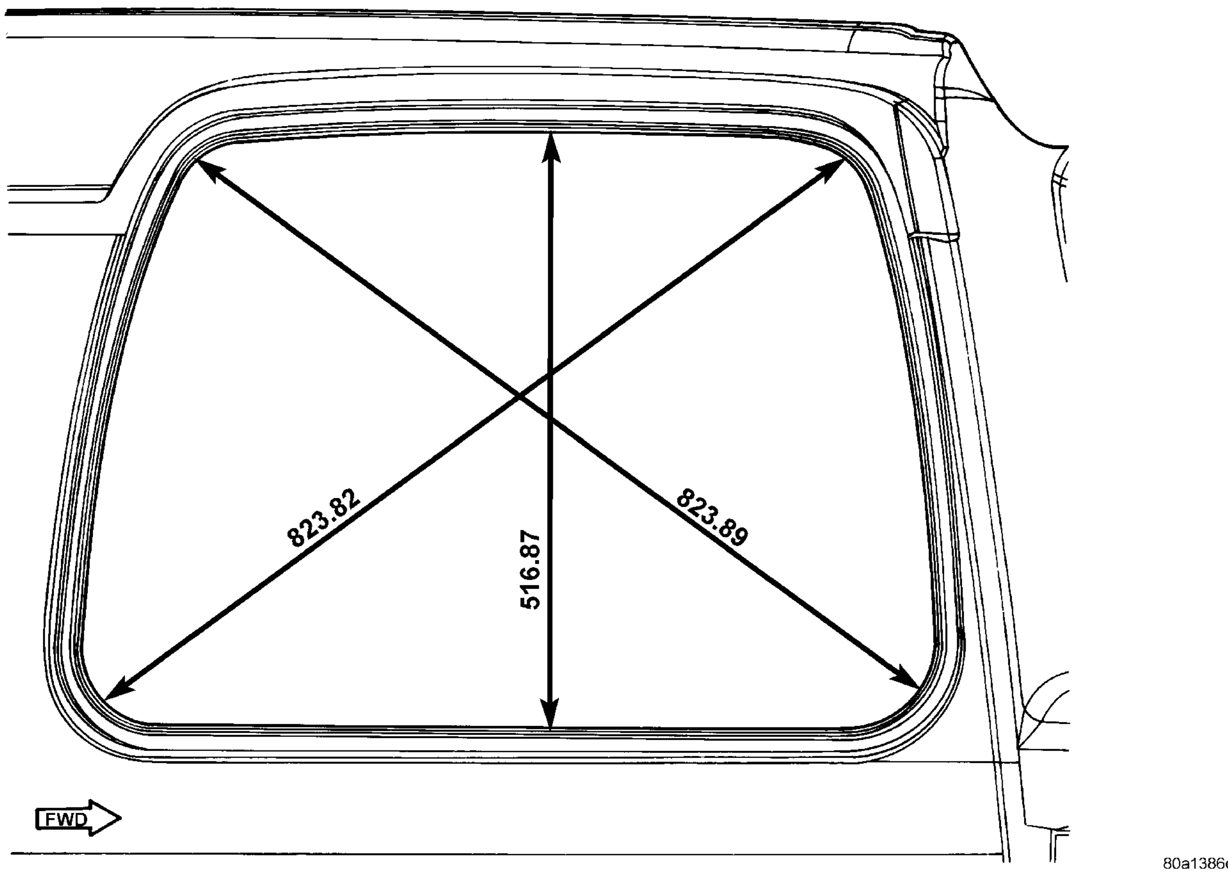

Fig. 5 QUARTER WINDOW OPENING

OPENING DIMENSIONS (Continued)

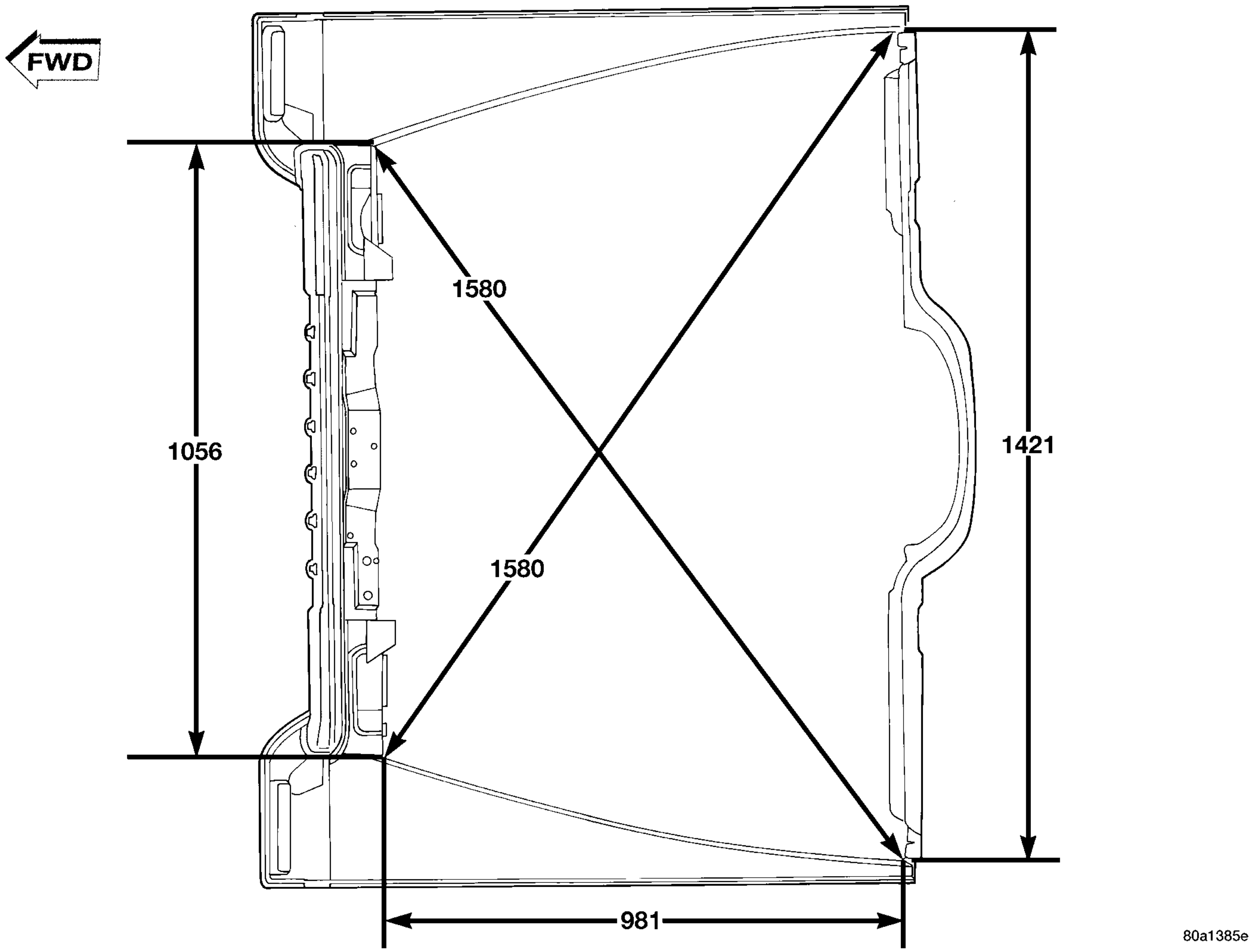

Fig. 6 ENGINE COMPARTMENT

OPENING DIMENSIONS (Continued)

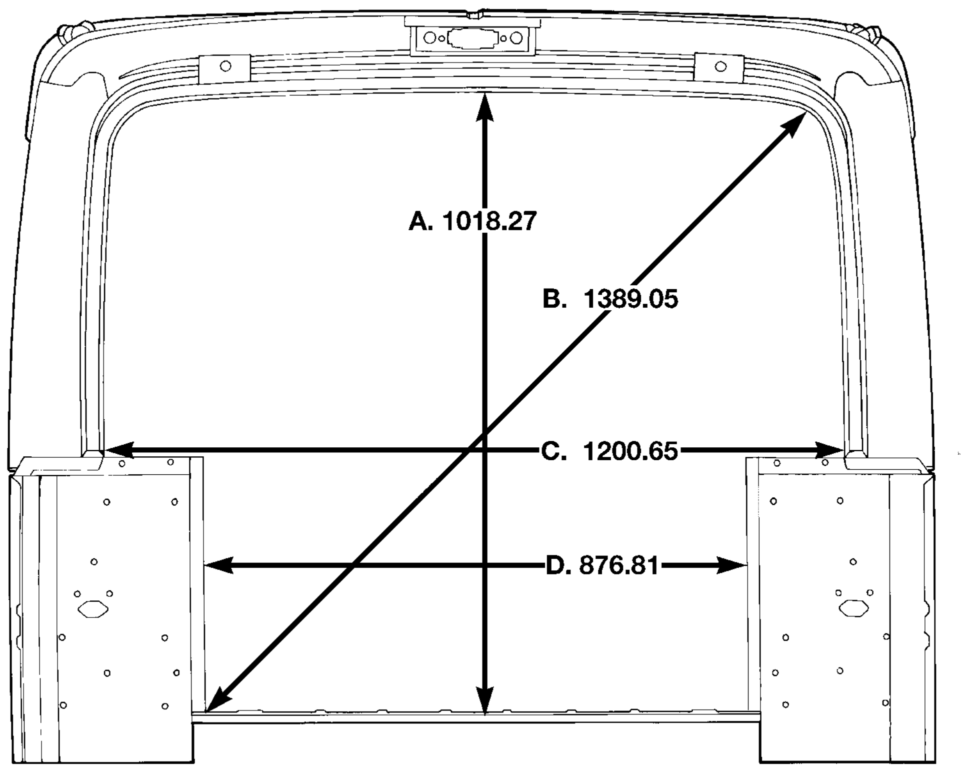

Fig. 7 TAILGATE AND LIFTGATE OPENING

- A. Center of liftgate opening to floor.
- B. Center of radius upper corner to center of body and floor corner.
- C. Liftgate opening distance.
- D. Tailgate opening distance.

SEALER LOCATIONS

SPECIFICATIONS

SEALER LOCATIONS

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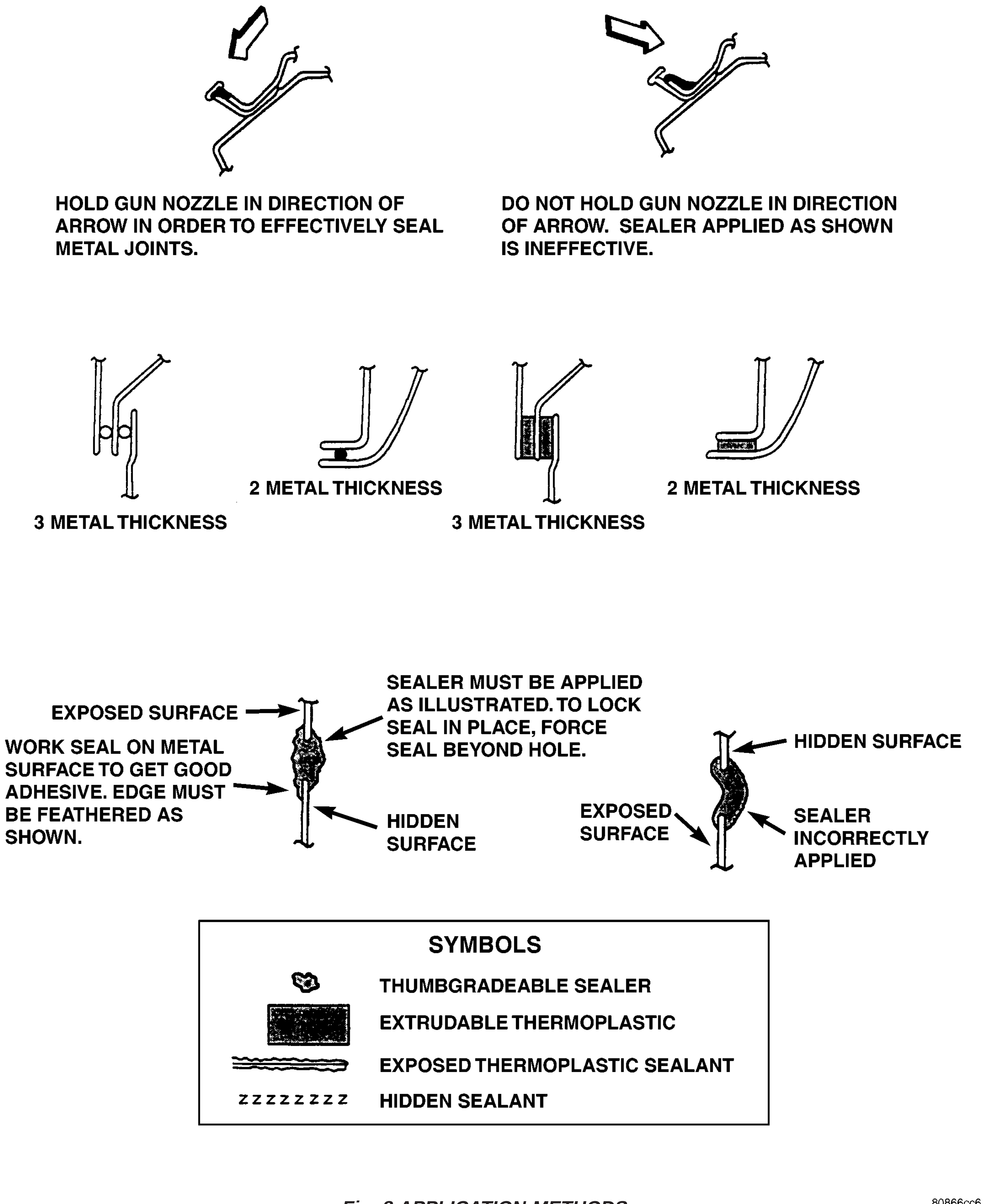

Fig. 8 APPLICATION METHODS

SEALER LOCATIONS (Continued)

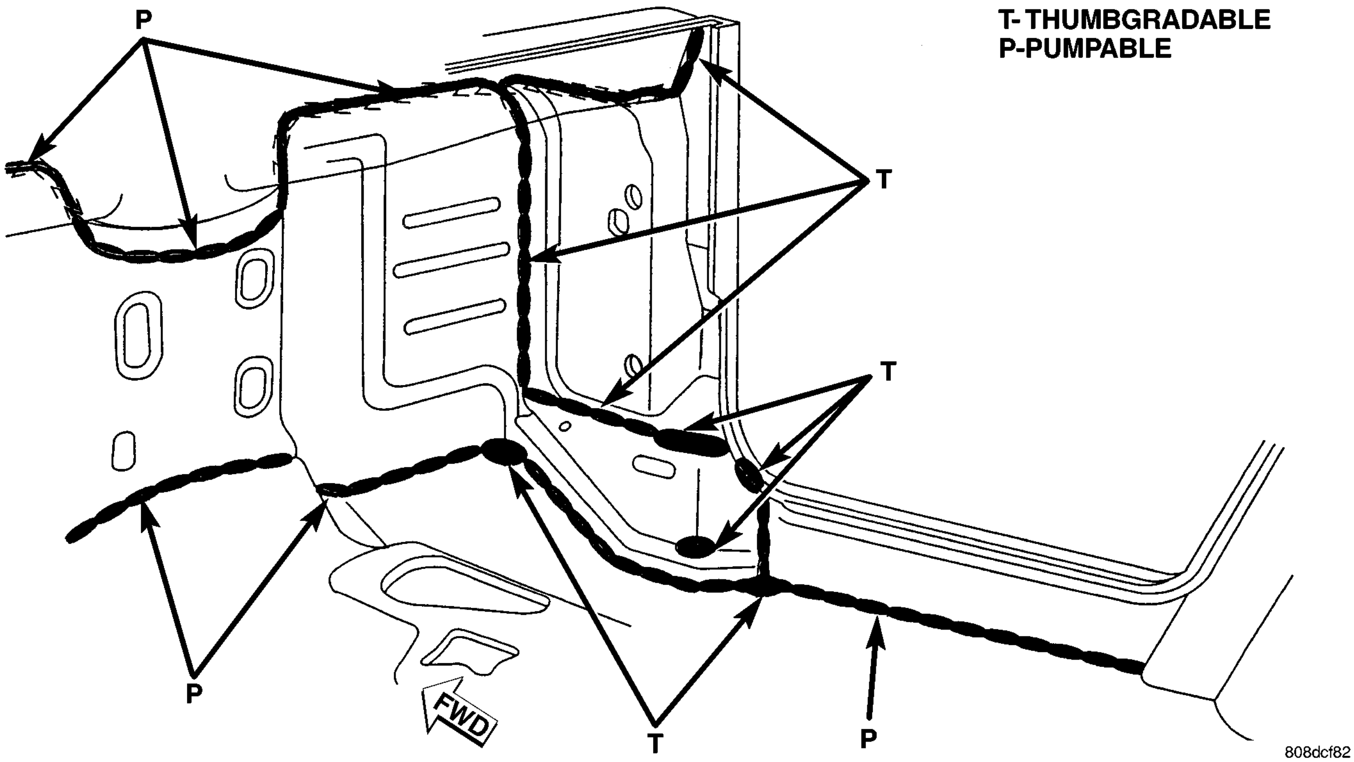

Fig. 9 COWL AND PLENUM

SEALER LOCATIONS (Continued)

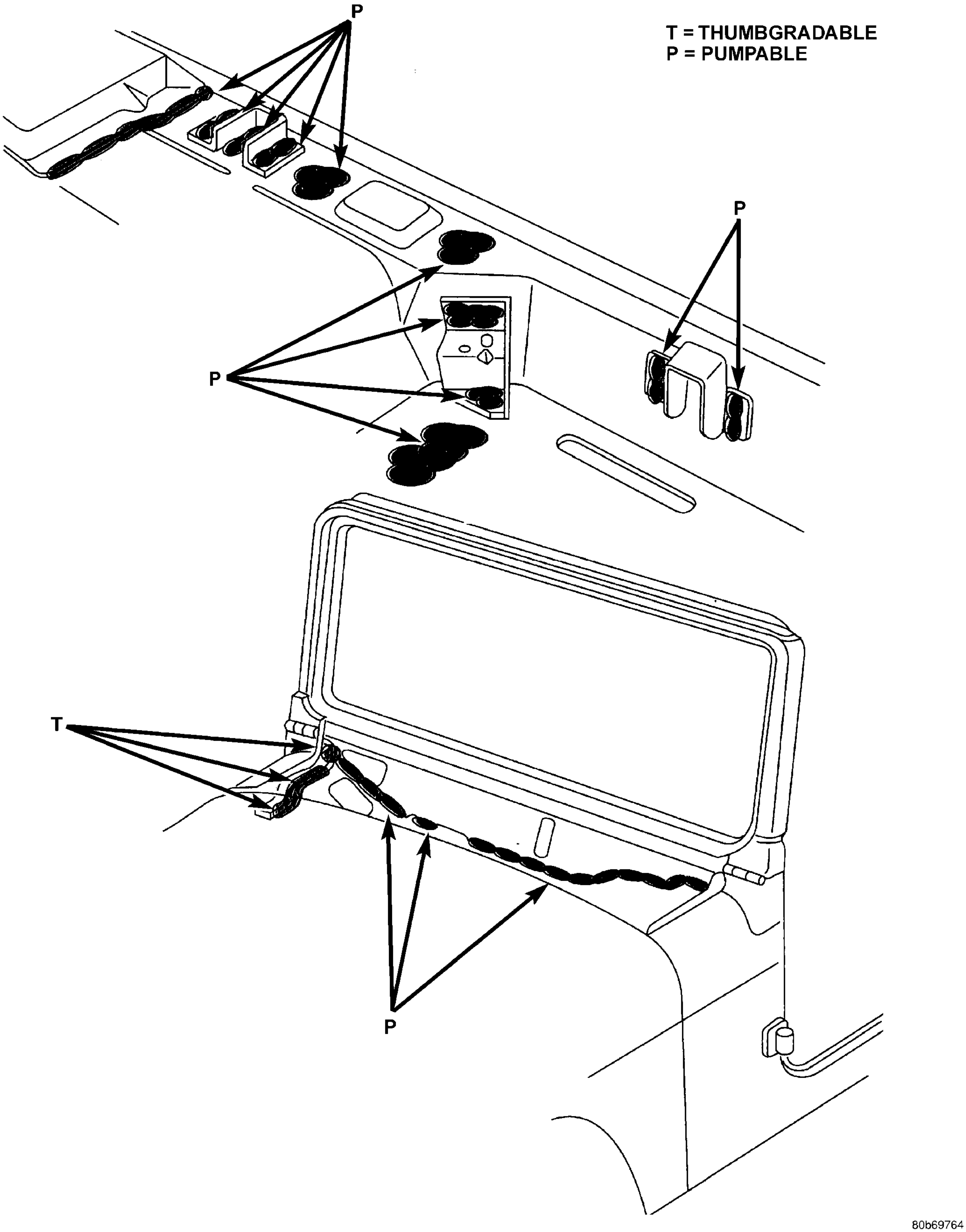

Fig. 10 COWL TOP END AND PLENUM

SEALER LOCATIONS (Continued)

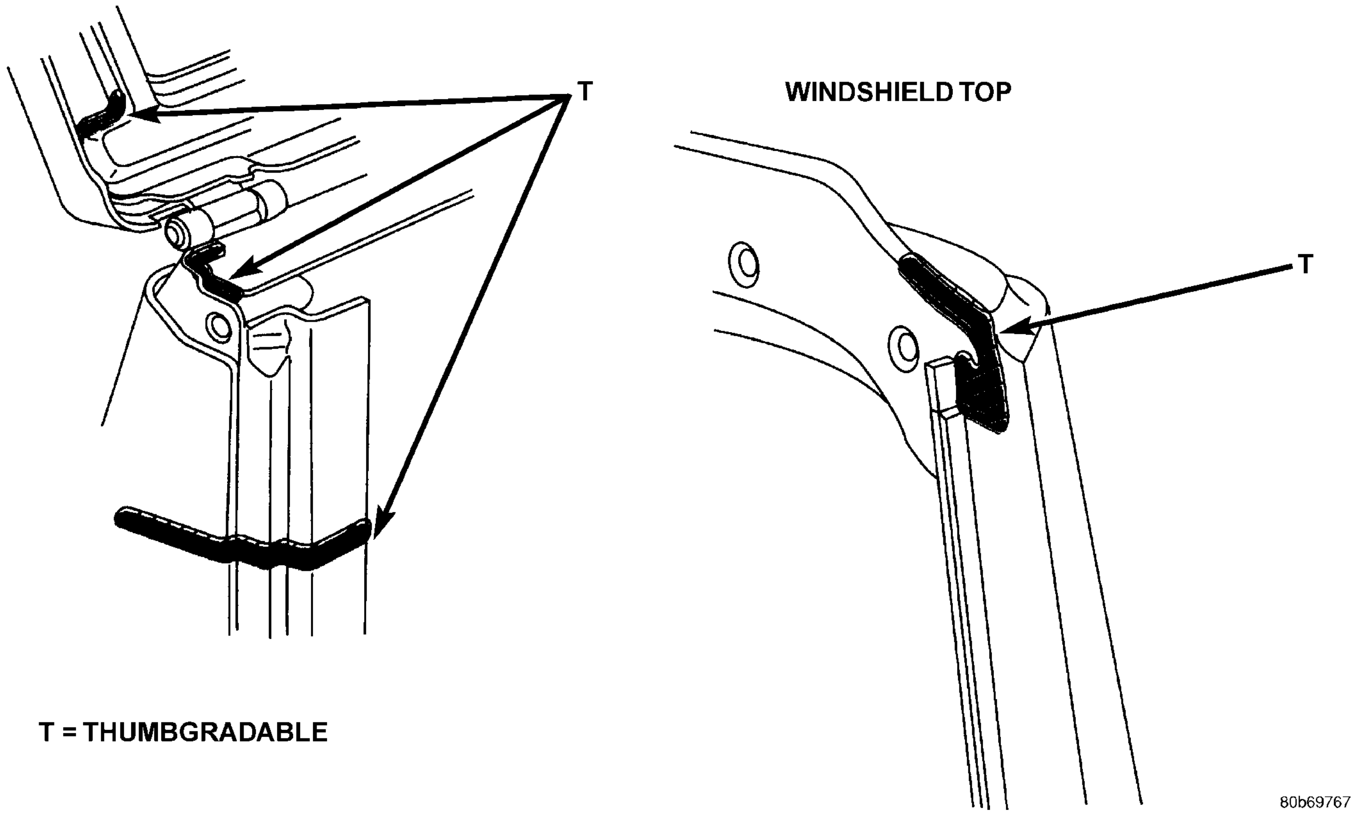

Fig. 11 COWL AND WINDSHIELD OUTER PANEL

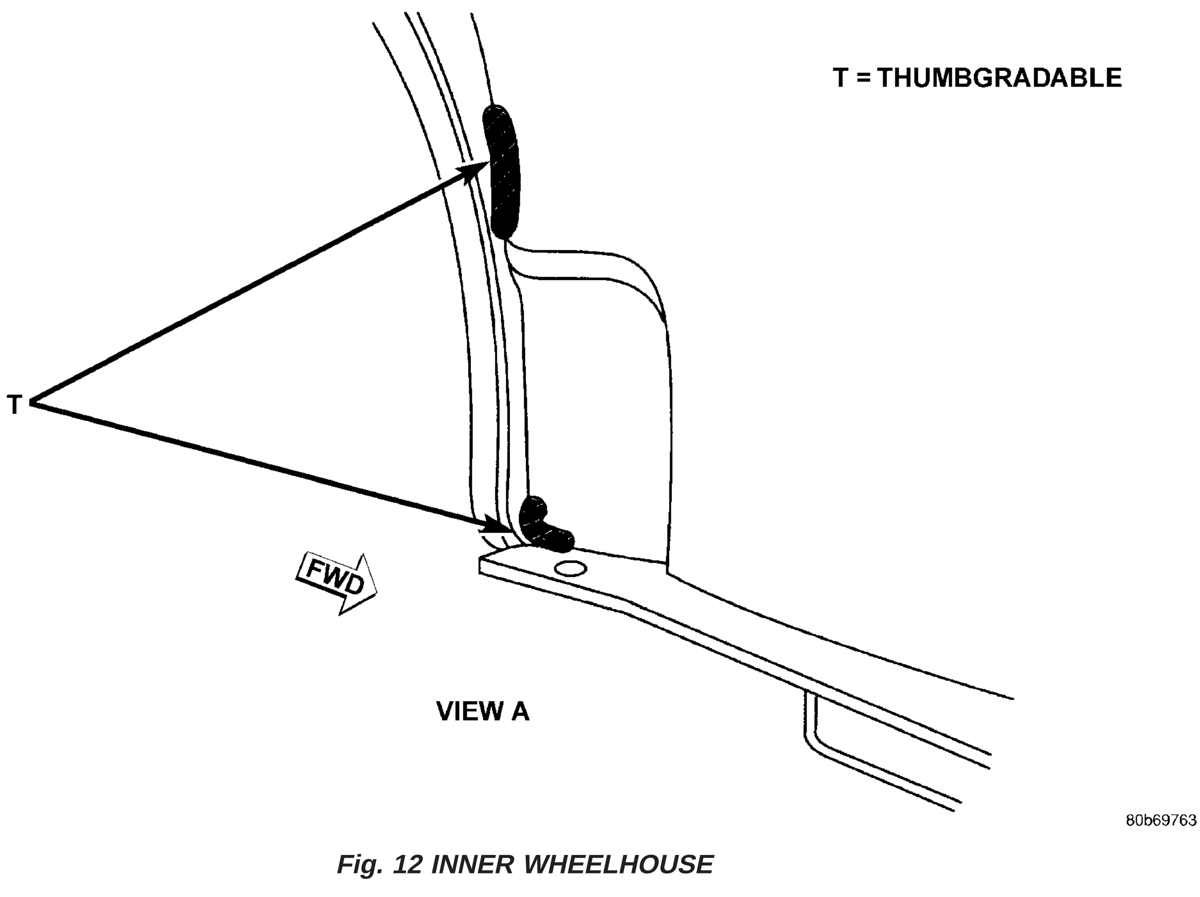

Fig. 12 INNER WHEELHOUSE

SEALER LOCATIONS (Continued)

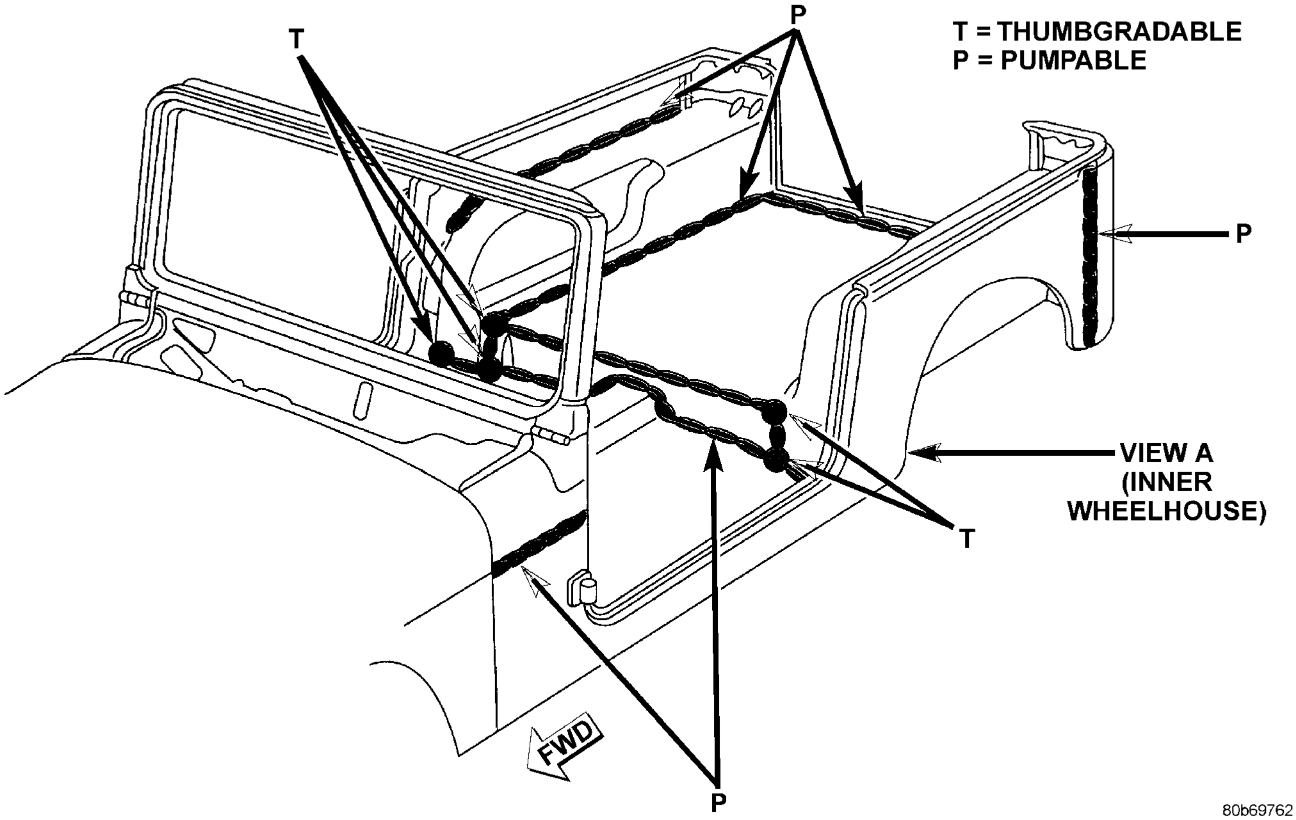

Fig. 13 REAR FLOOR RISER AND OUTER BODY SEAMS

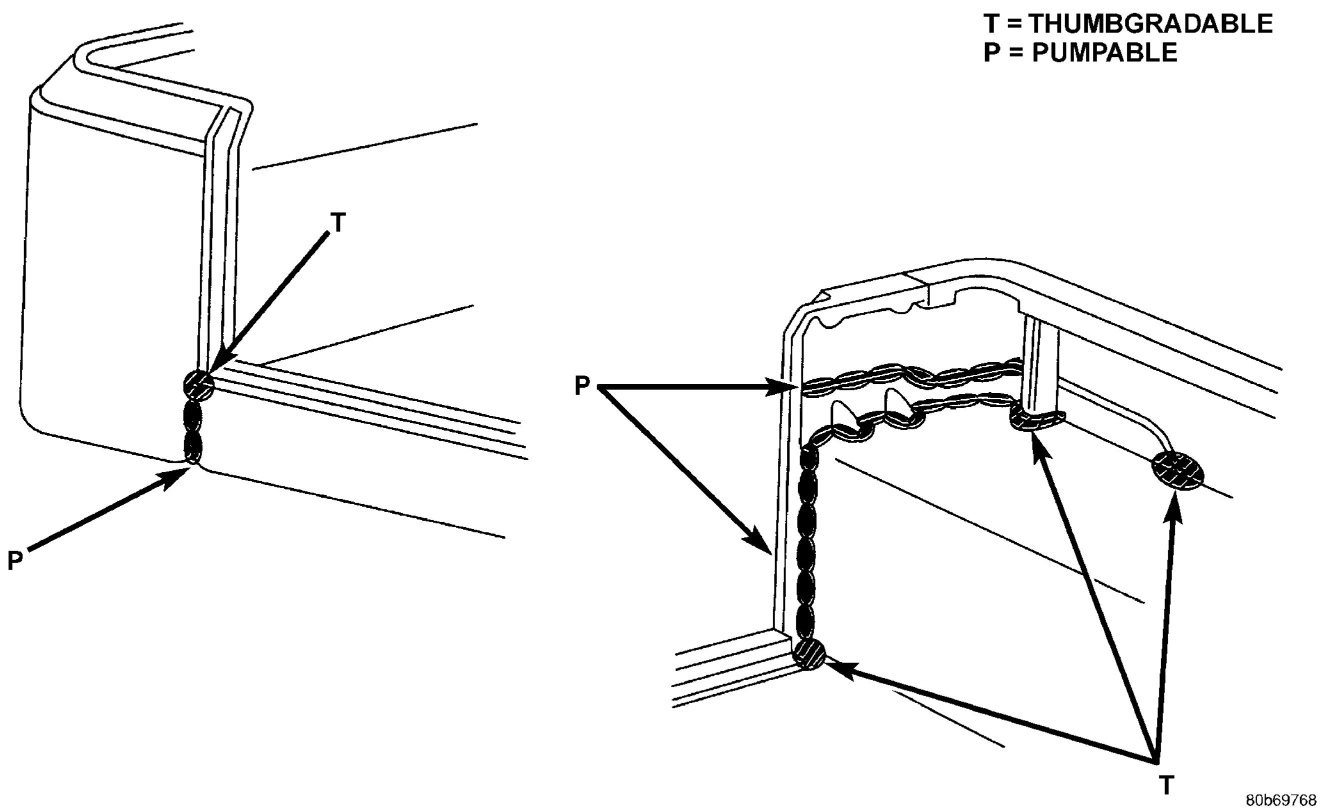

Fig. 14 REAR CORNER PANEL

SEALER LOCATIONS (Continued)

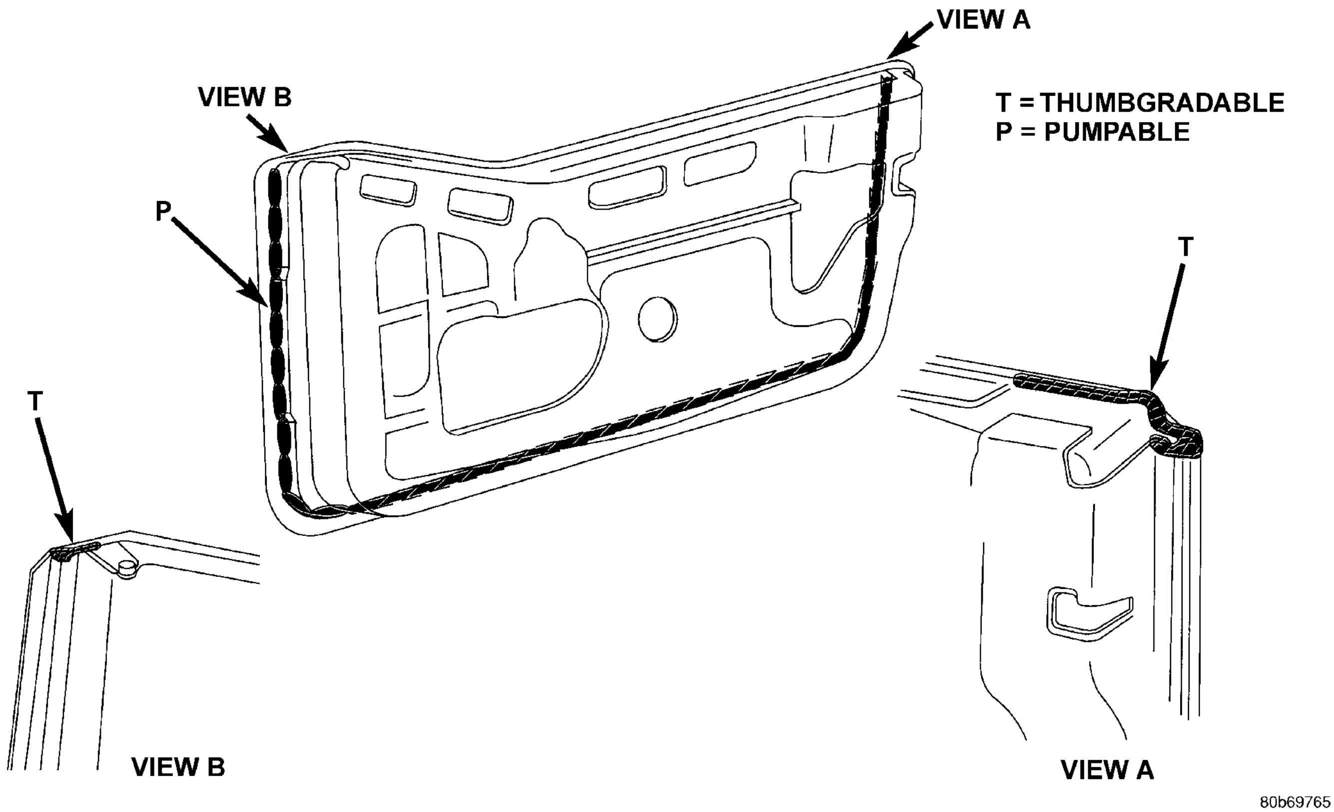

Fig. 15 HALF DOOR

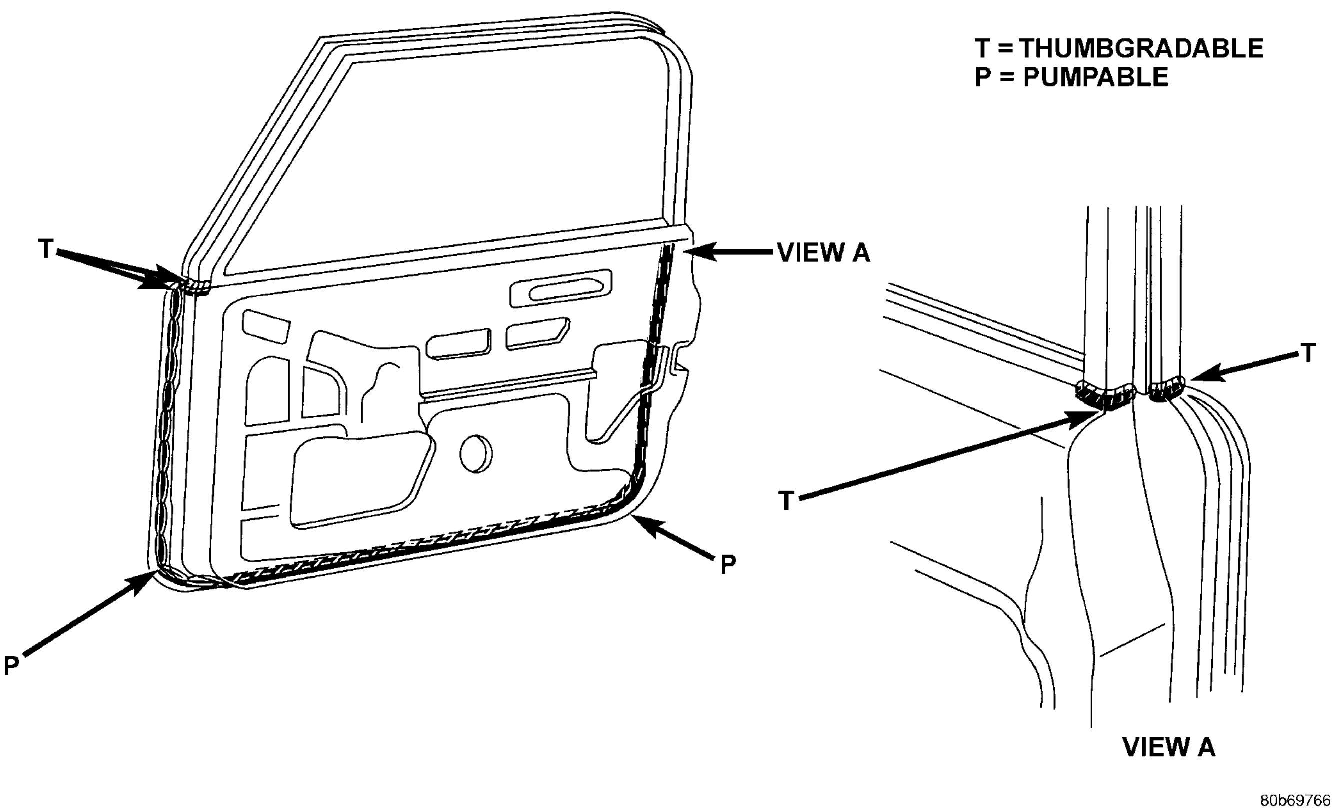

Fig. 16 FULL DOOR

SEALER LOCATIONS (Continued)

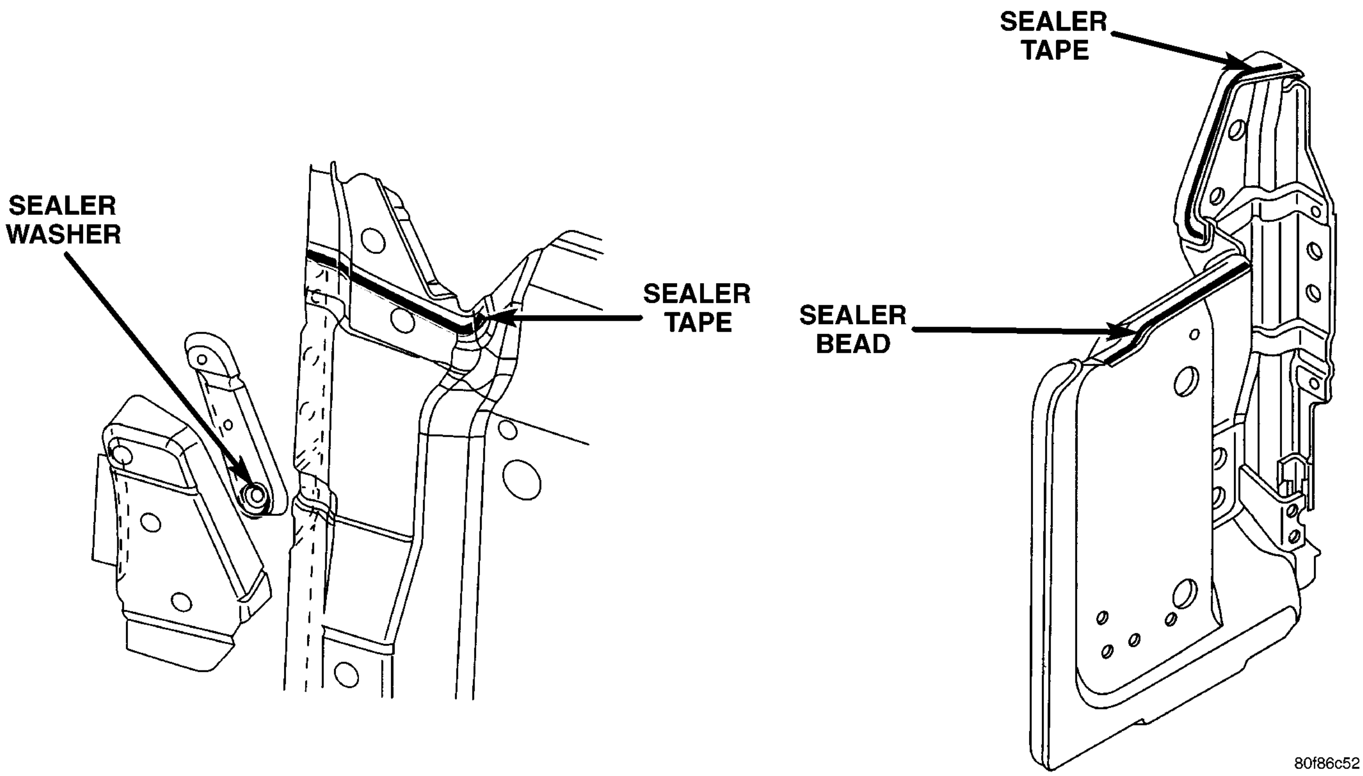

Fig. 17 DASH COWL AND PLENUM

SEALER LOCATIONS (Continued)

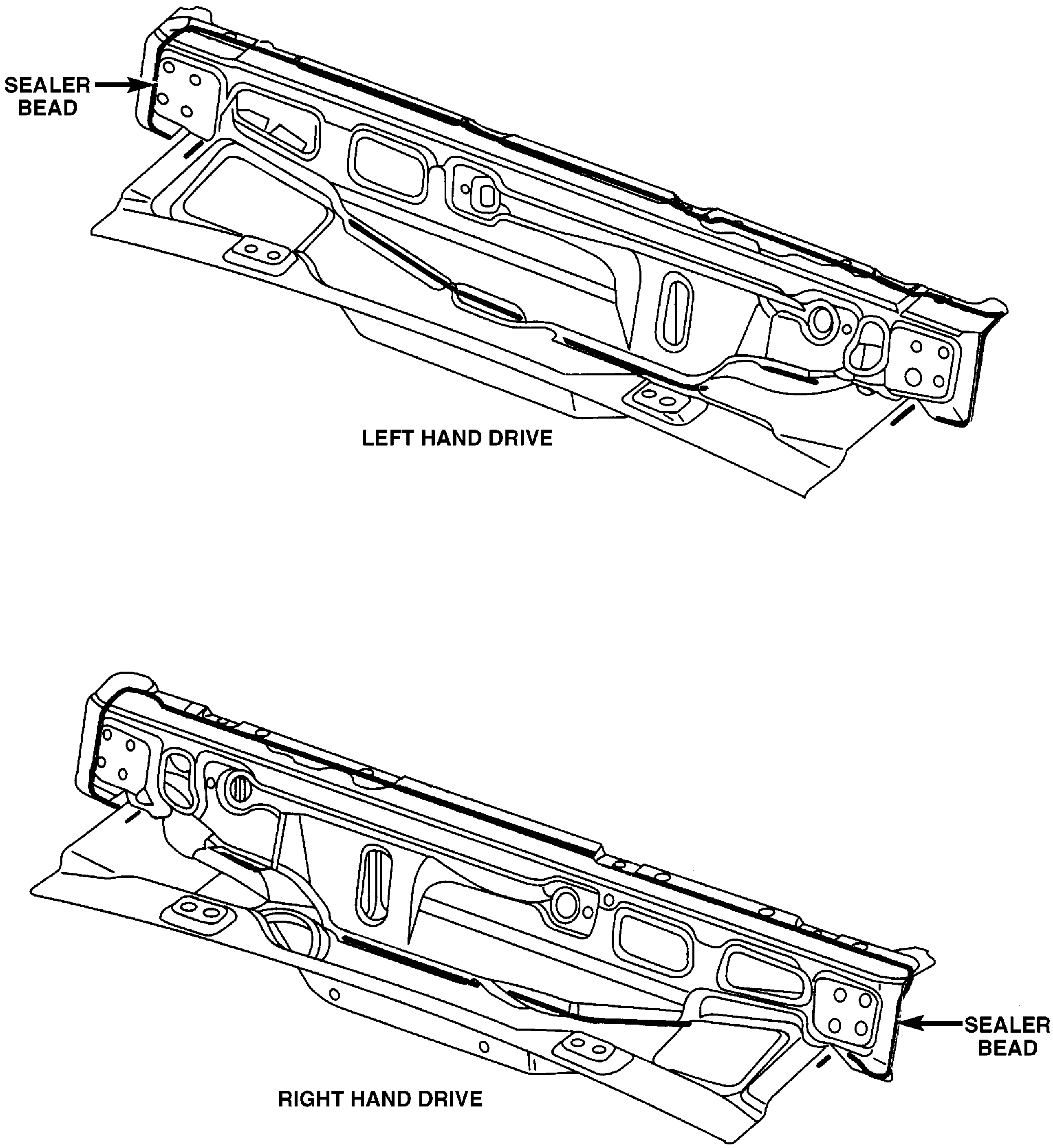

Fig. 18 DASH, COWL AND PLENUM

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SEALER LOCATIONS (Continued)

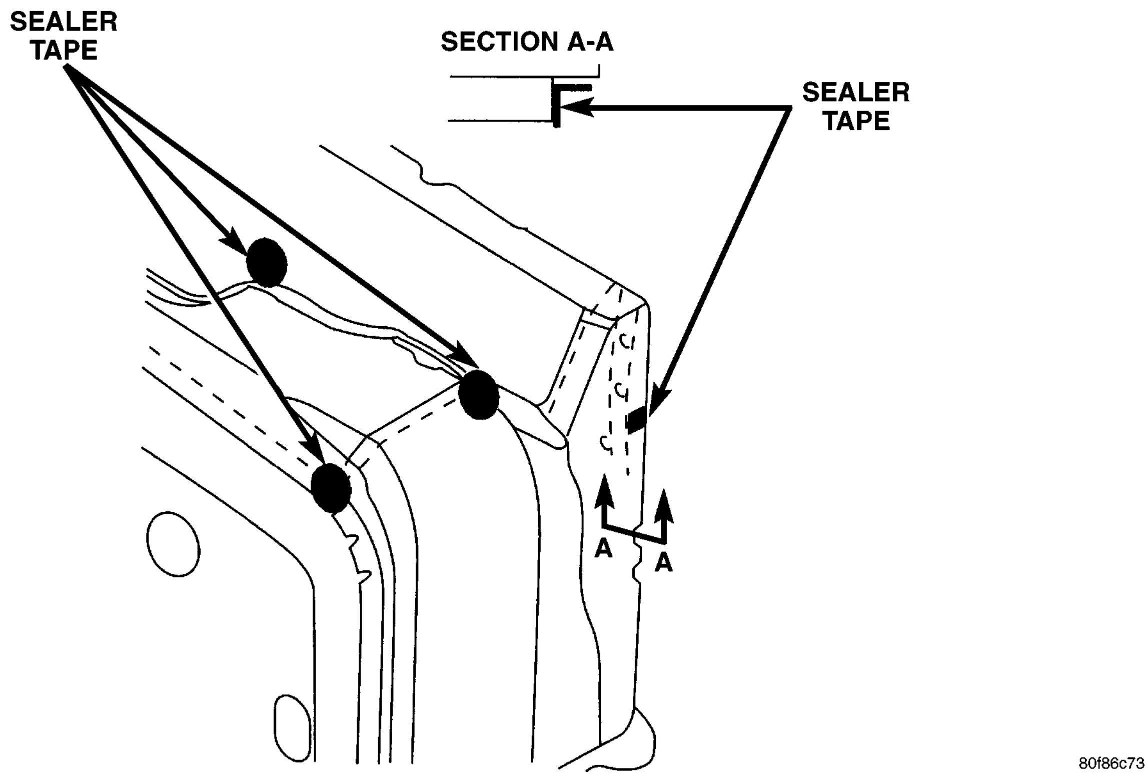

Fig. 19 DASH, COWL AND PLENUM

SEALER LOCATIONS (Continued)

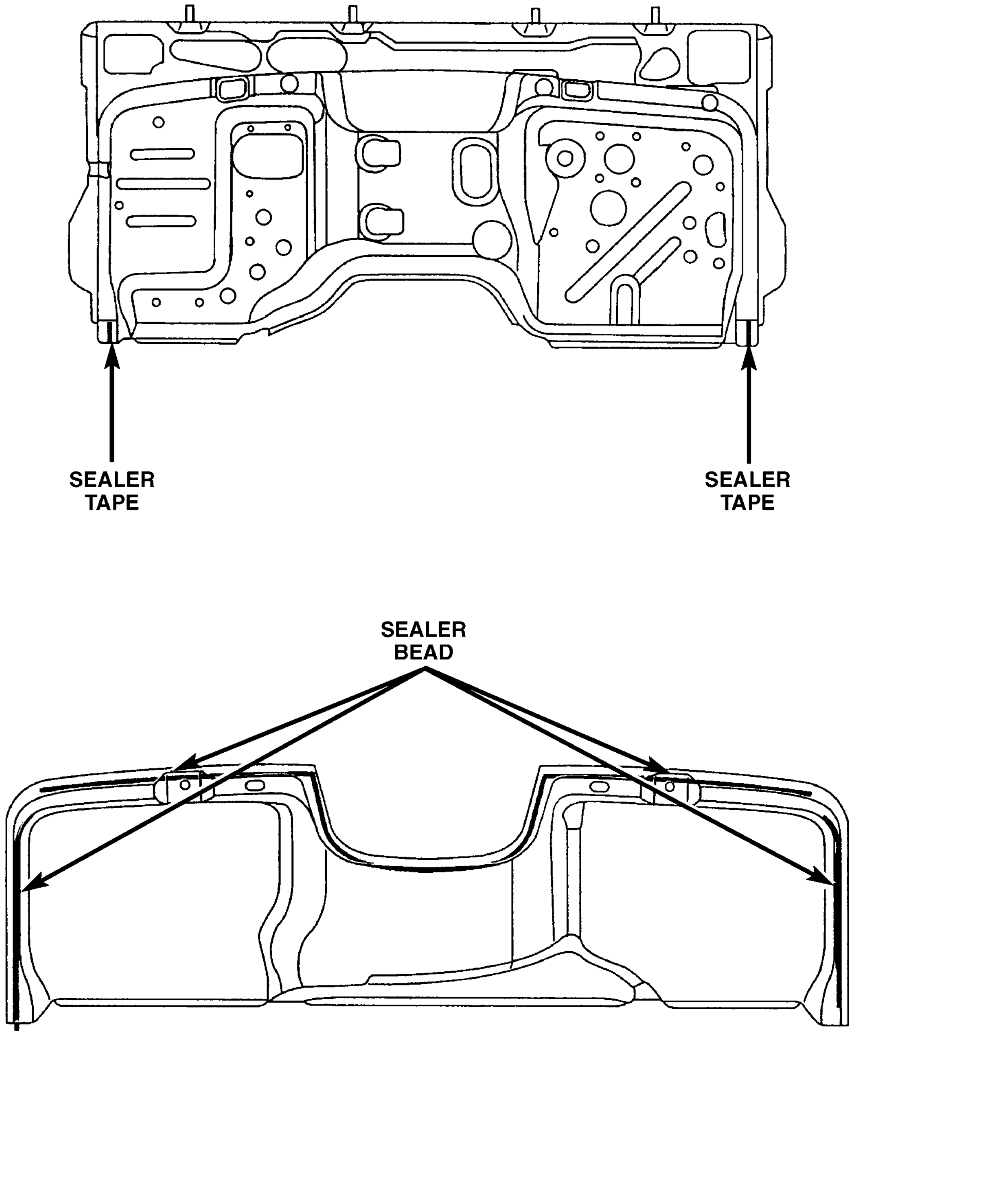

Fig. 20 DASH, COWL AND PLENUM

SEALER LOCATIONS (Continued)

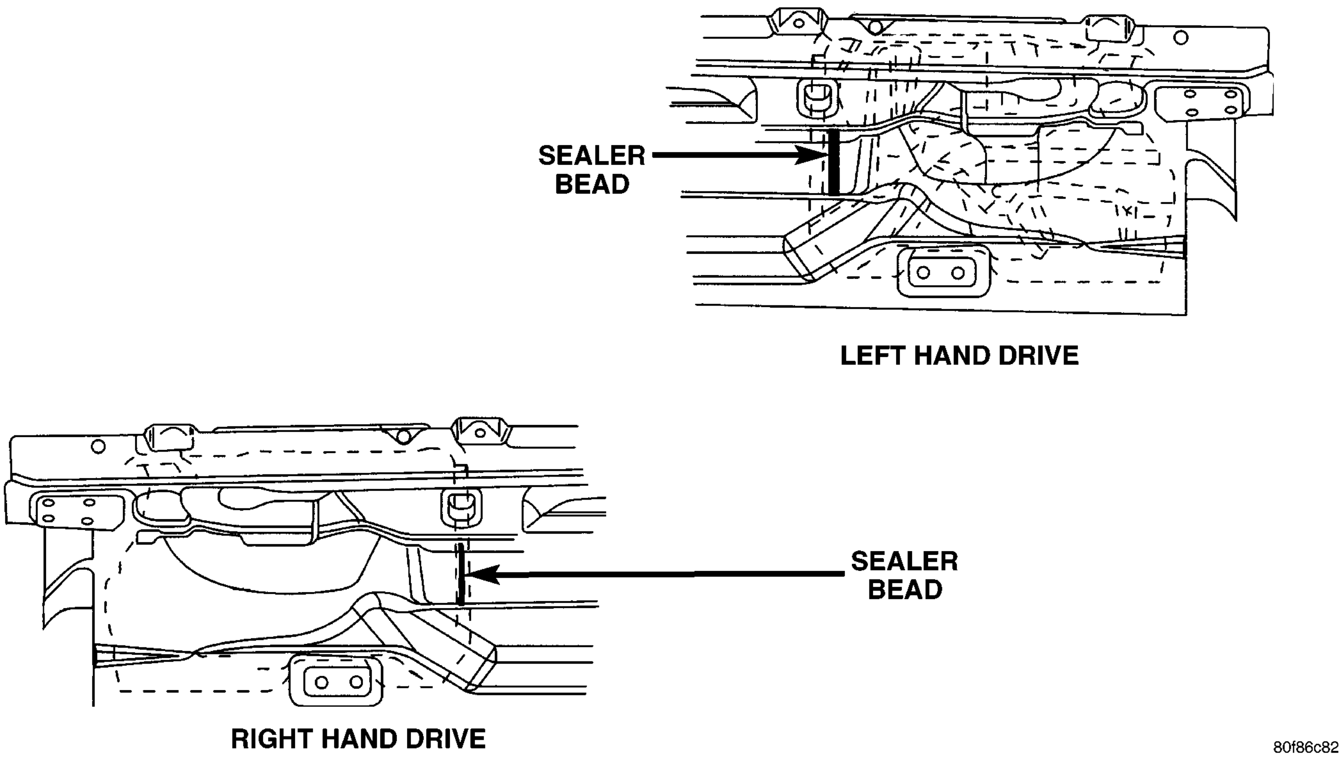

Fig. 21 DASH, COWL AND PLENUM SUPPORTS AND REINFORCEMENTS

SEALER LOCATIONS (Continued)

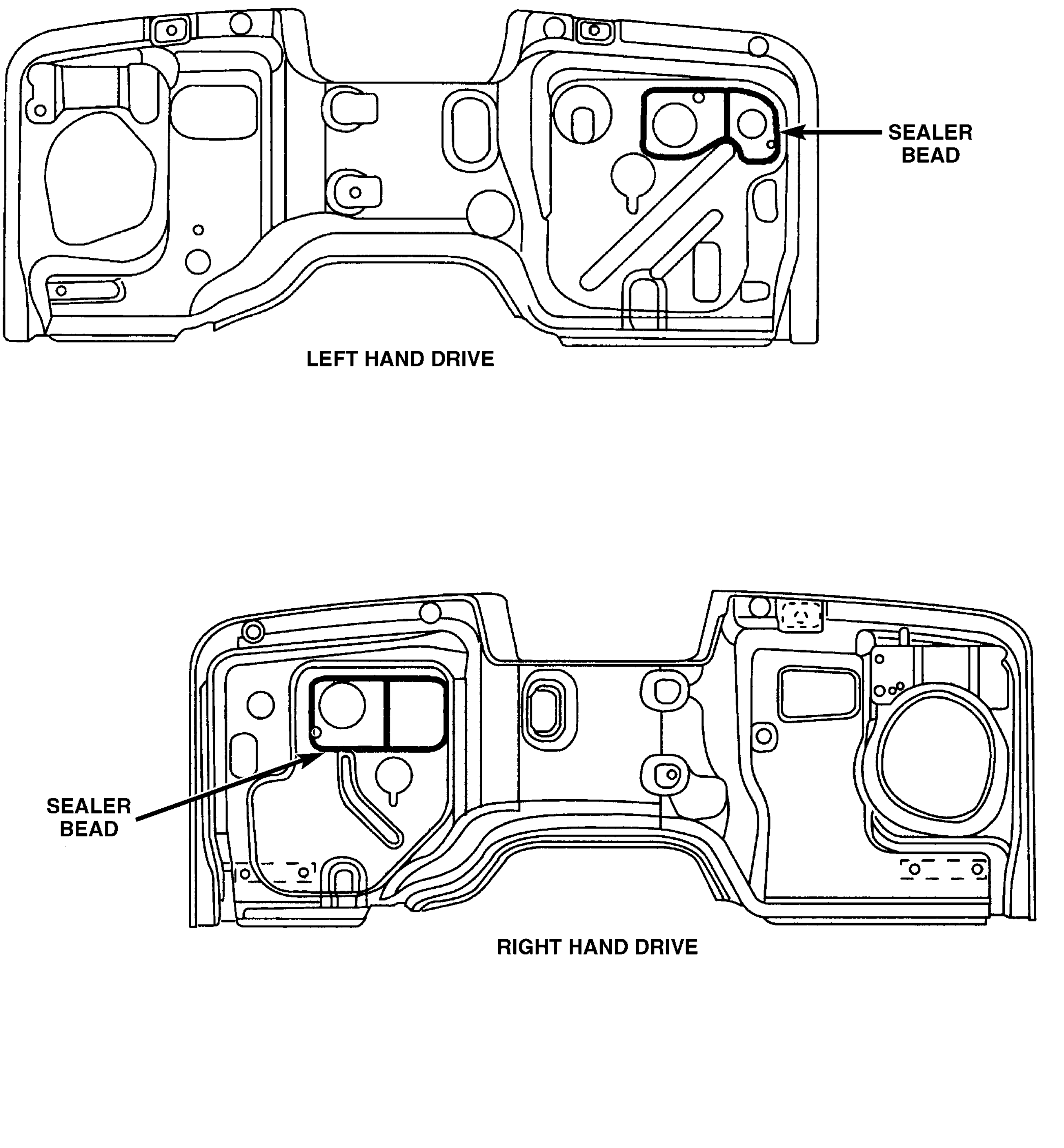

Fig. 22 DASH, COWL AND PLENUM SUPPORTS AND REINFORCEMENTS

SEALER LOCATIONS (Continued)

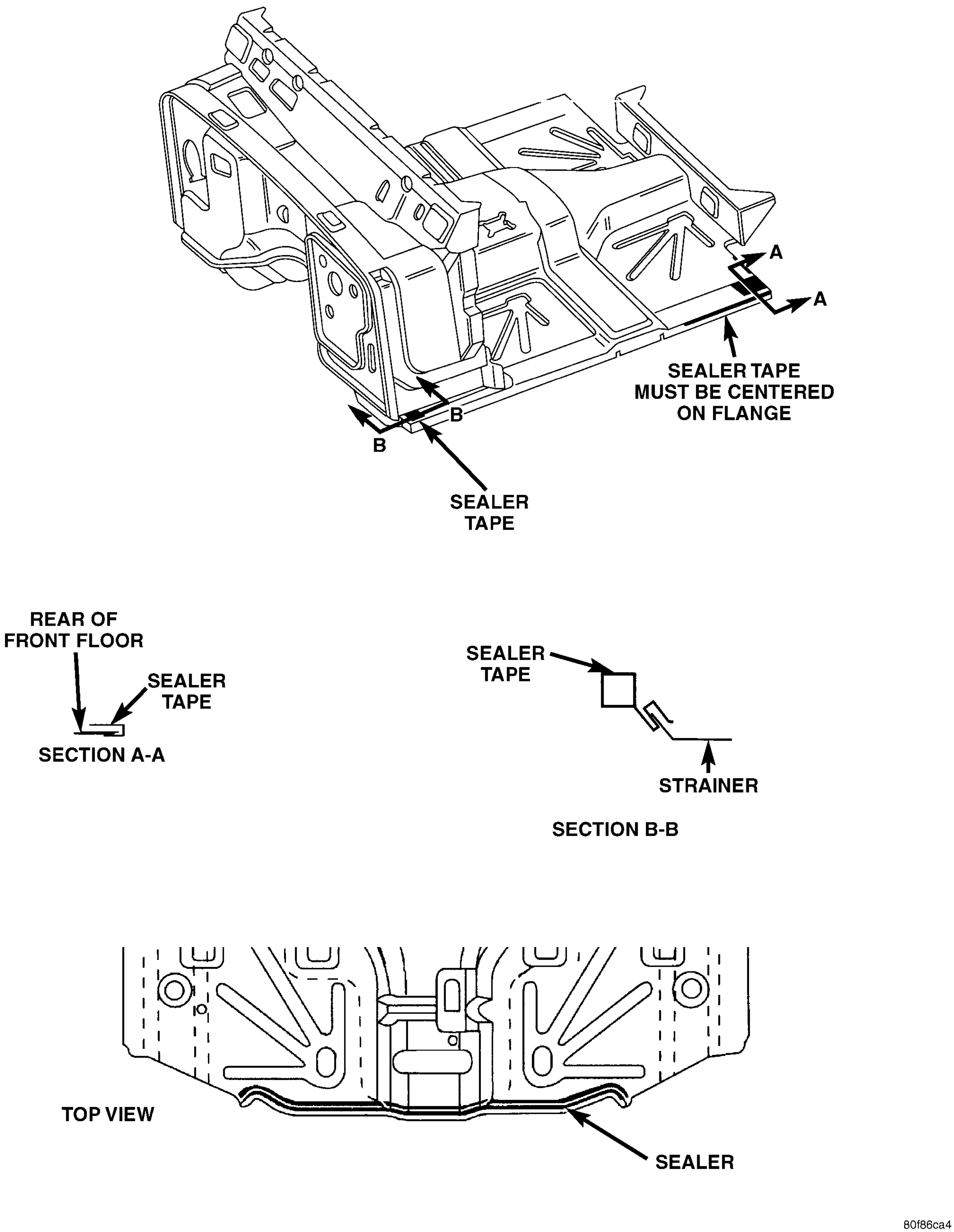

Fig. 23 FRONT FLOOR, STRAINER, REINFORCEMENT AND COWL SIDE LOWER

SEALER LOCATIONS (Continued)

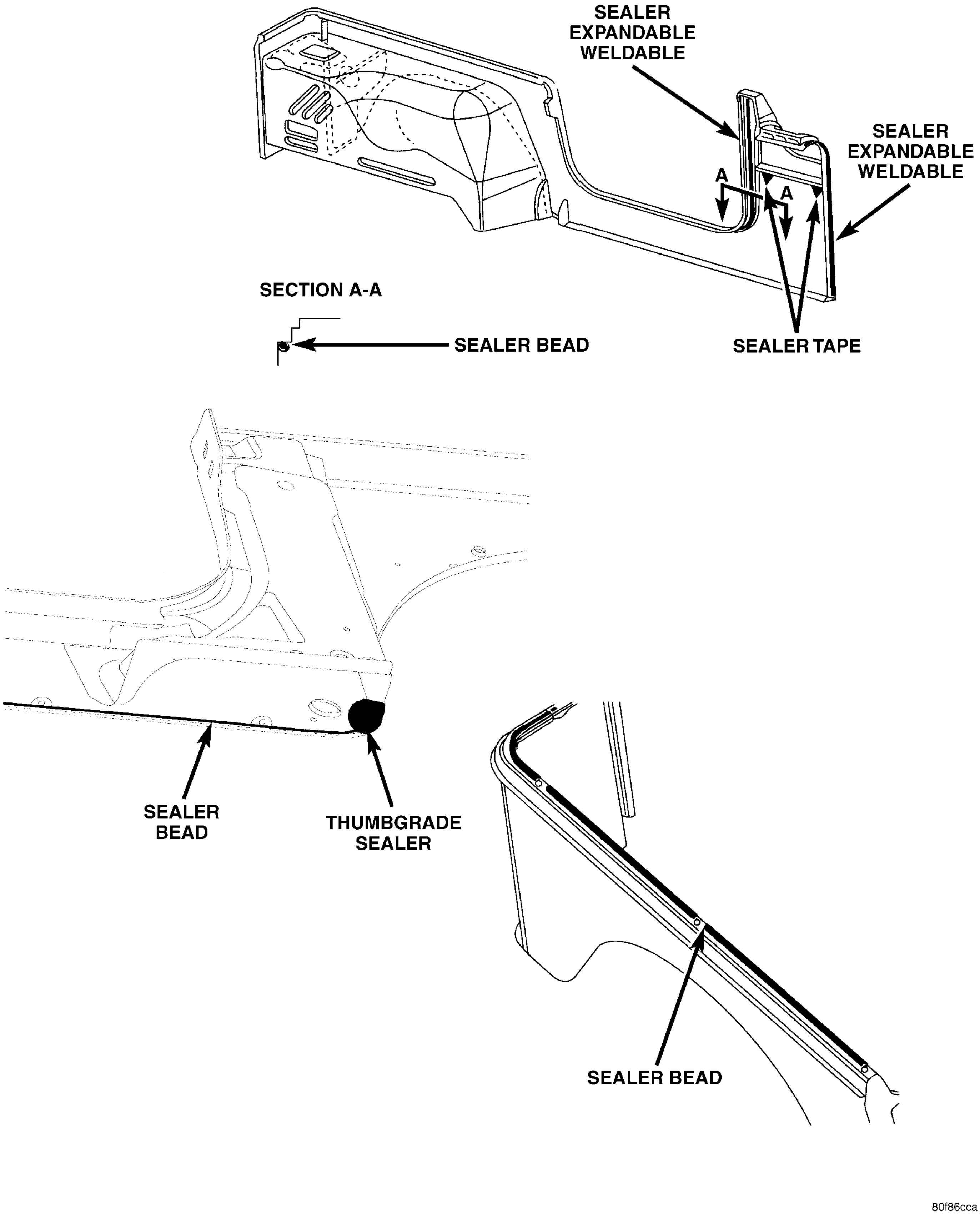

Fig. 24 BODY SIDE APERTURE

SEALER LOCATIONS (Continued)

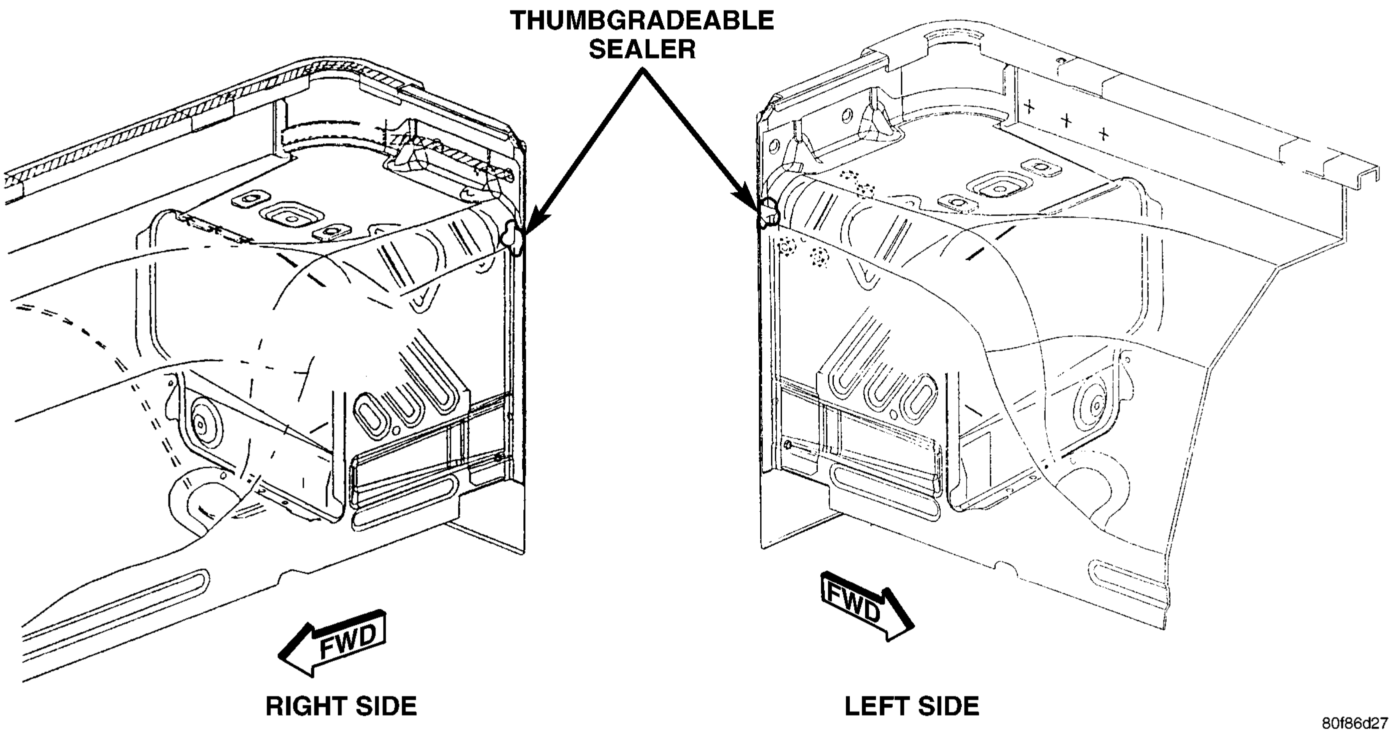

Fig. 25 WHEELHOUSE

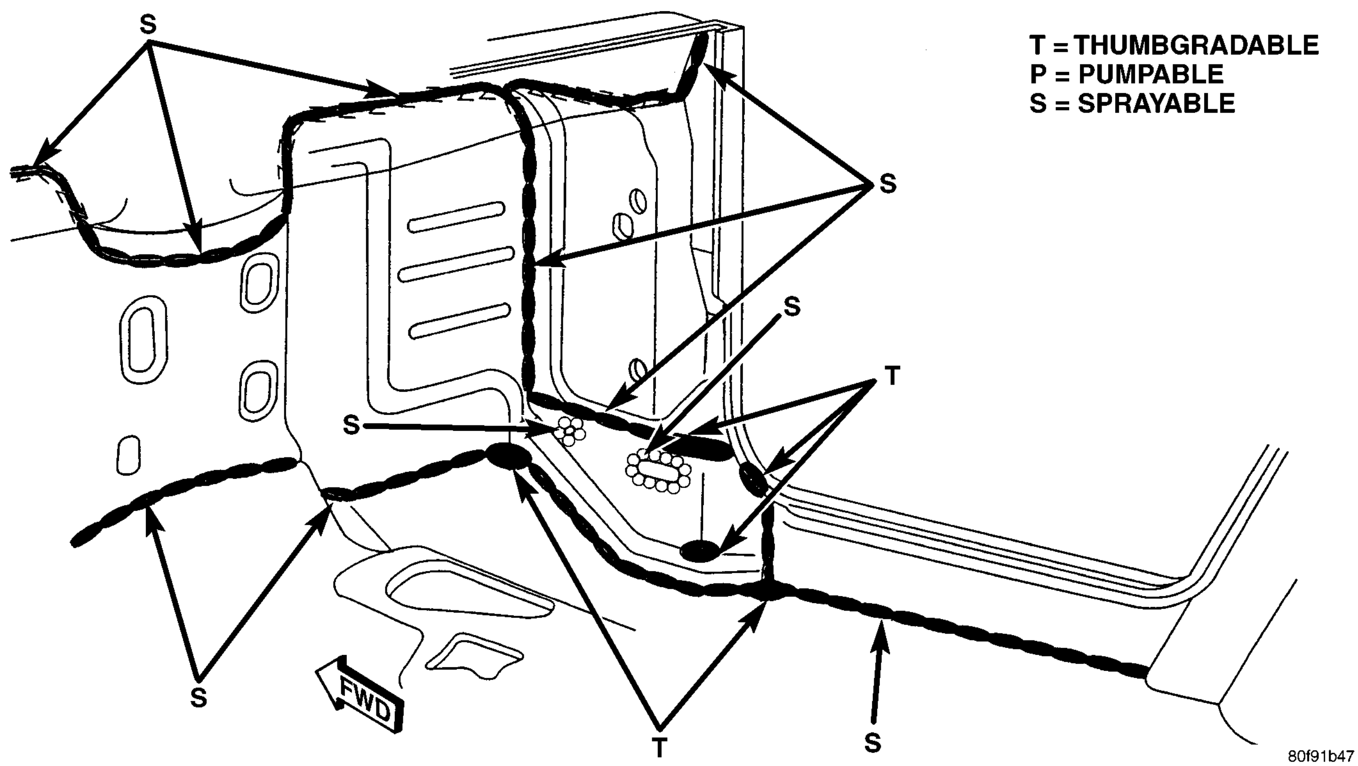

Fig. 26 COWL AND PLENUM

SEALER LOCATIONS (Continued)

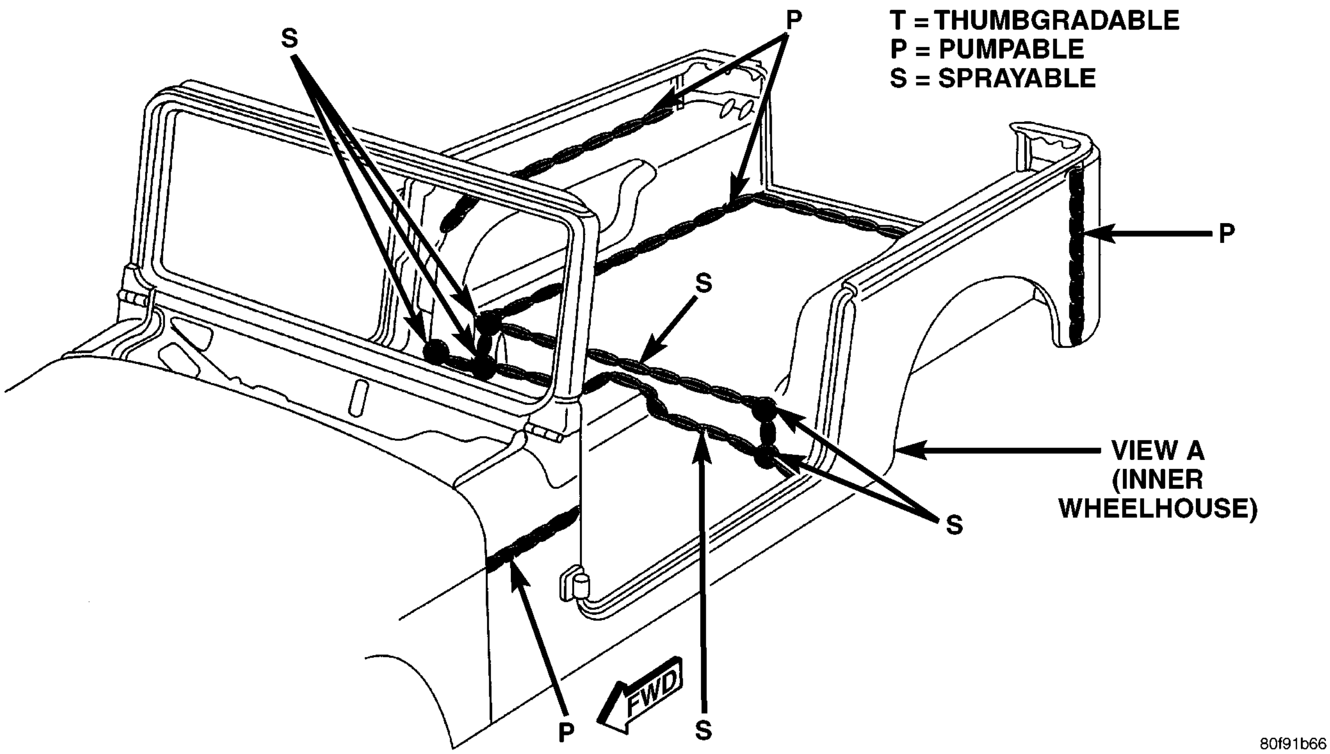

Fig. 27 REAR FLOOR AND OUTER BODY SEAMS

STRUCTURAL ADHESIVE LOCATIONS

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STRUCTURAL ADHESIVE LOCATIONS (Continued)

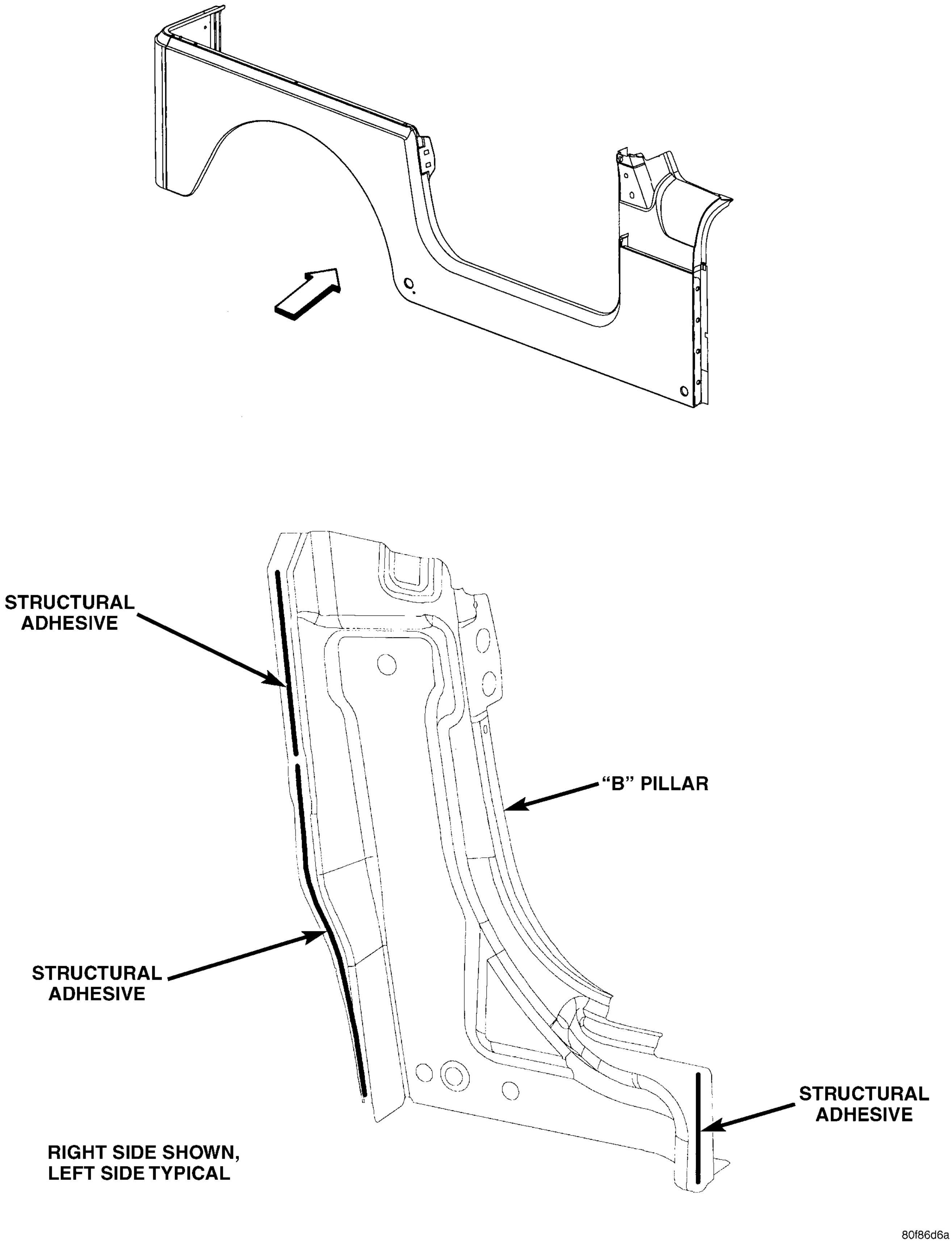

Fig. 28 BODY SIDE APERTURE

STRUCTURAL ADHESIVE LOCATIONS (Continued)

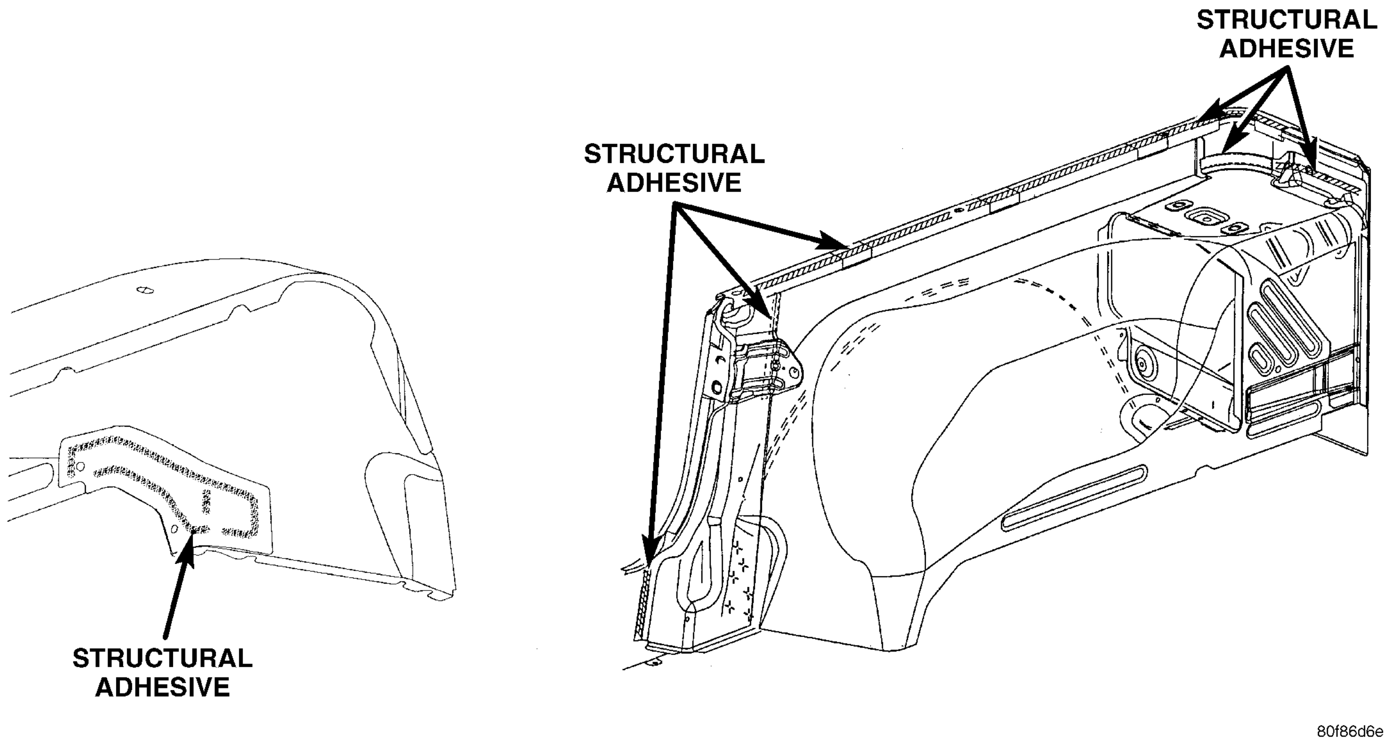

Fig. 29 WHEELHOUSE

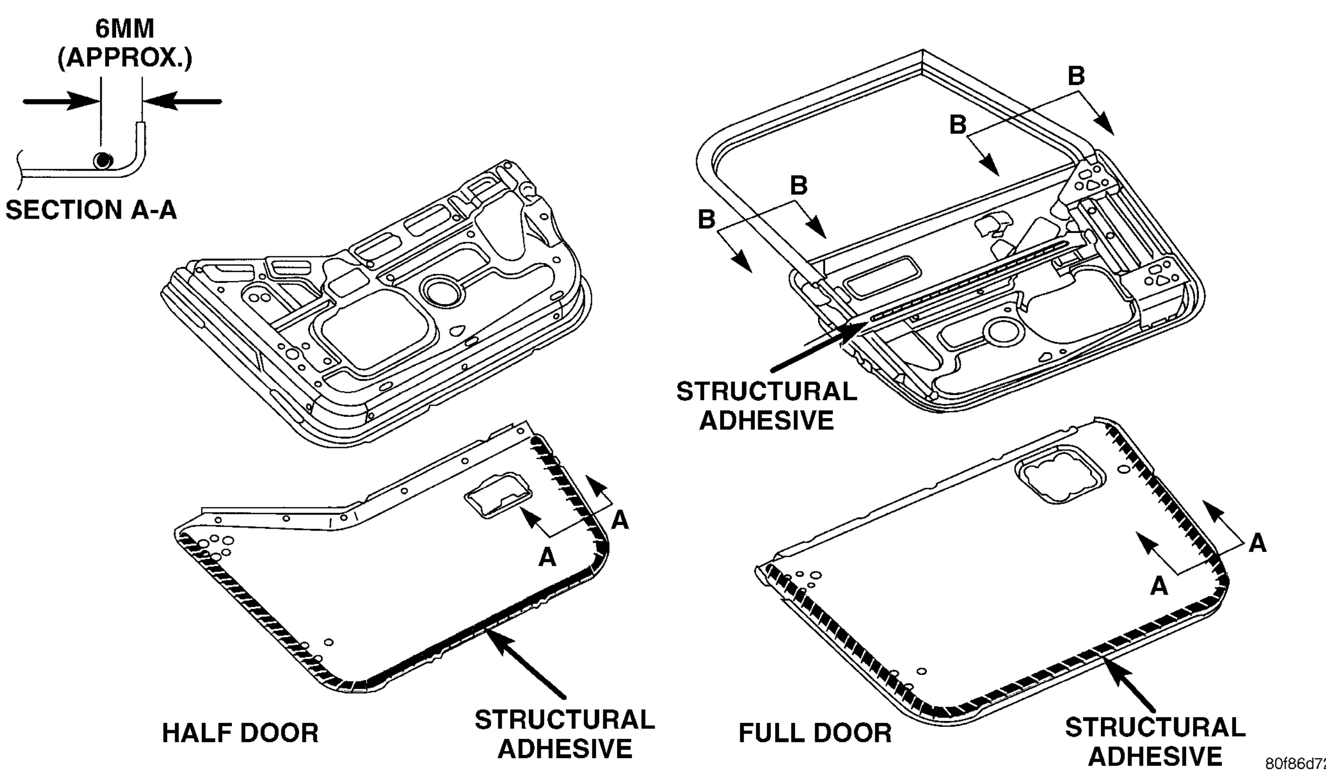

Fig. 30 DOOR OUTER PANELS

STRUCTURAL ADHESIVE LOCATIONS (Continued)

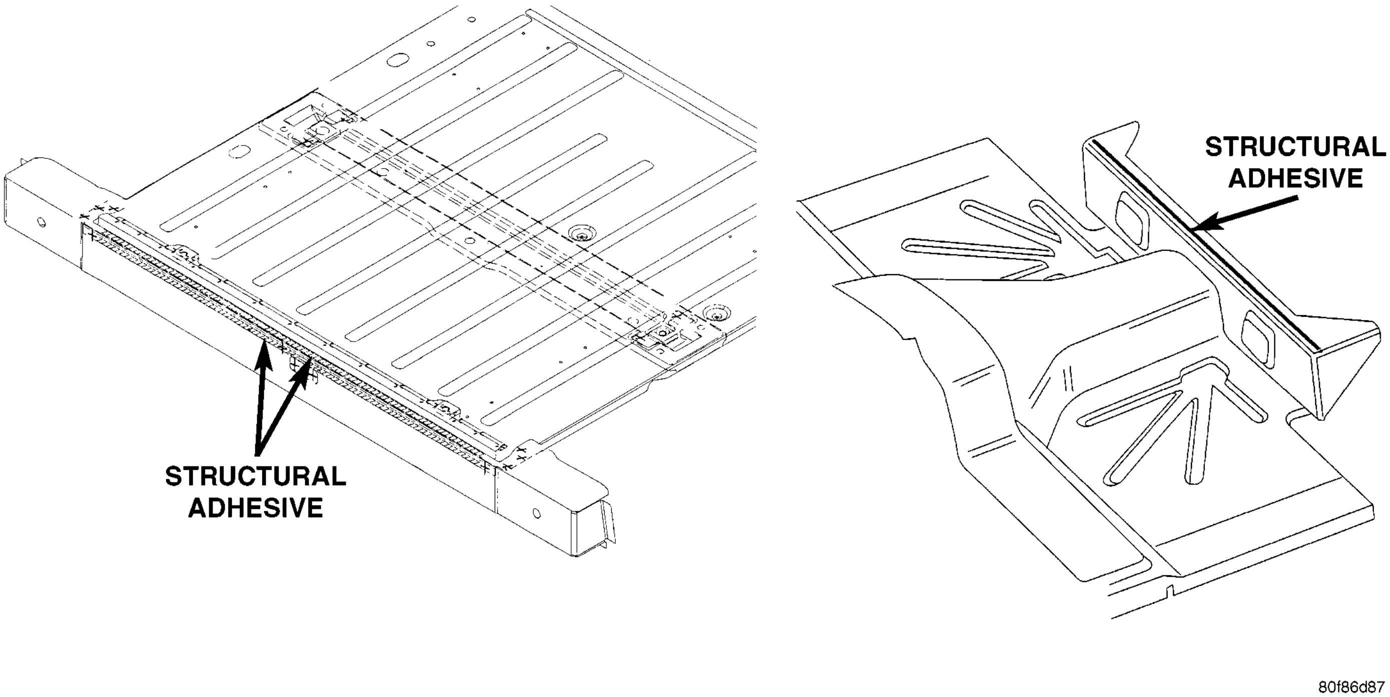

Fig. 31 REAR FLOOR PAN

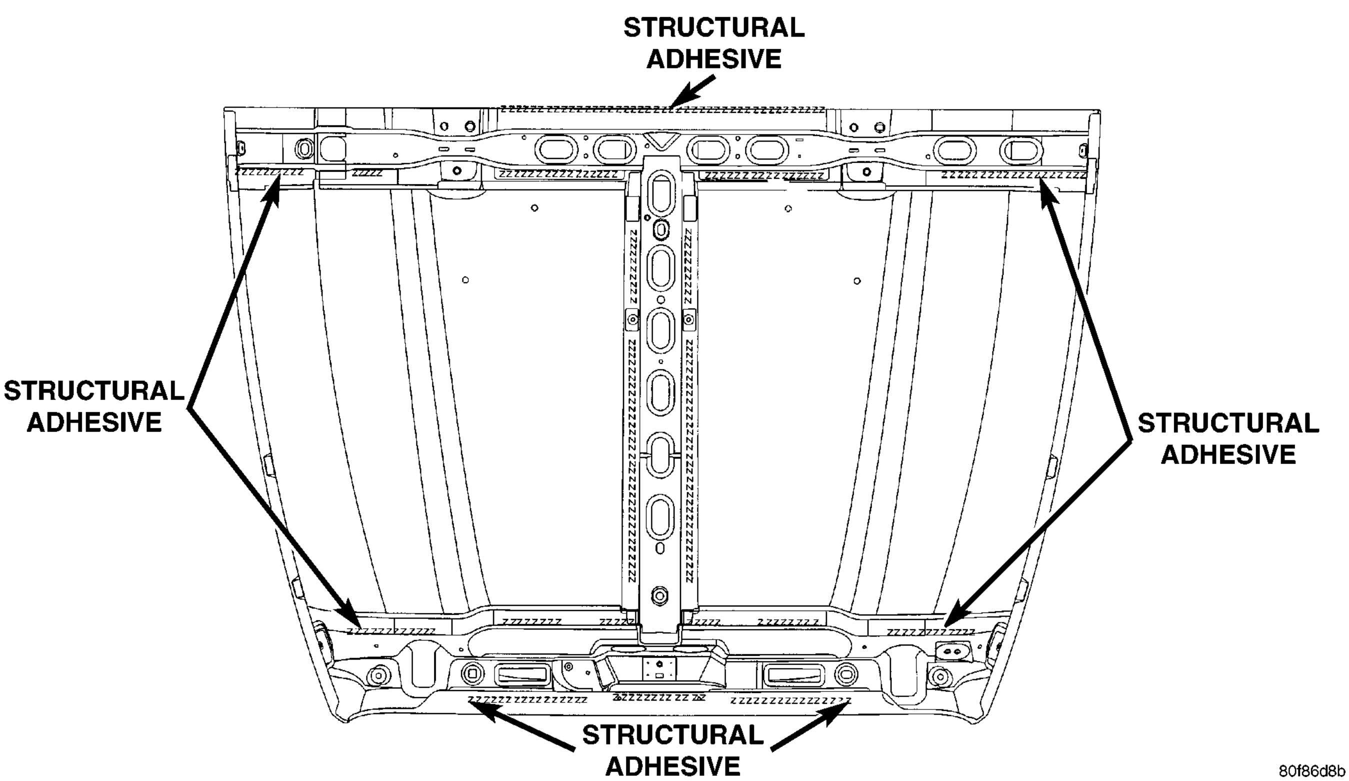

Fig. 32 HOOD ASSEMBLY

STRUCTURAL ADHESIVE LOCATIONS (Continued)

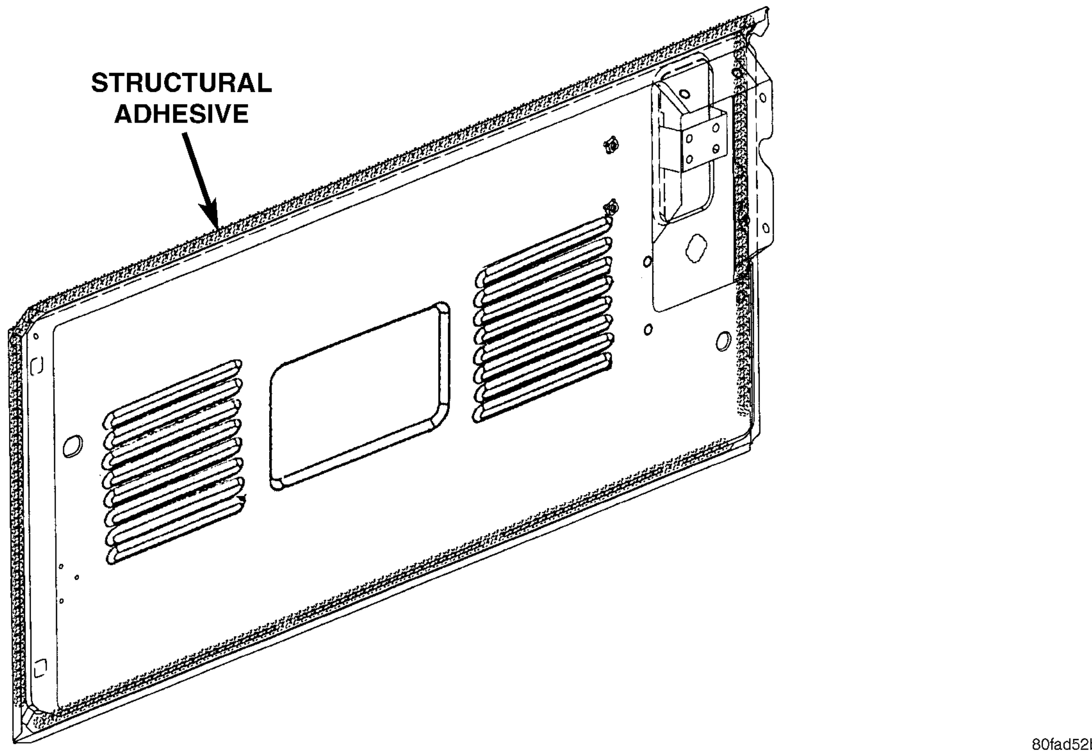

Fig. 33 TAIL GATE

STRUCTURAL ADHESIVE LOCATIONS (Continued)

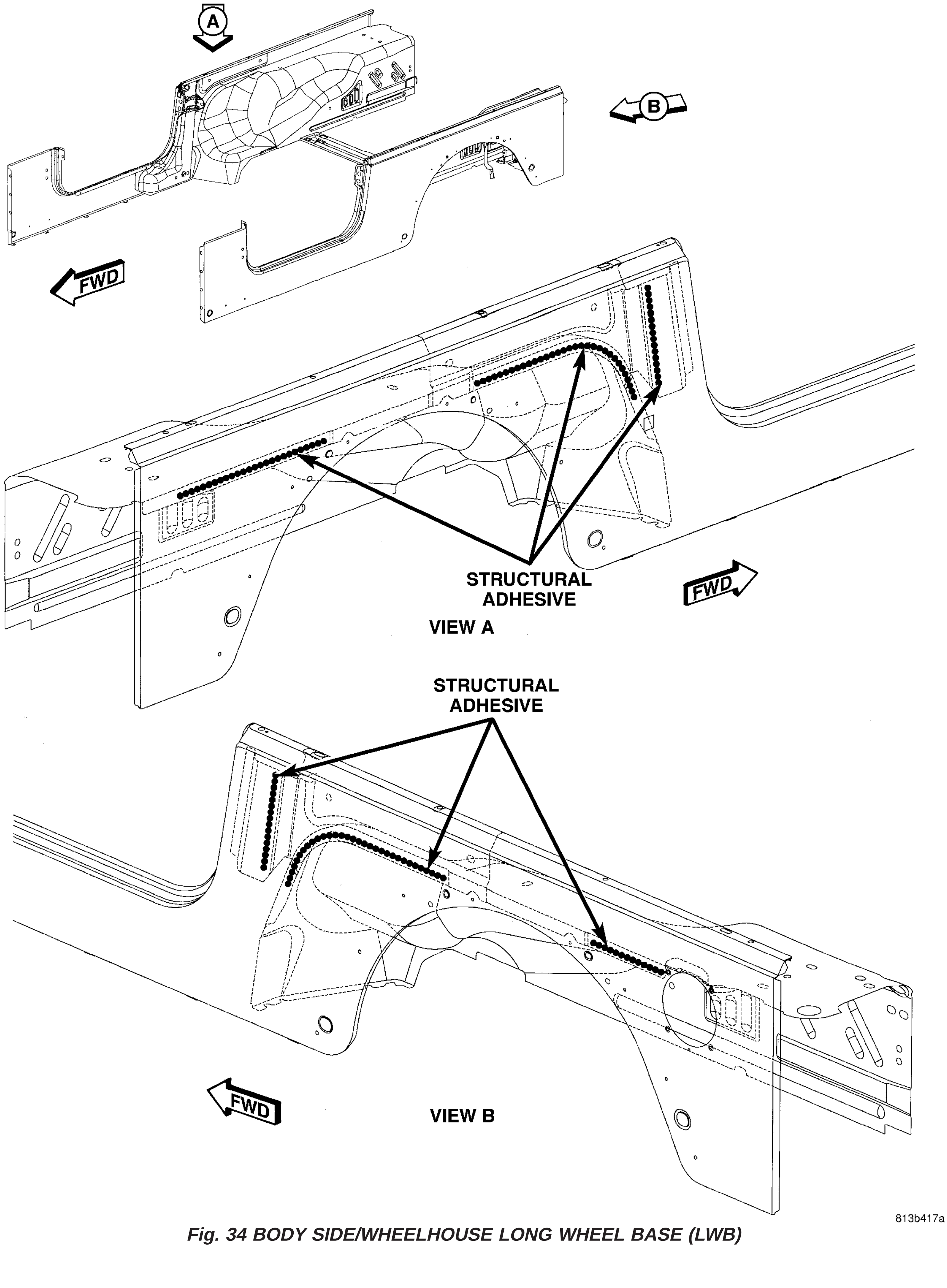

Fig. 34 BODY SIDE/WHEELHOUSE LONG WHEEL BASE (LWB)

STRUCTURAL ADHESIVE LOCATIONS (Continued)

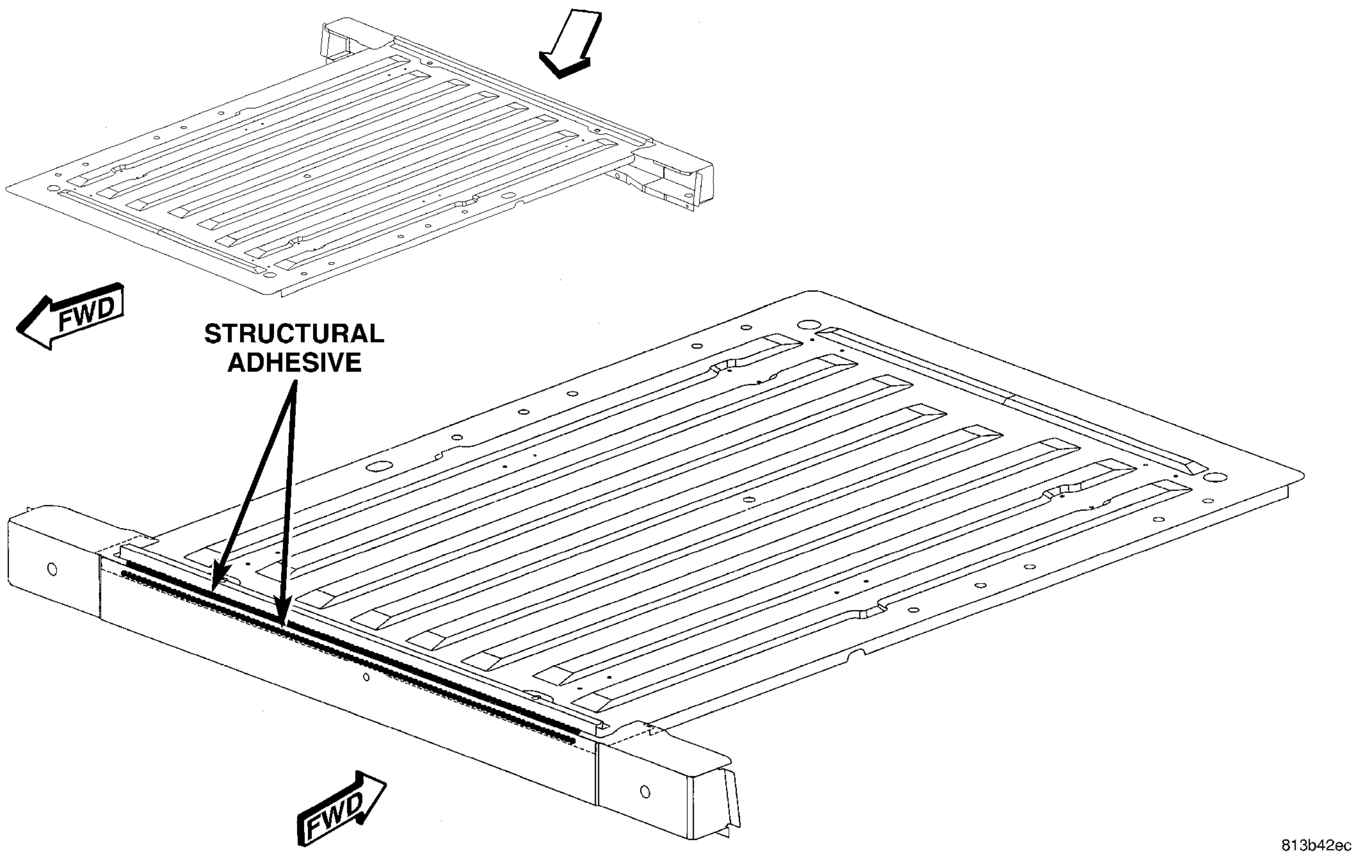

Fig. 35 REAR FLOOR LWB

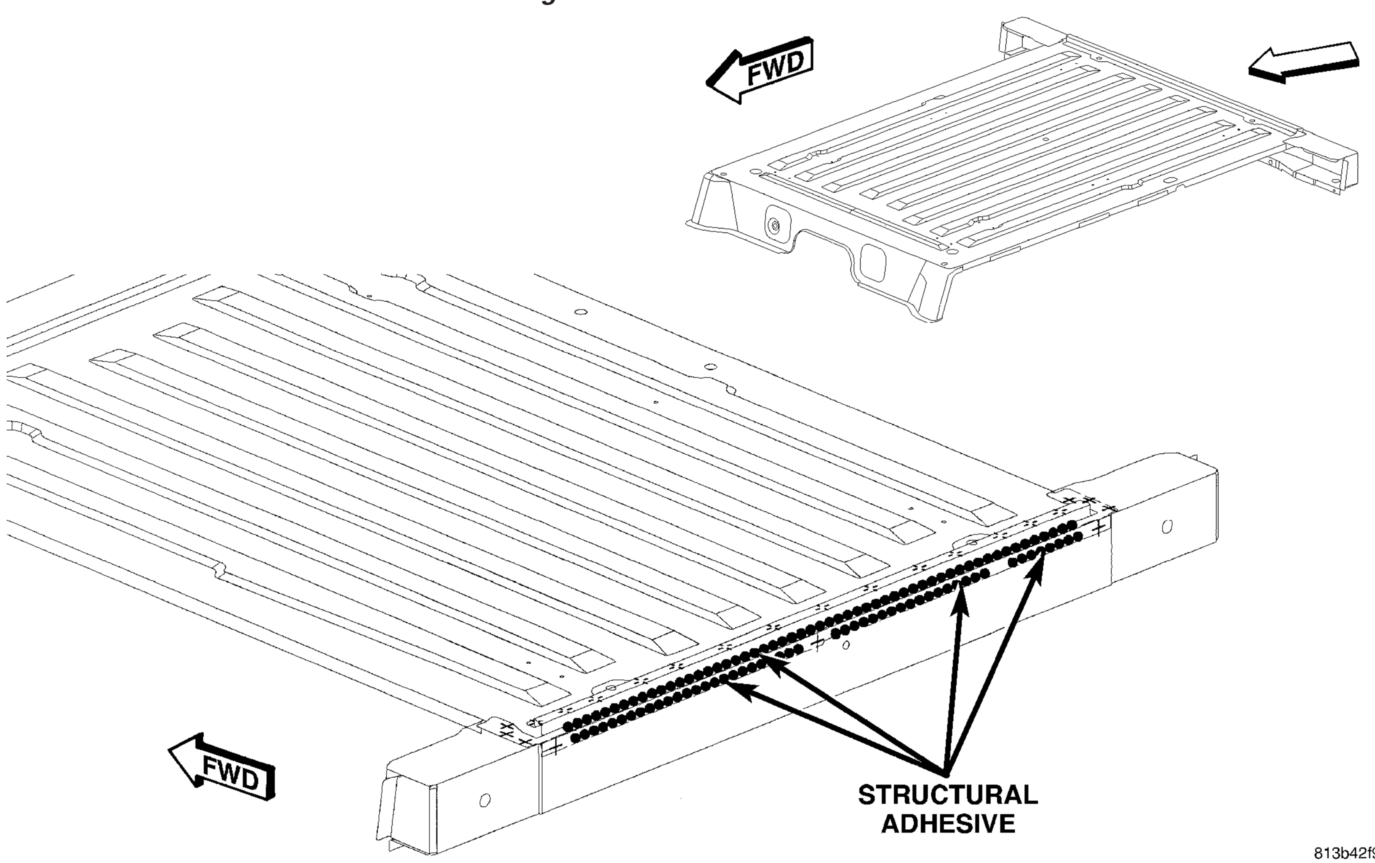

Fig. 36 UNDERBODY LWB

STRUCTURAL ADHESIVE LOCATIONS (Continued)

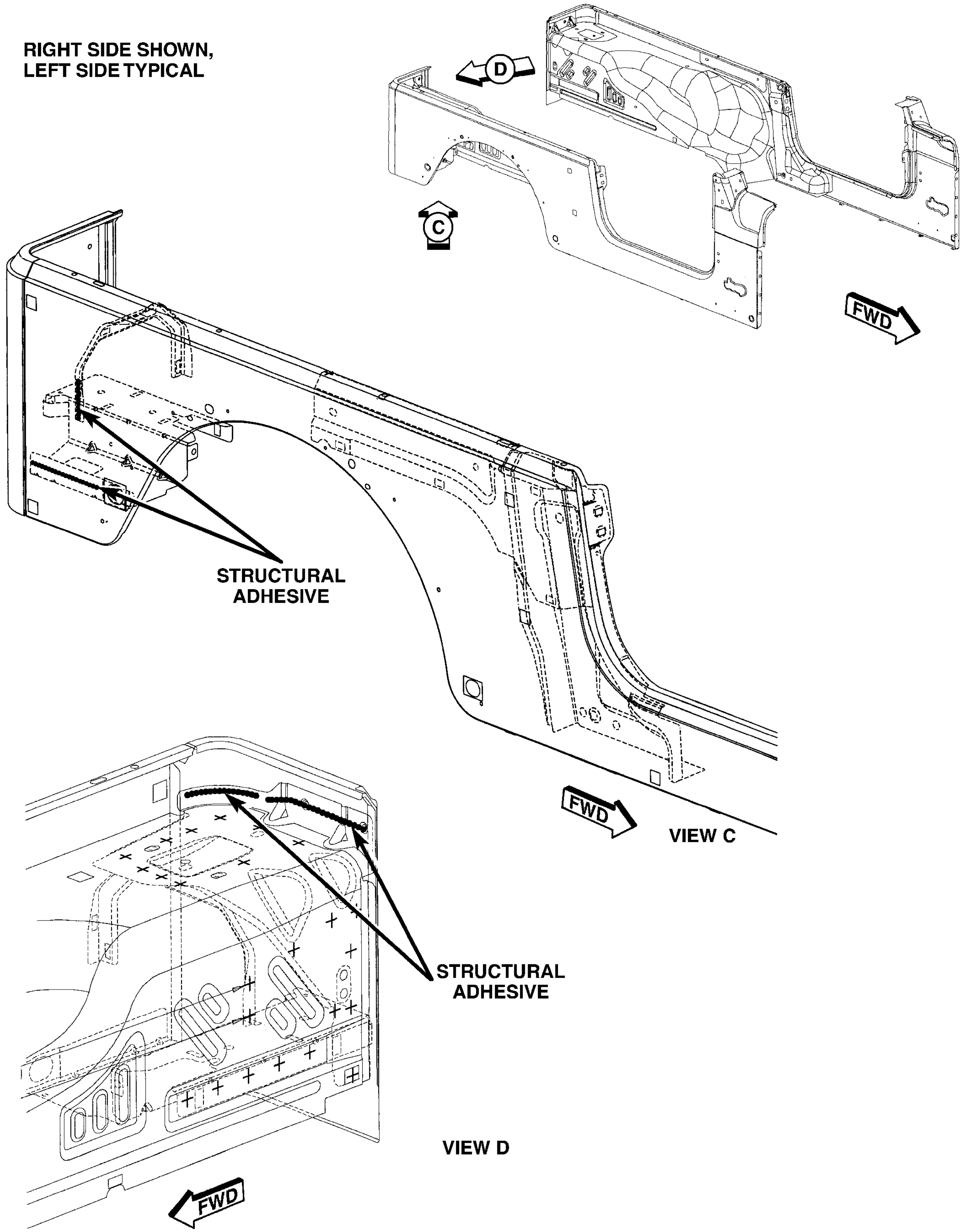

Fig. 37 BODY SIDE COMPLETE LWB

STRUCTURAL ADHESIVE LOCATIONS (Continued)

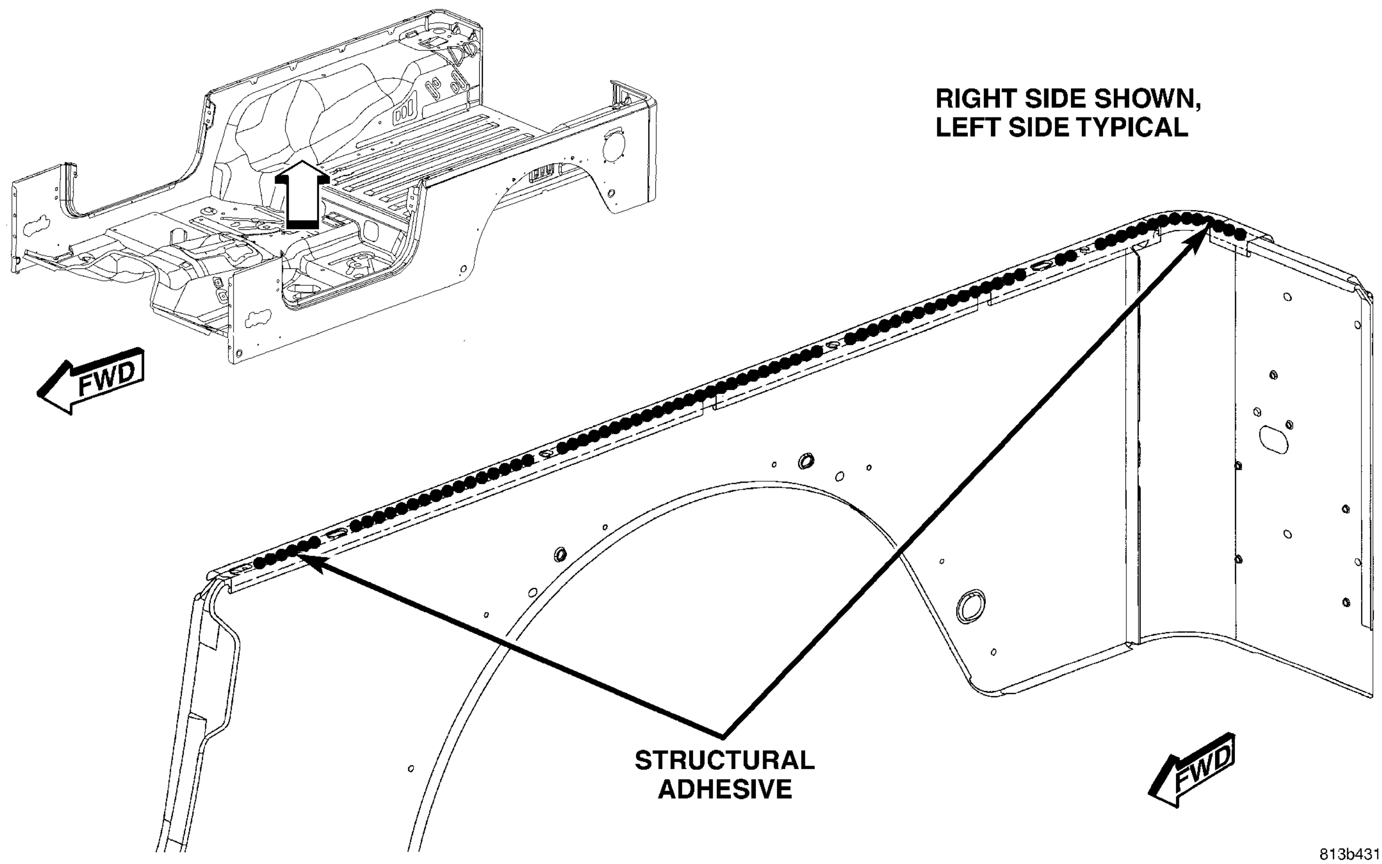

Fig. 38 BODY COMPLETE LWB

WELD LOCATIONS

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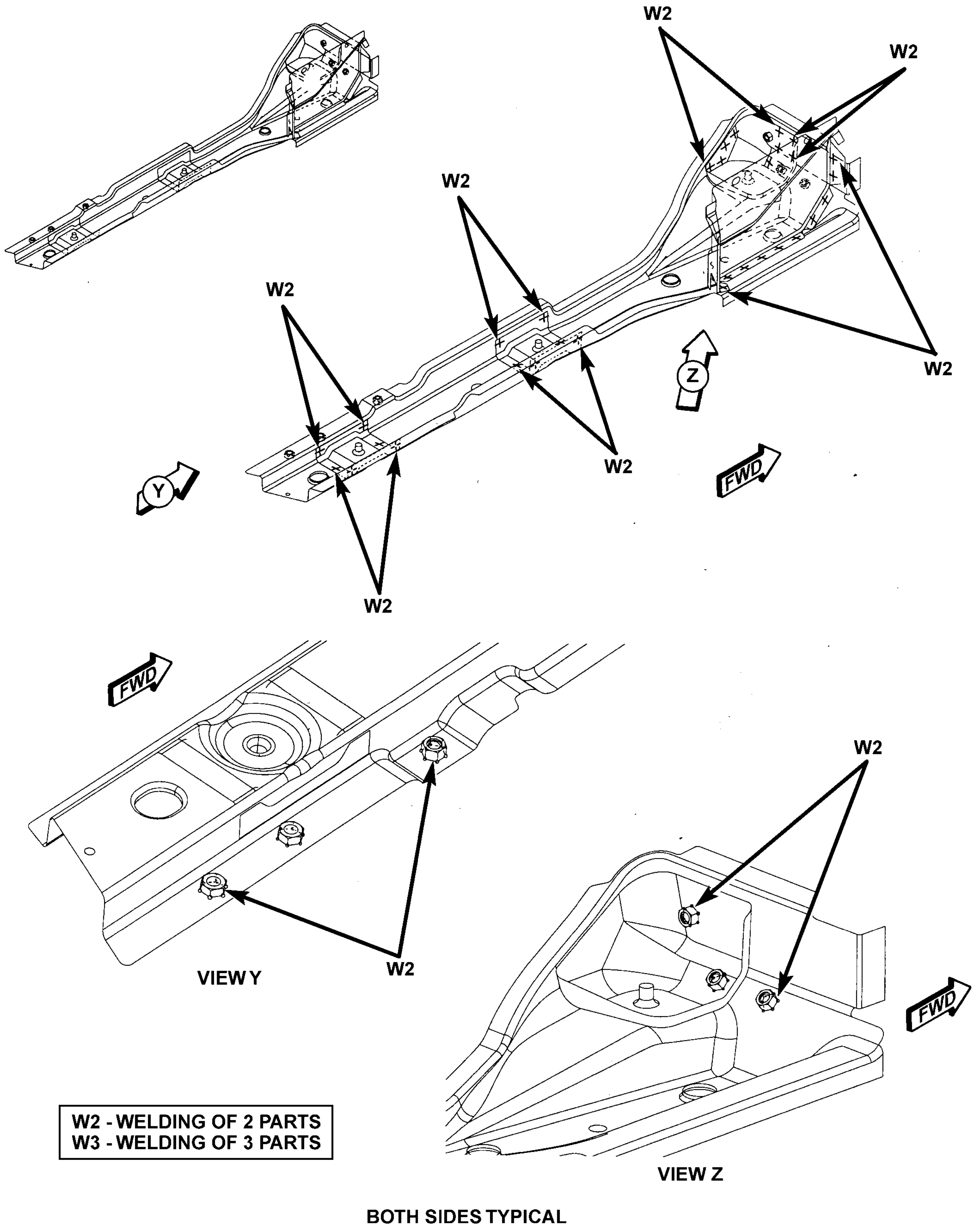

Fig. 39 CROSSMEMBERS/STRAINERS

WELD LOCATIONS (Continued)

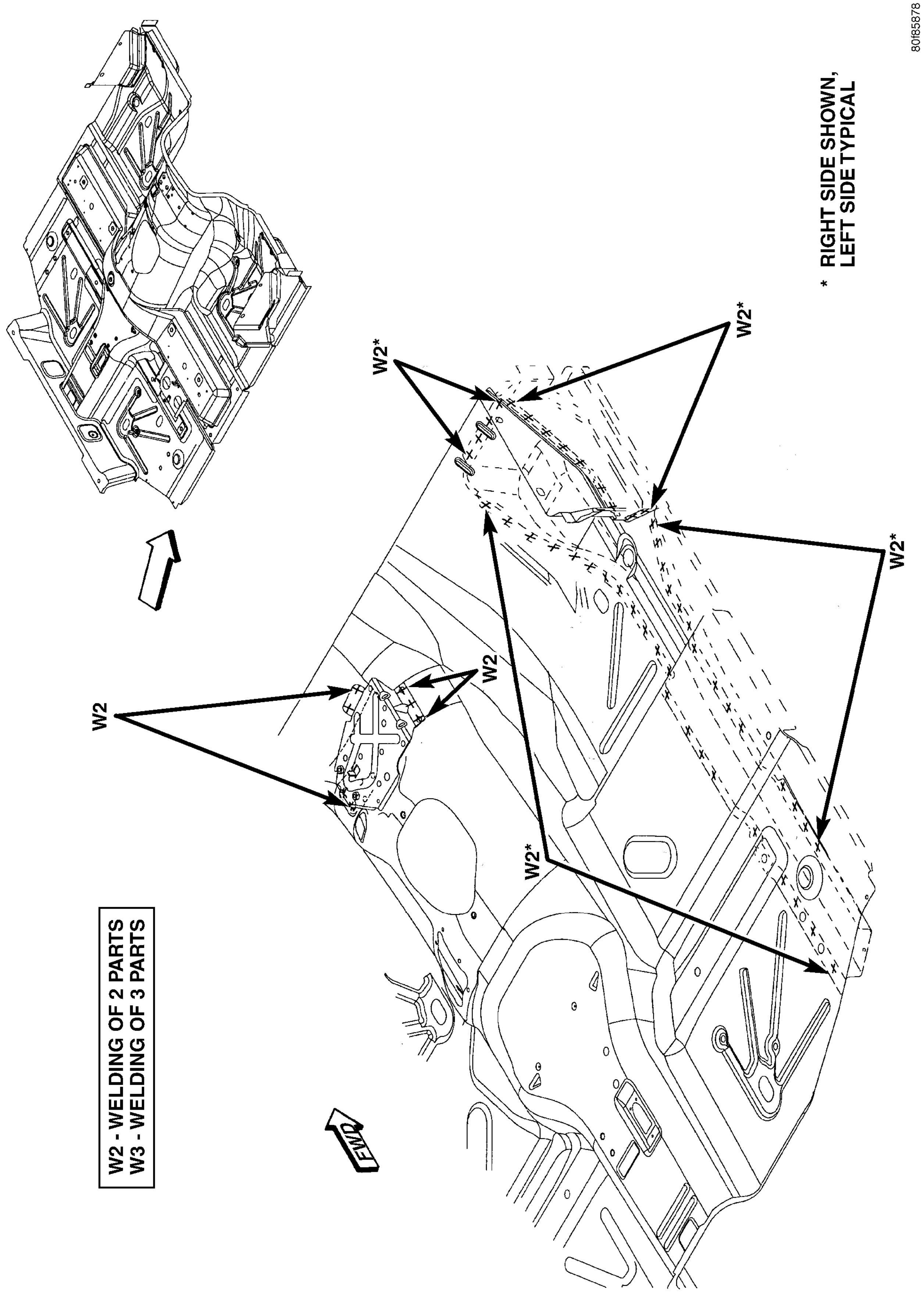

Fig. 40 FRONT FLOOR PAN (1 OF 3)

WELD LOCATIONS (Continued)

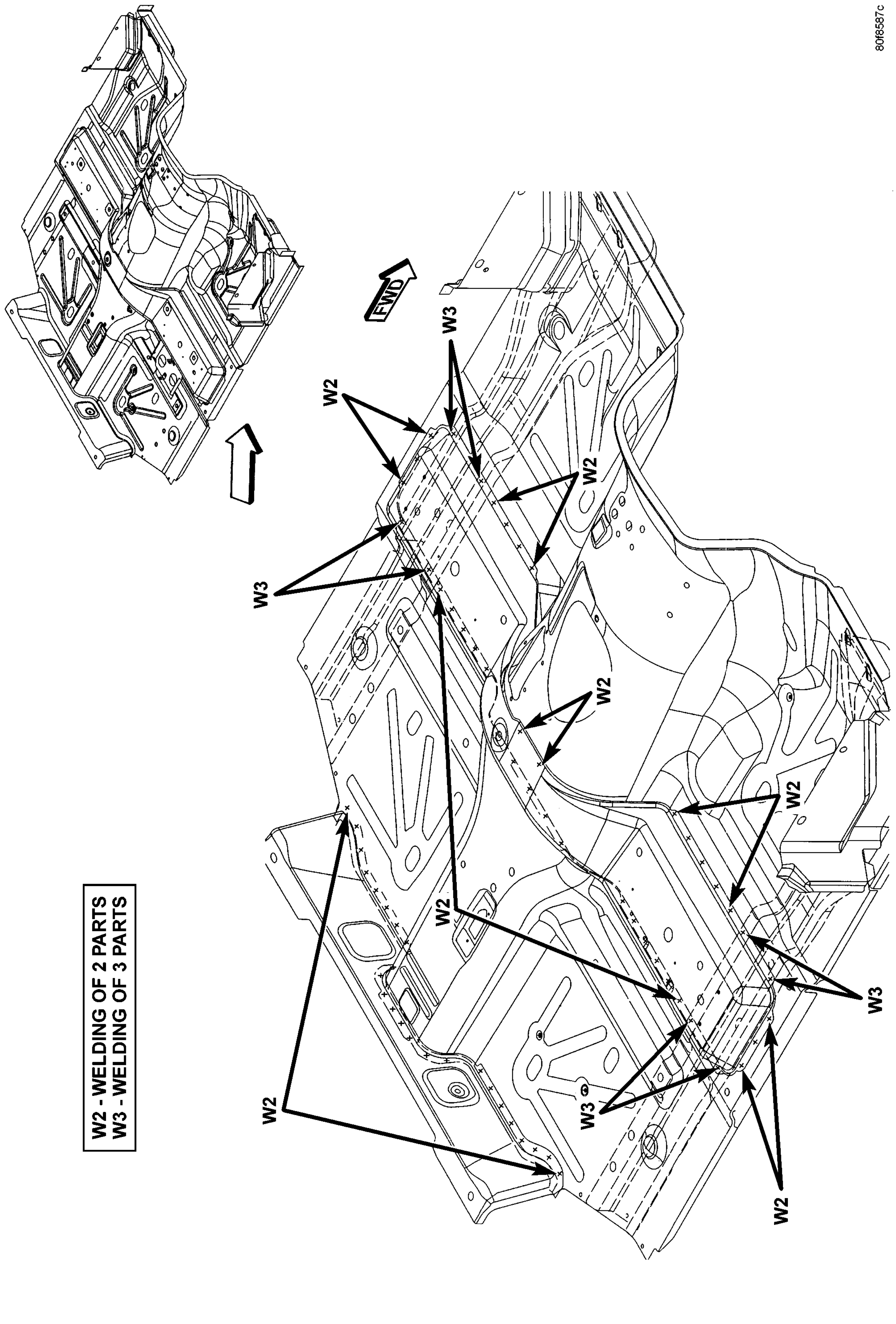

Fig. 41 FRONT FLOOR PAN (2 OF 3)

WELD LOCATIONS (Continued)

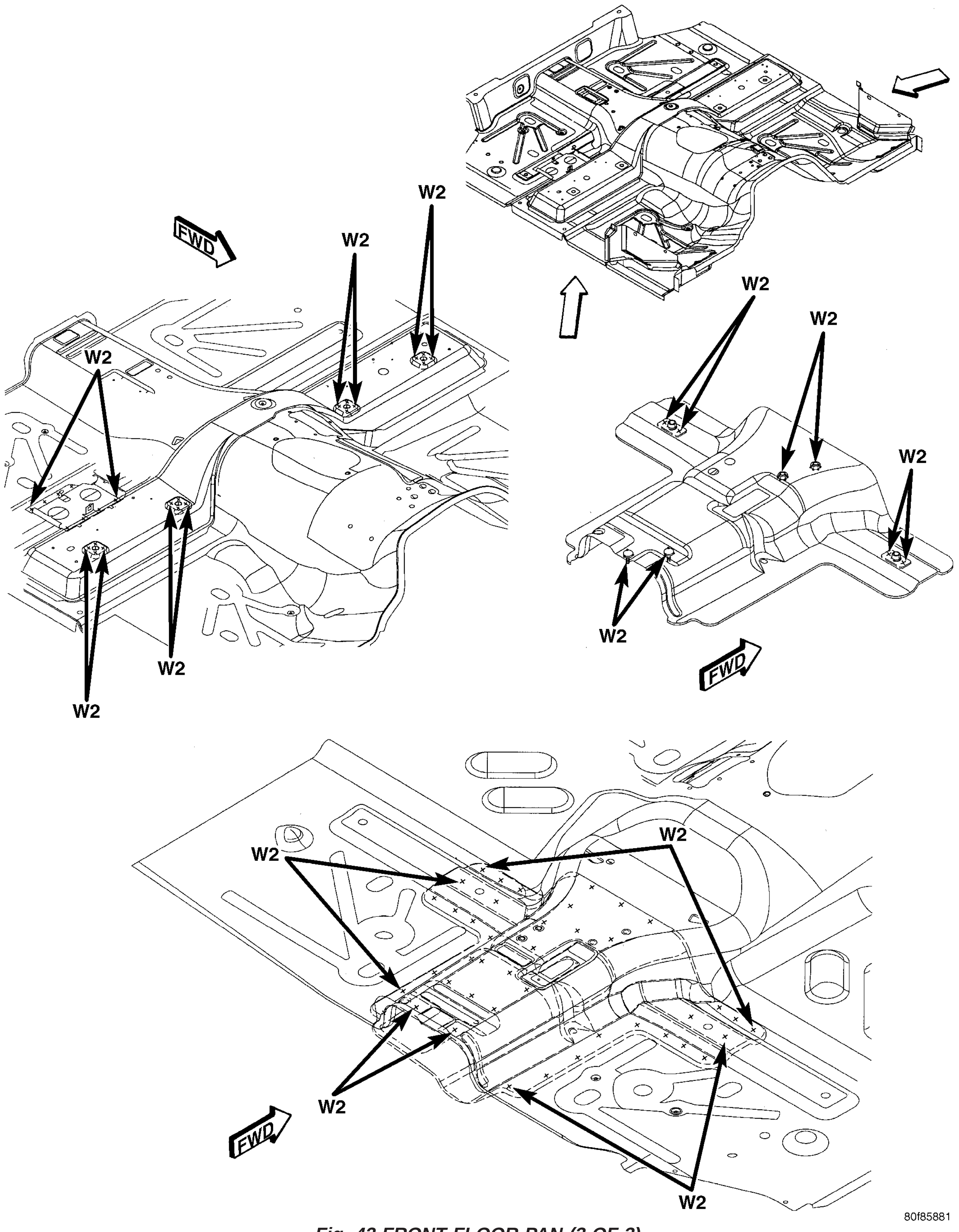

Fig. 42 FRONT FLOOR PAN (3 OF 3)

WELD LOCATIONS (Continued)

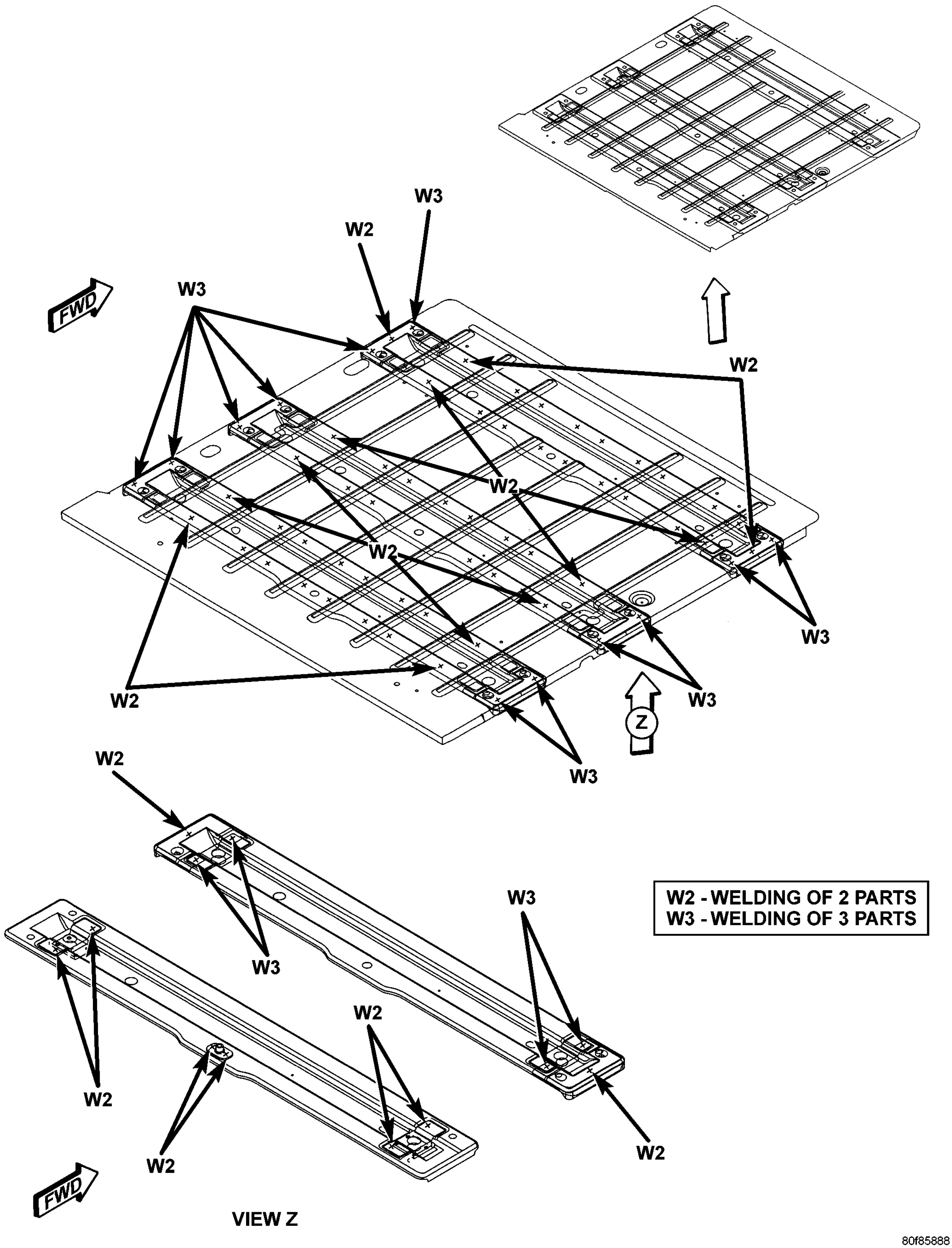

Fig. 43 REAR FLOOR PAN (1 OF 2)

WELD LOCATIONS (Continued)

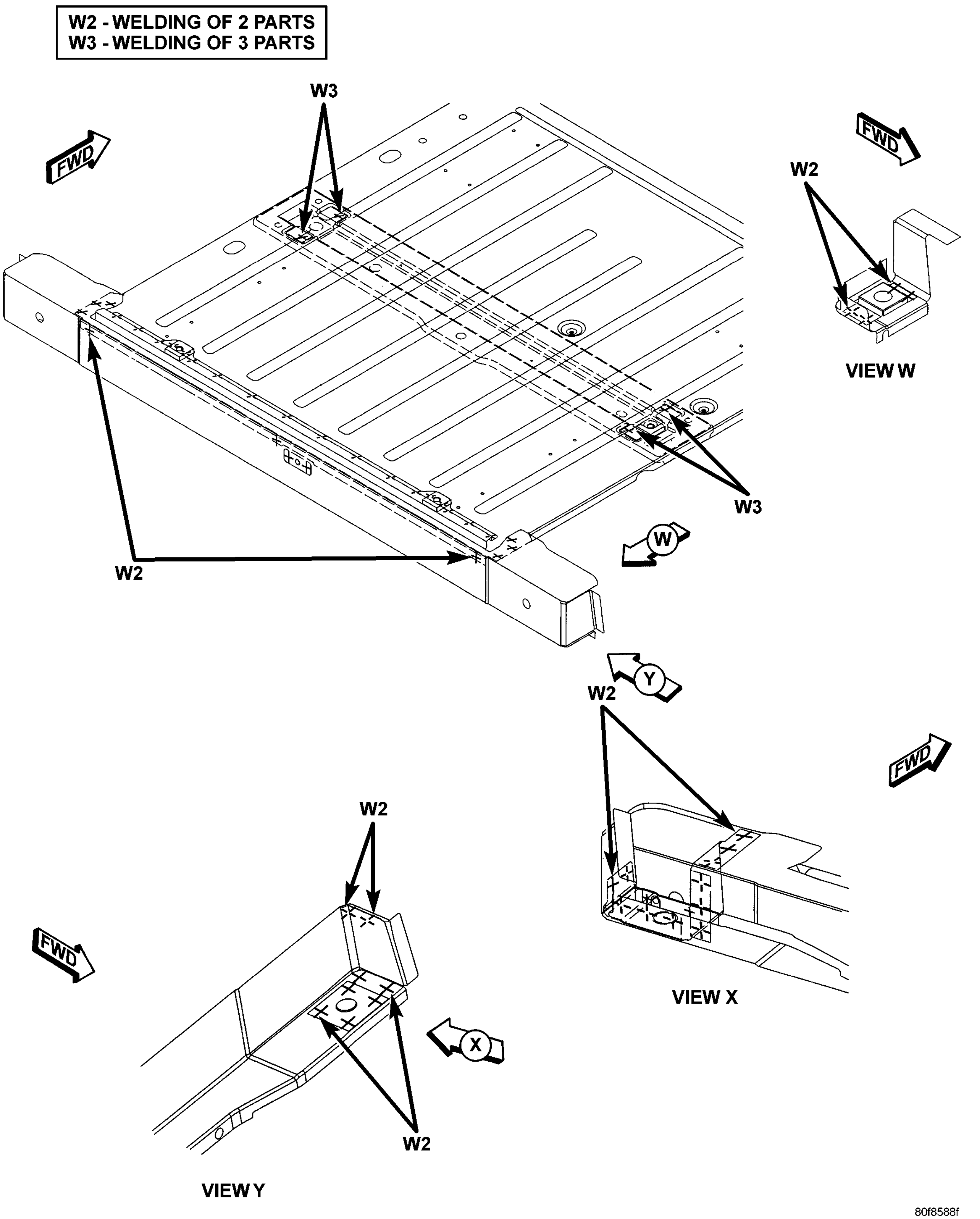

Fig. 44 REAR FLOOR PAN (2 OF 2)

WELD LOCATIONS (Continued)

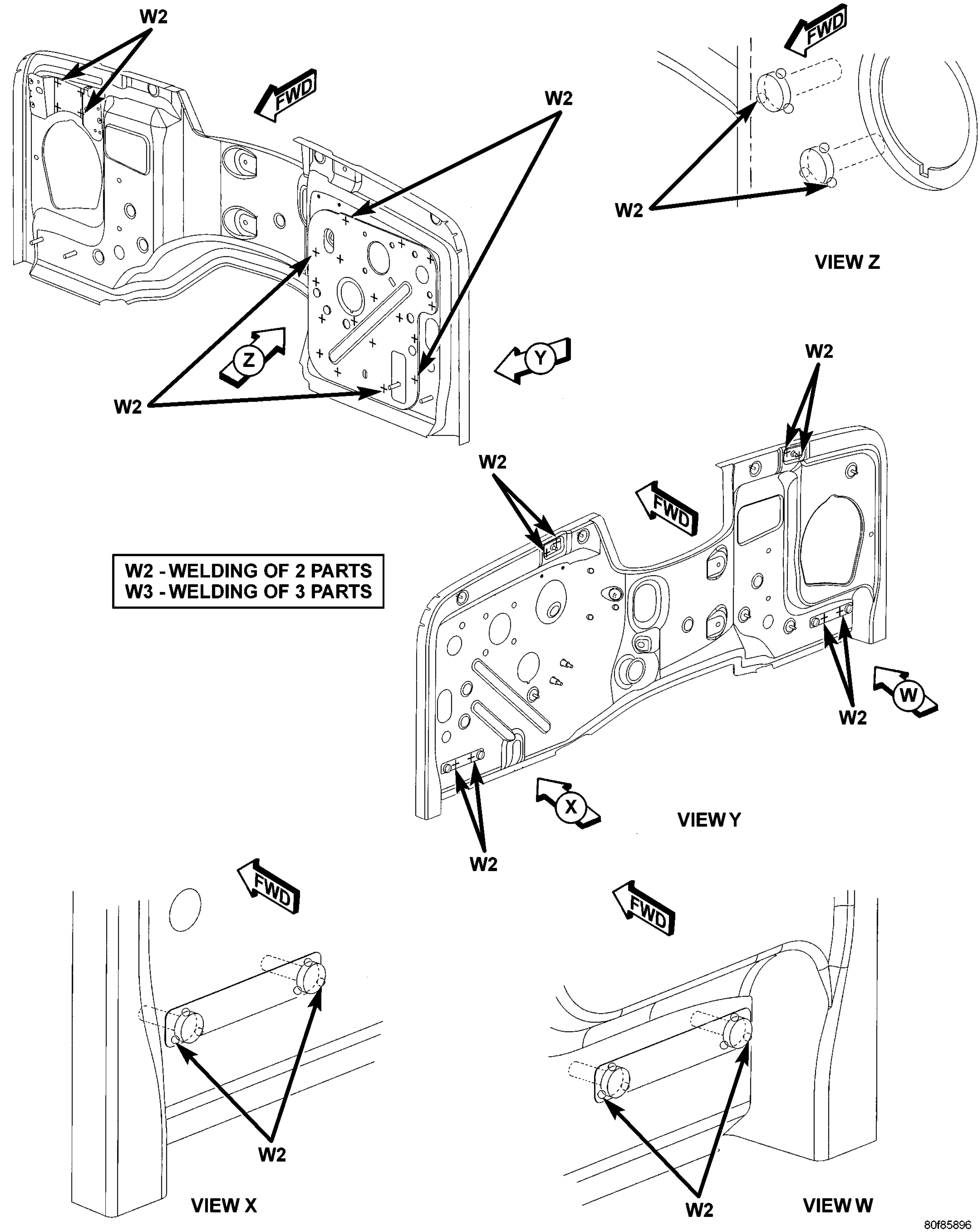

Fig. 45 DASH PANEL - LEFT HAND DRIVE

WELD LOCATIONS (Continued)

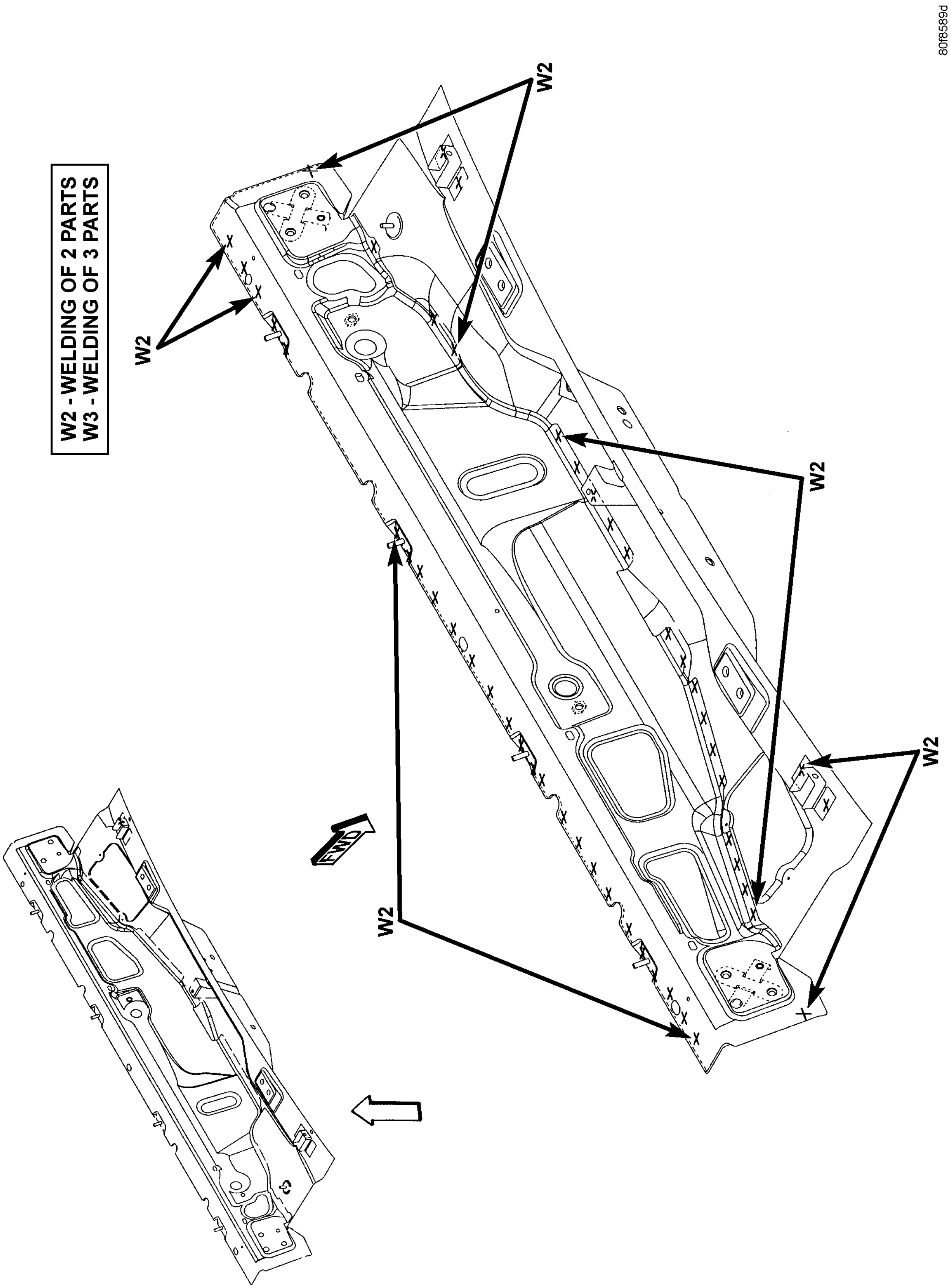

Fig. 46 COWL ASSEMBLY - LEFT HAND DRIVE (1 OF 3)

WELD LOCATIONS (Continued)

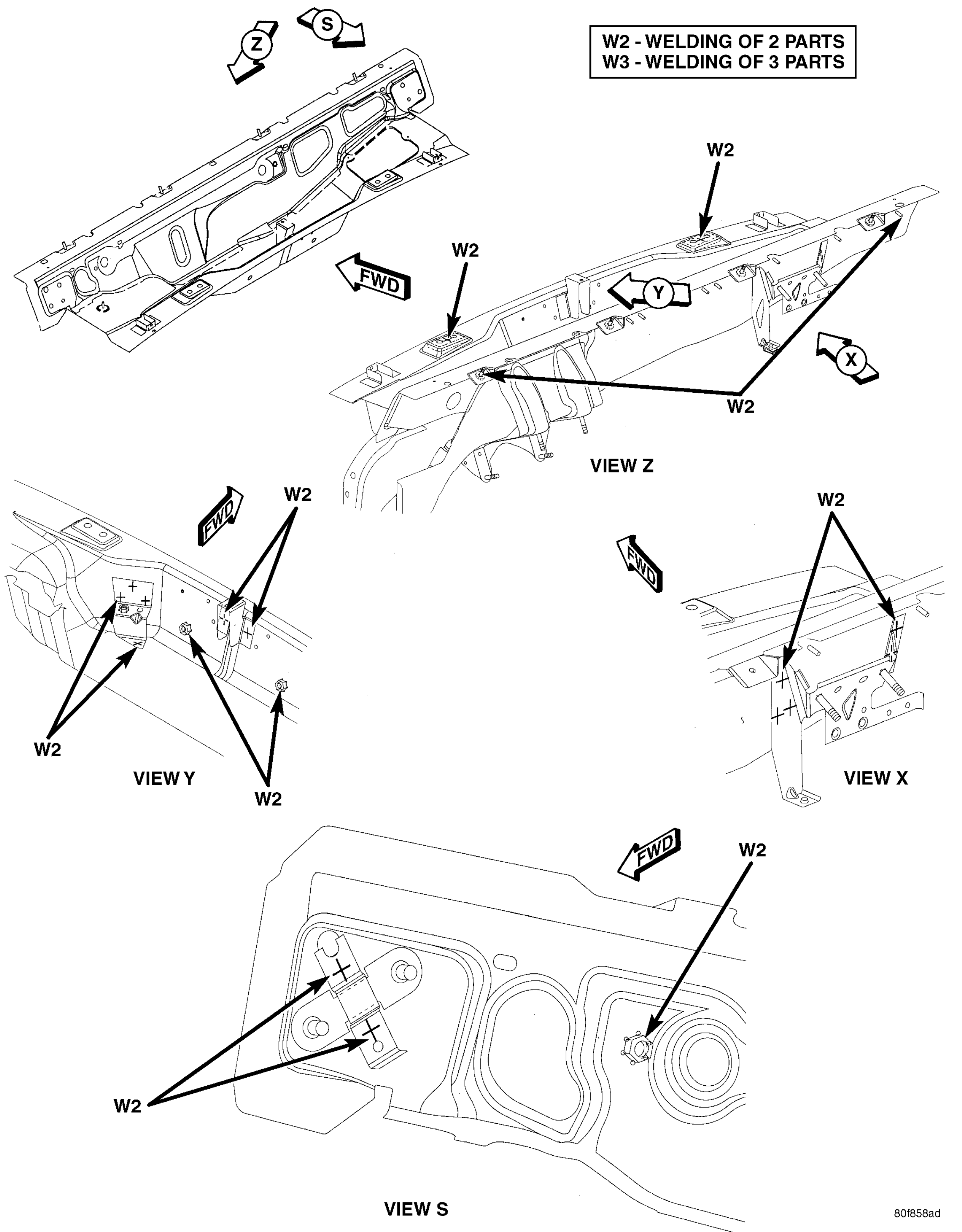

Fig. 47 COWL ASSEMBLY - LEFT HAND DRIVE (2 OF 3)

WELD LOCATIONS (Continued)

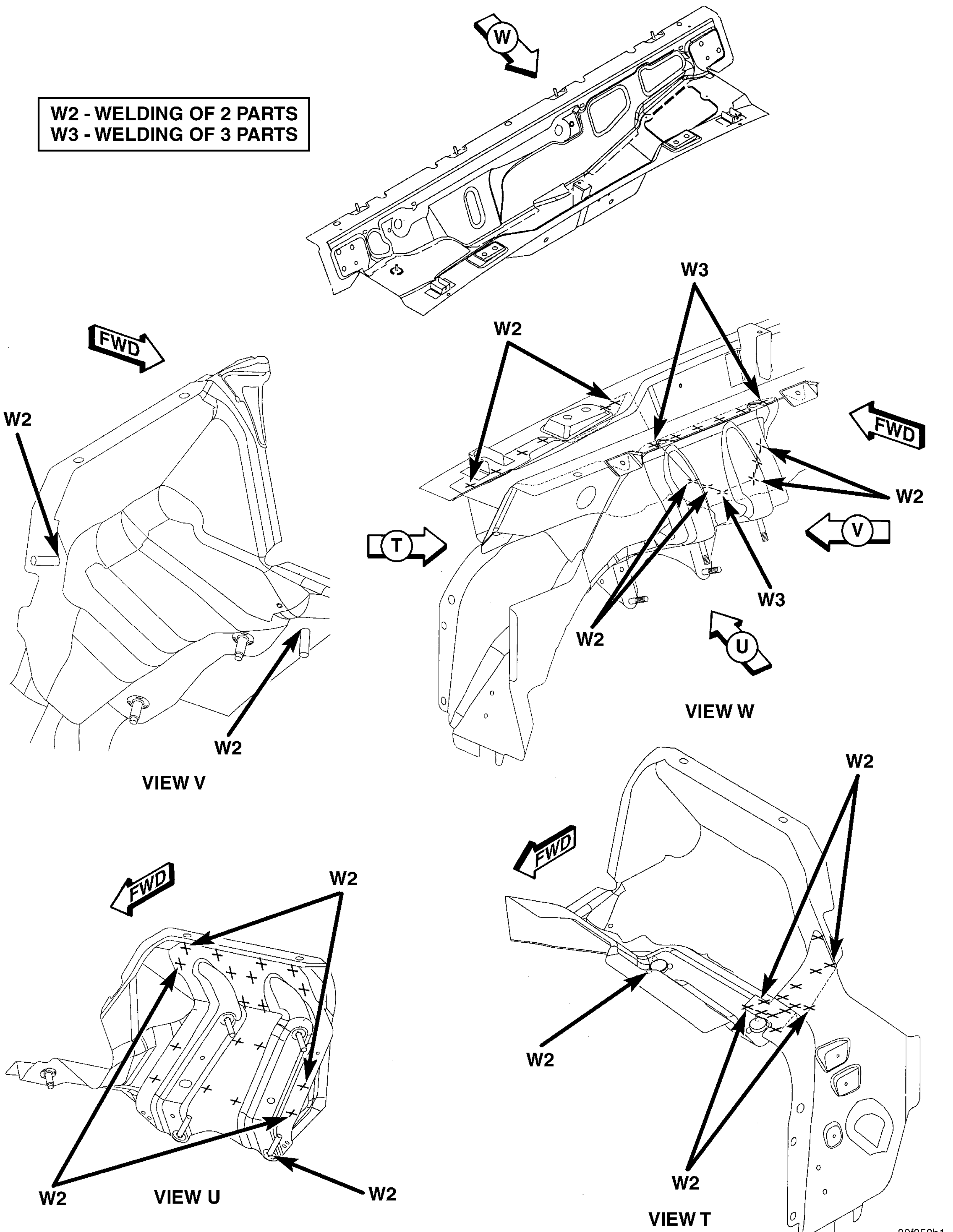

Fig. 48 COWL ASSEMBLY - LEFT HAND DRIVE (3 OF 3)

WELD LOCATIONS (Continued)

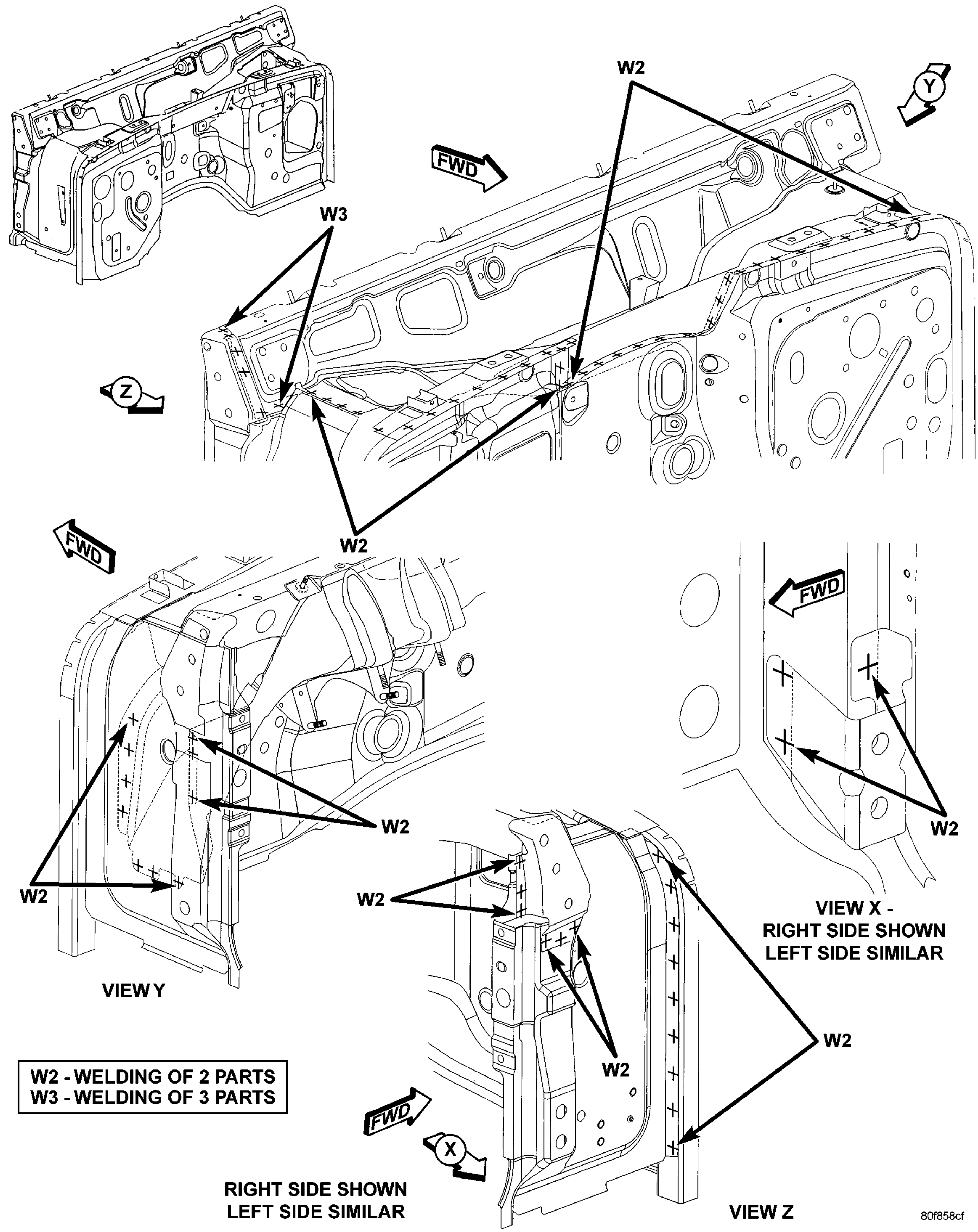

Fig. 49 DASH COWL ASSEMBLY - LEFT HAND DRIVE

WELD LOCATIONS (Continued)

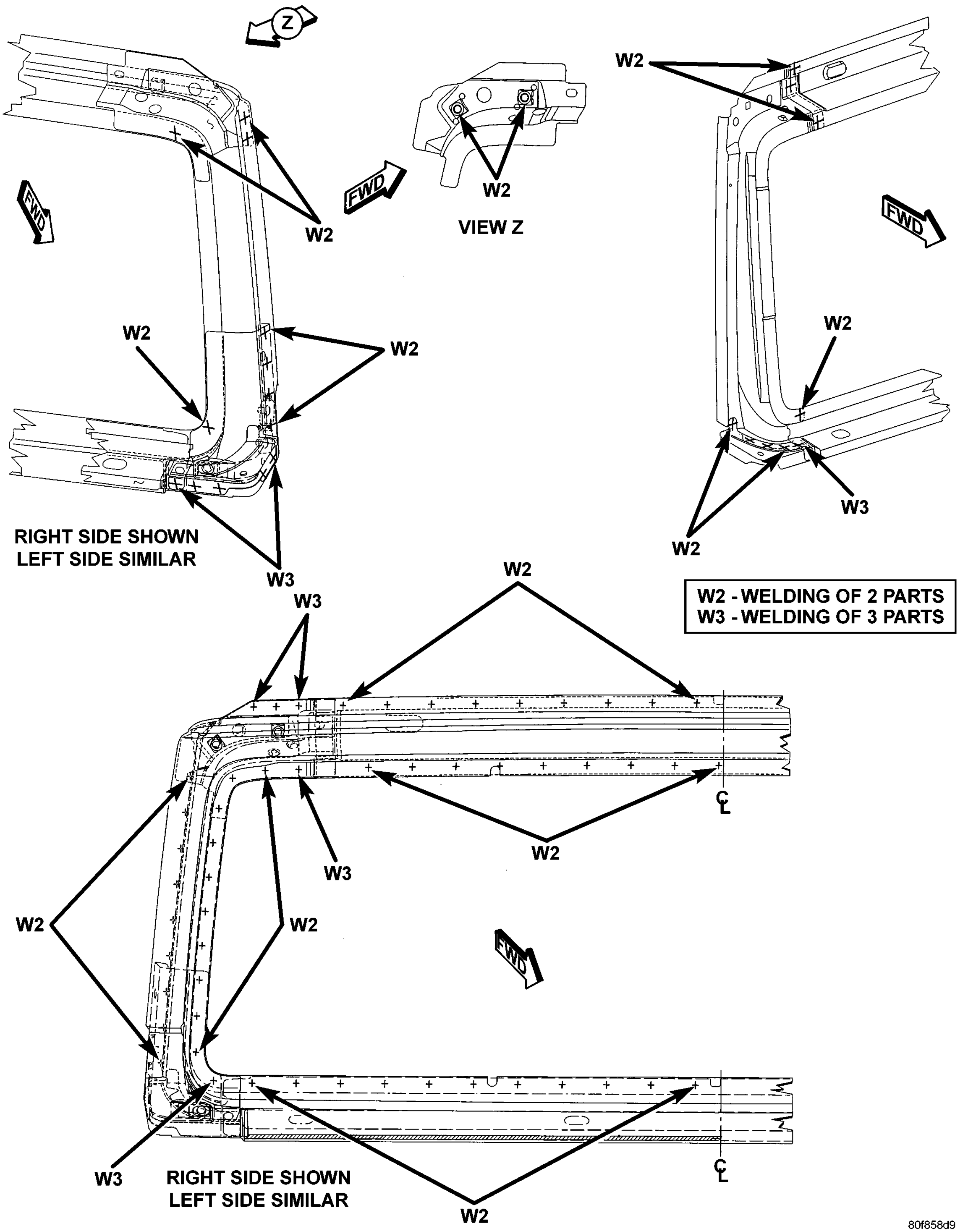

Fig. 50 WINDSHIELD FRAME

WELD LOCATIONS (Continued)

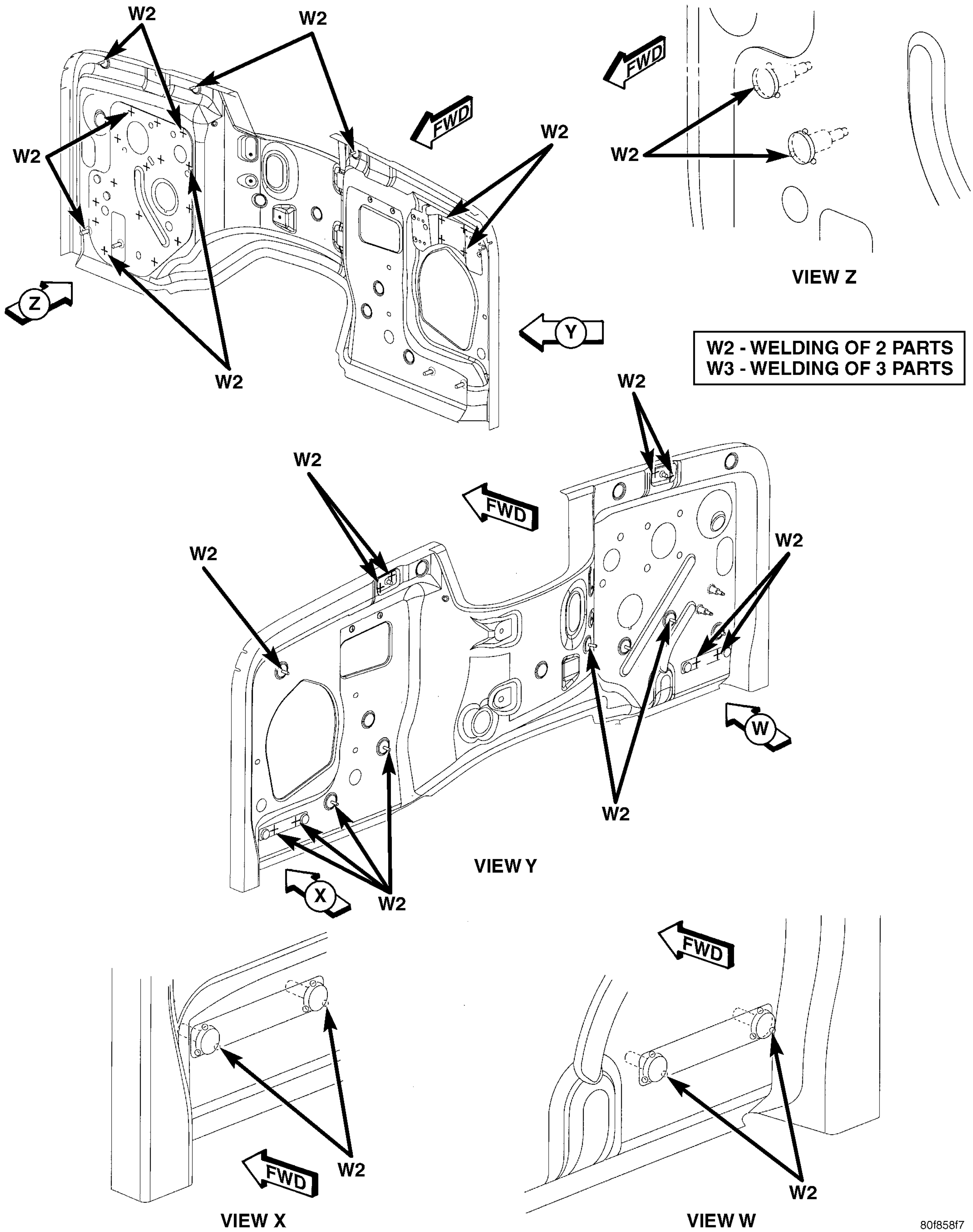

Fig. 51 DASH PANEL - RIGHT HAND DRIVE

WELD LOCATIONS (Continued)

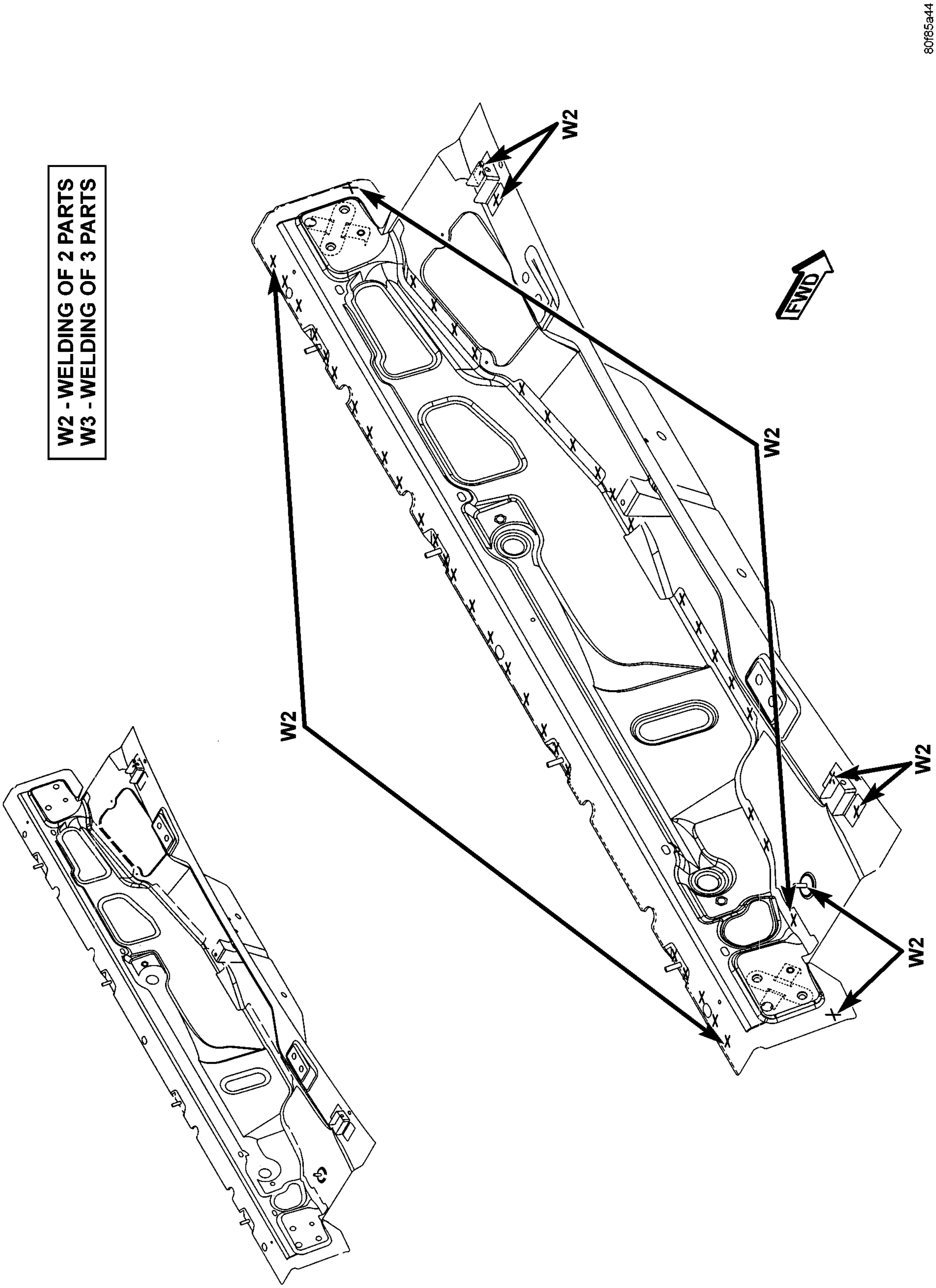

Fig. 52 COWL ASSEMBLY - RIGHT HAND DRIVE (1 OF 3)

WELD LOCATIONS (Continued)

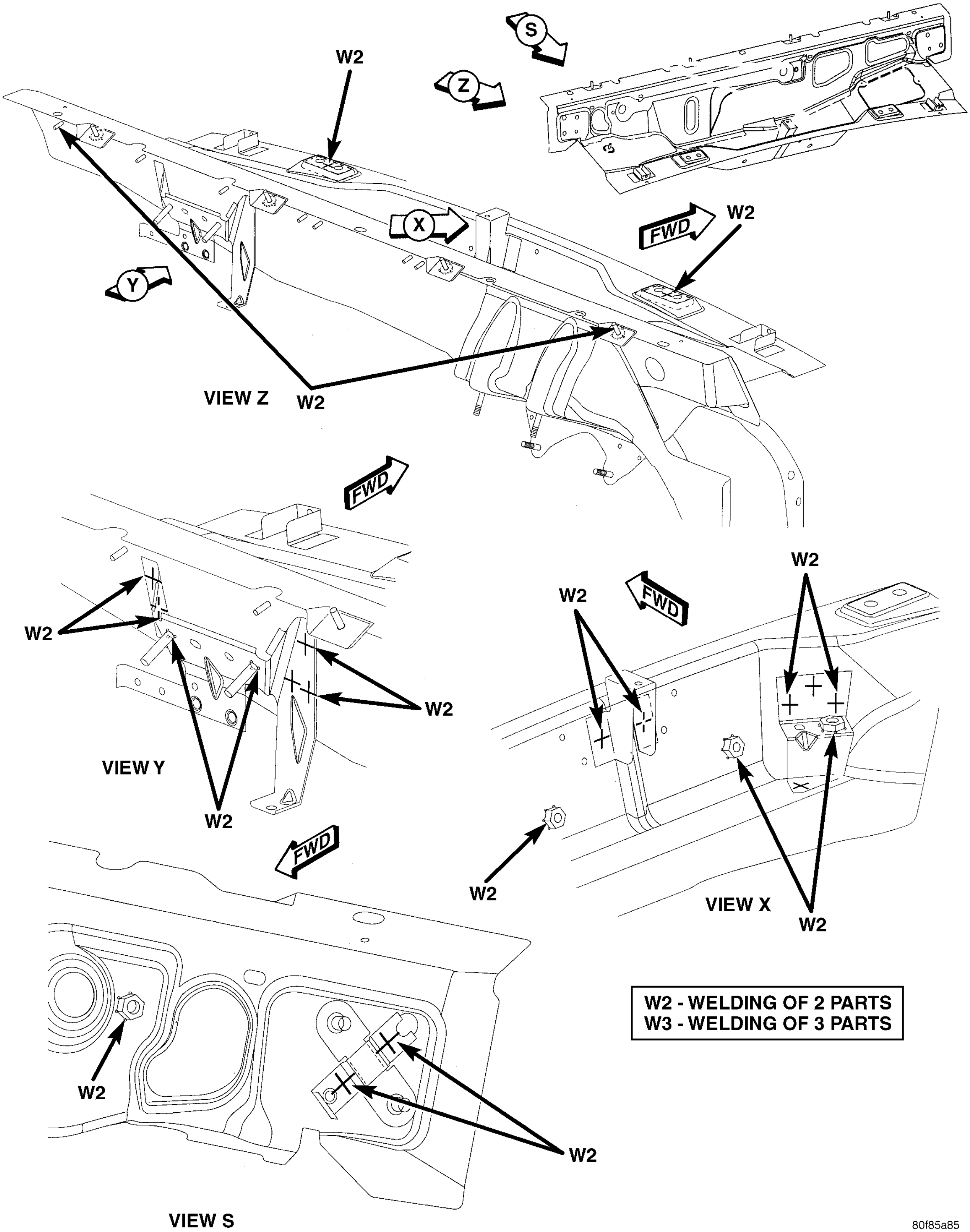

Fig. 53 COWL ASSEMBLY - RIGHT HAND DRIVE (2 OF 3)

WELD LOCATIONS (Continued)

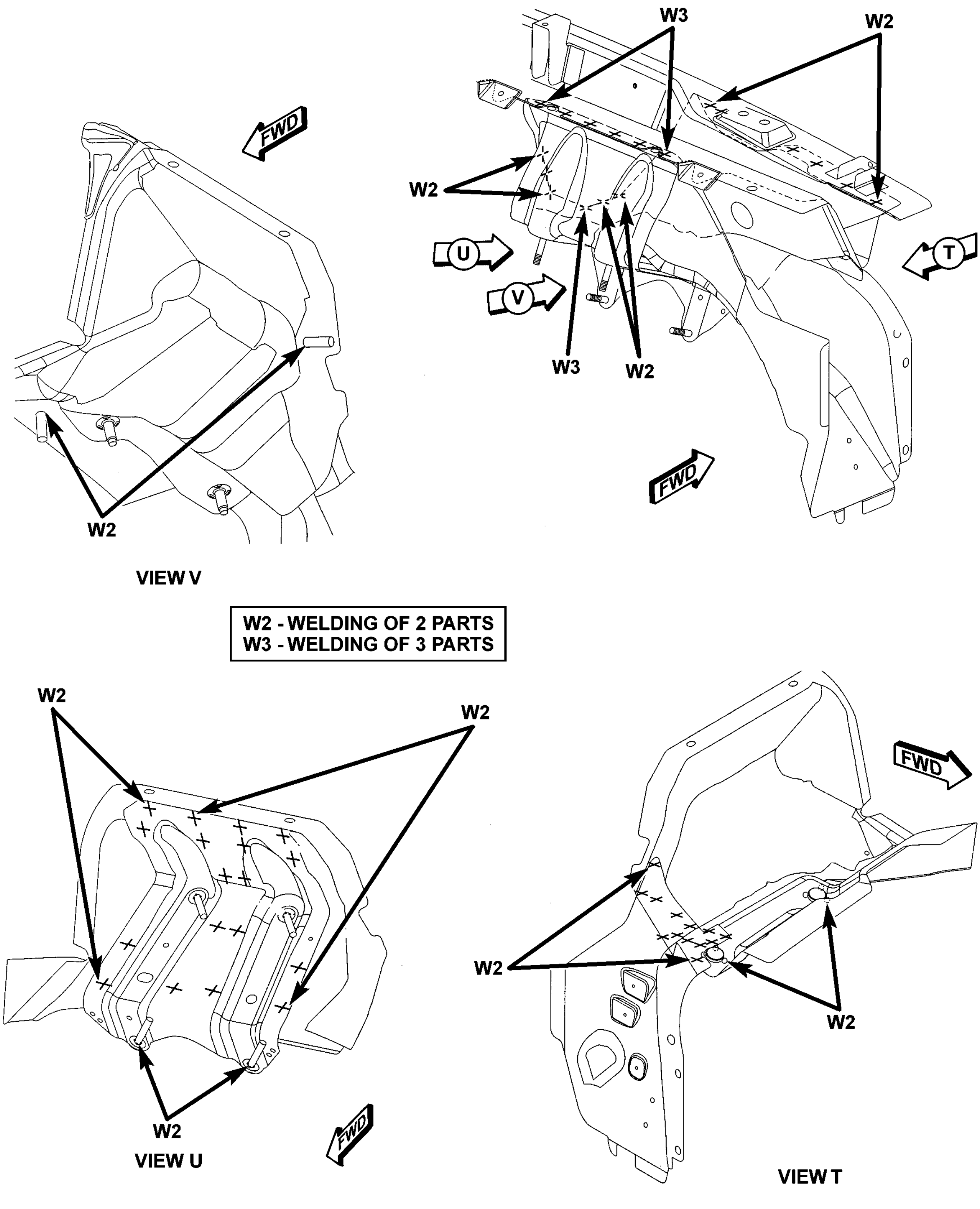

Fig. 54 COWL ASSEMBLY - RIGHT HAND DRIVE (3 OF 3)

WELD LOCATIONS (Continued)

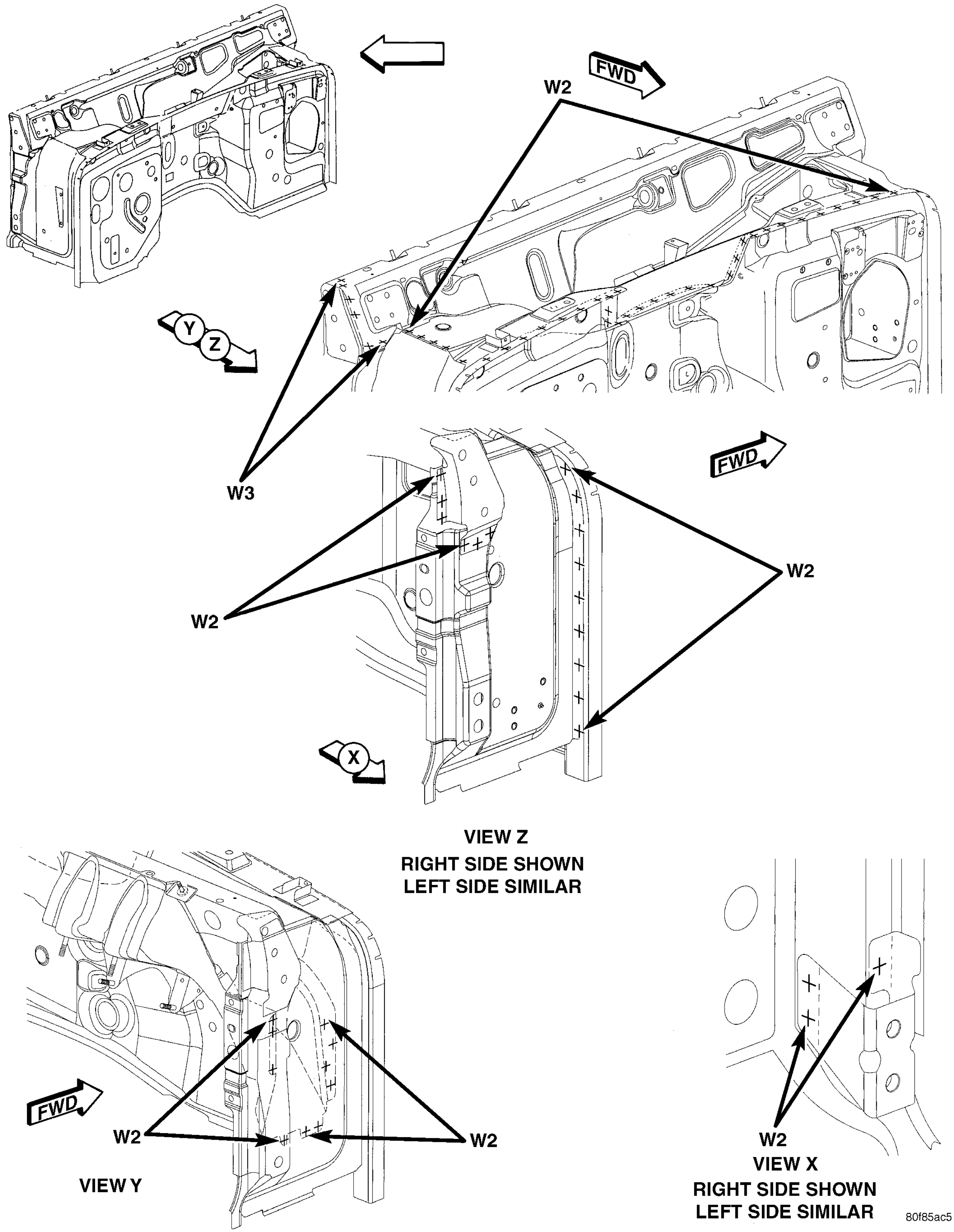

Fig. 55 DASH COWL ASSEMBLY - RIGHT HAND DRIVE

WELD LOCATIONS (Continued)

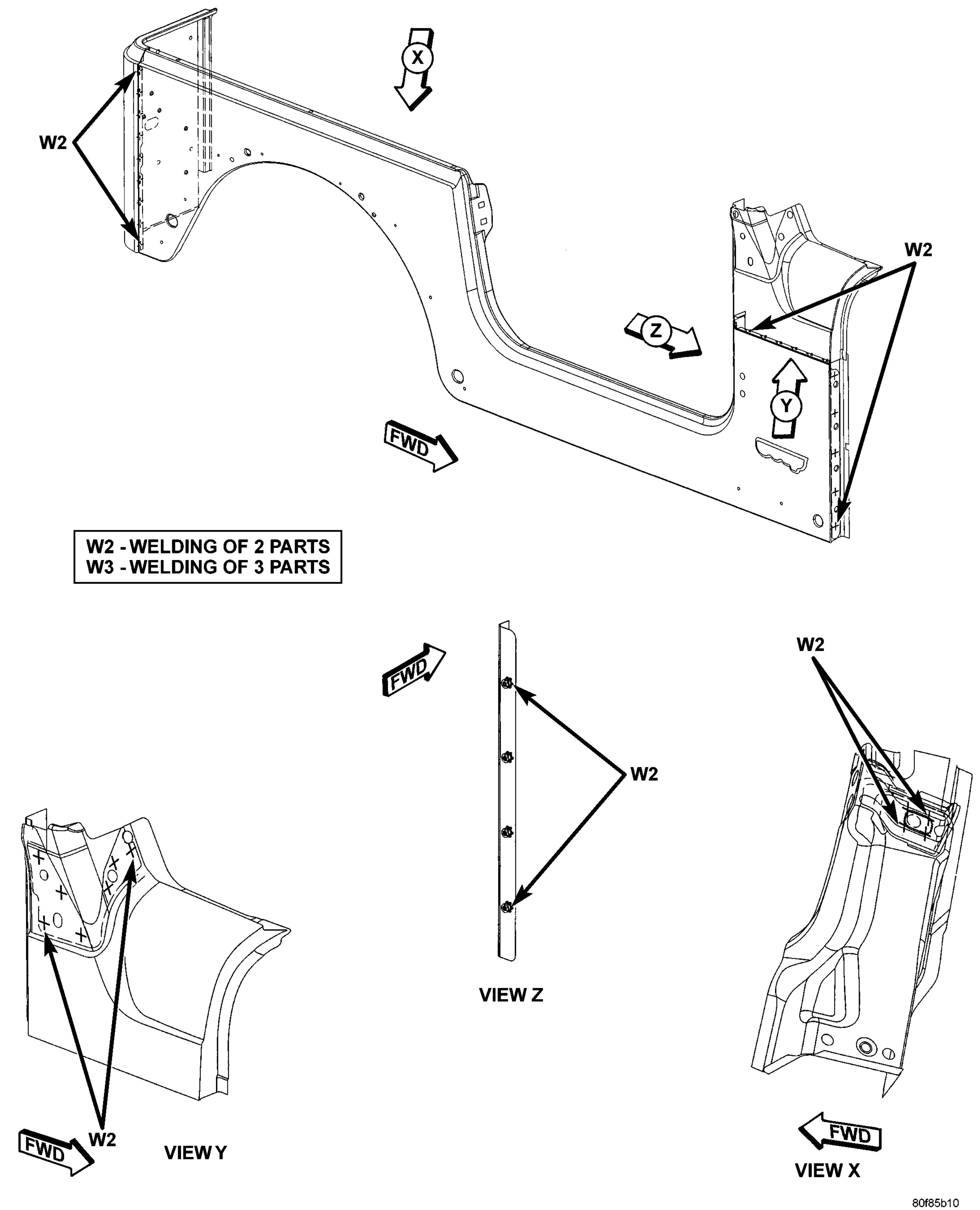

Fig. 56 BODY SIDE ASSEMBLY

WELD LOCATIONS (Continued)

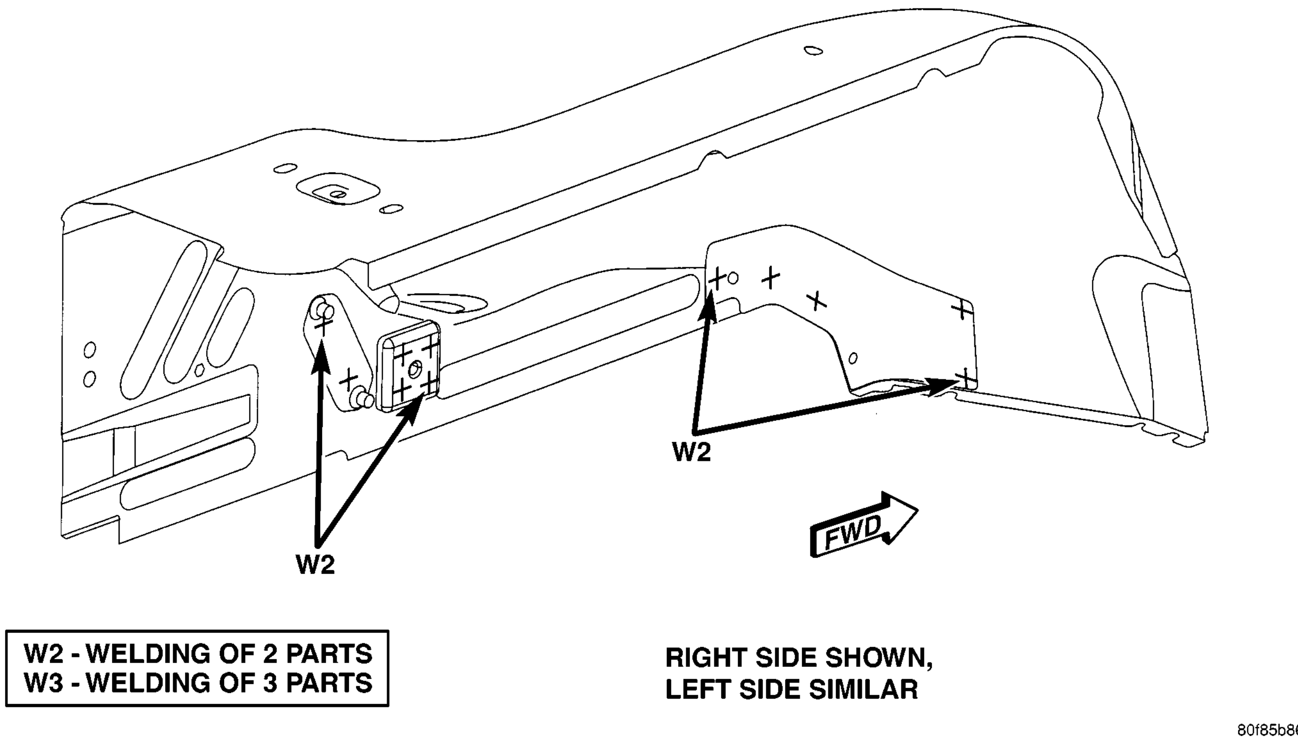

Fig. 57 WHEELHOUSE ASSEMBLY

WELD LOCATIONS (Continued)

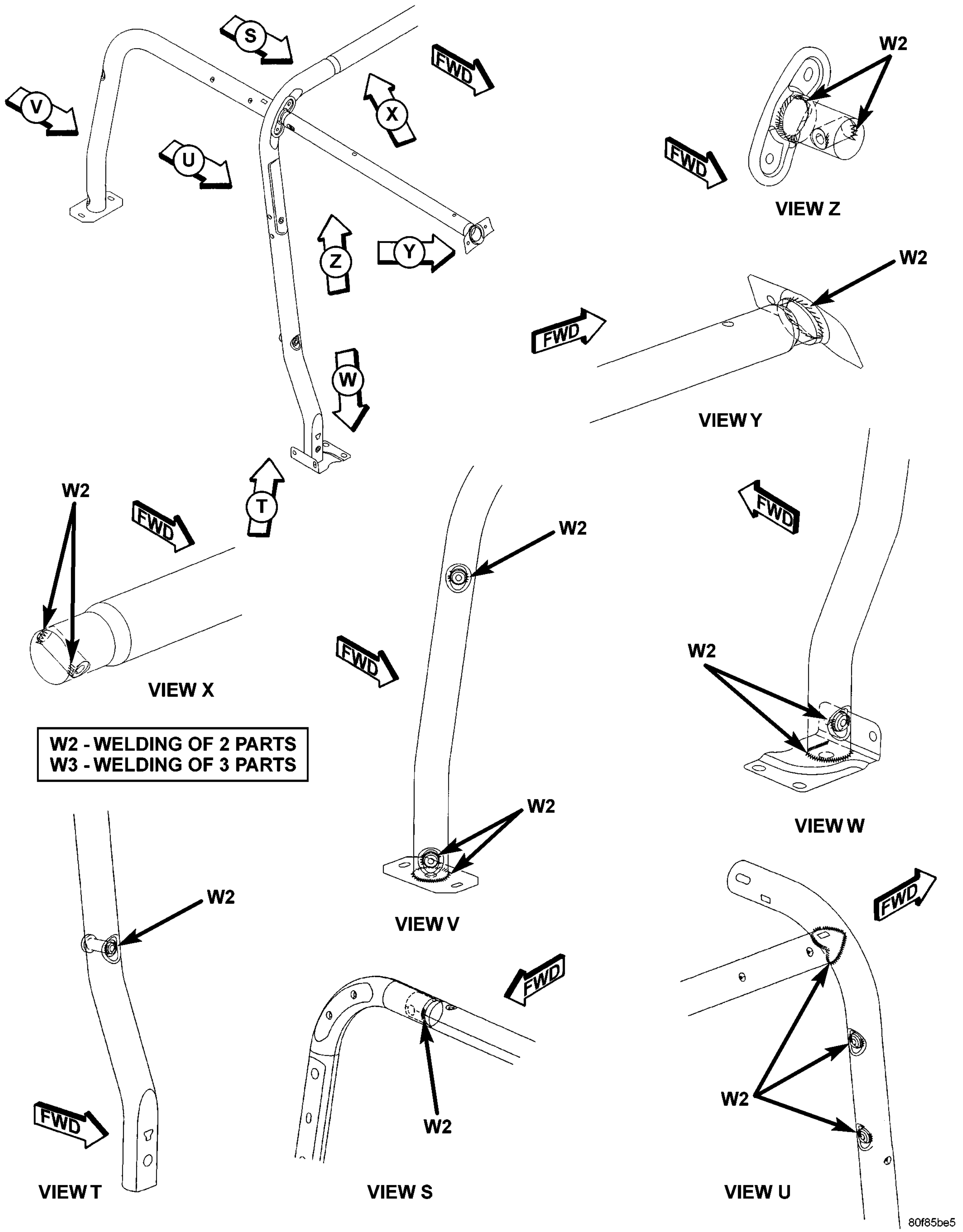

Fig. 58 SPORT BAR ASSEMBLY

WELD LOCATIONS (Continued)

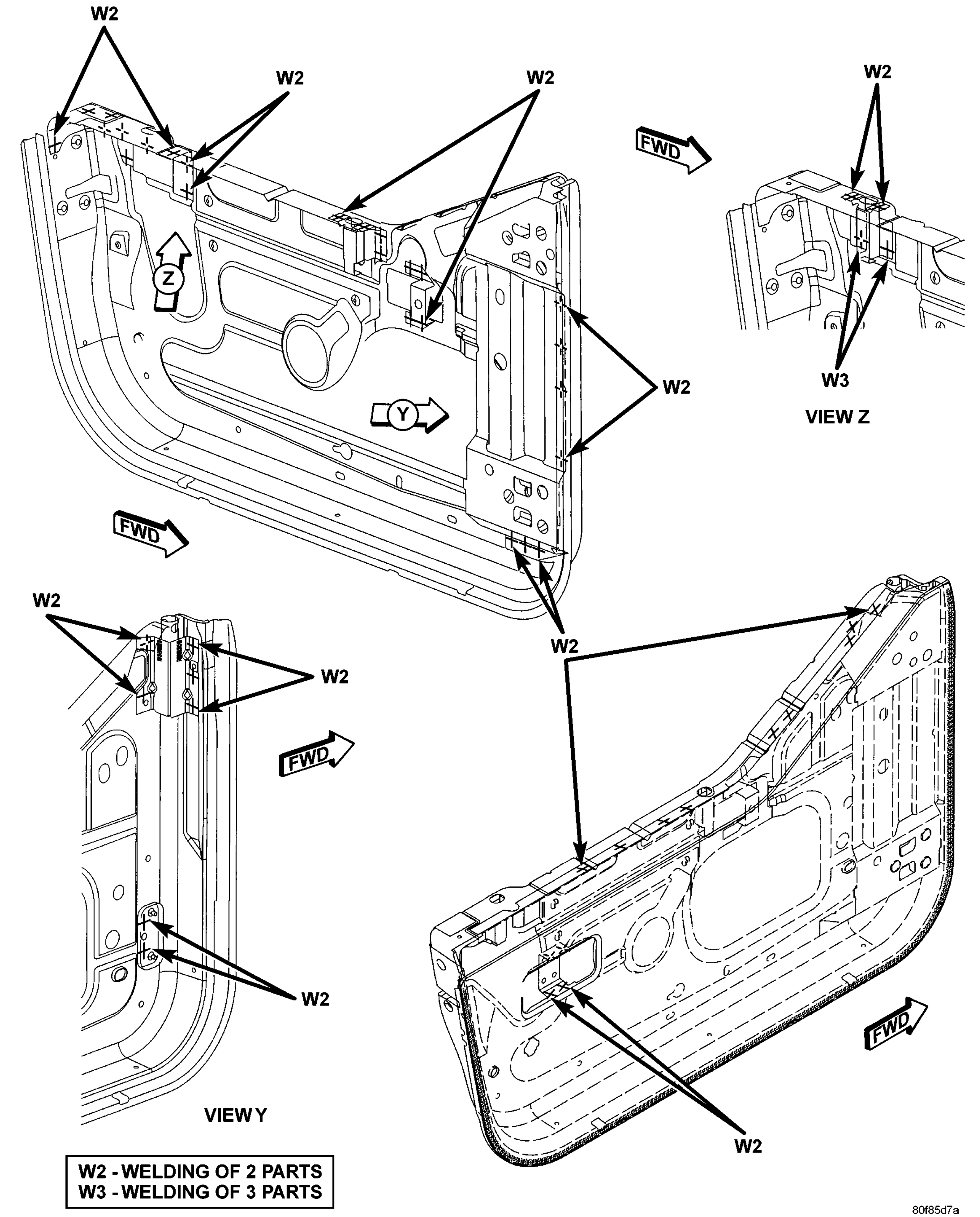

Fig. 59 HALF DOOR ASSEMBLY

WELD LOCATIONS (Continued)

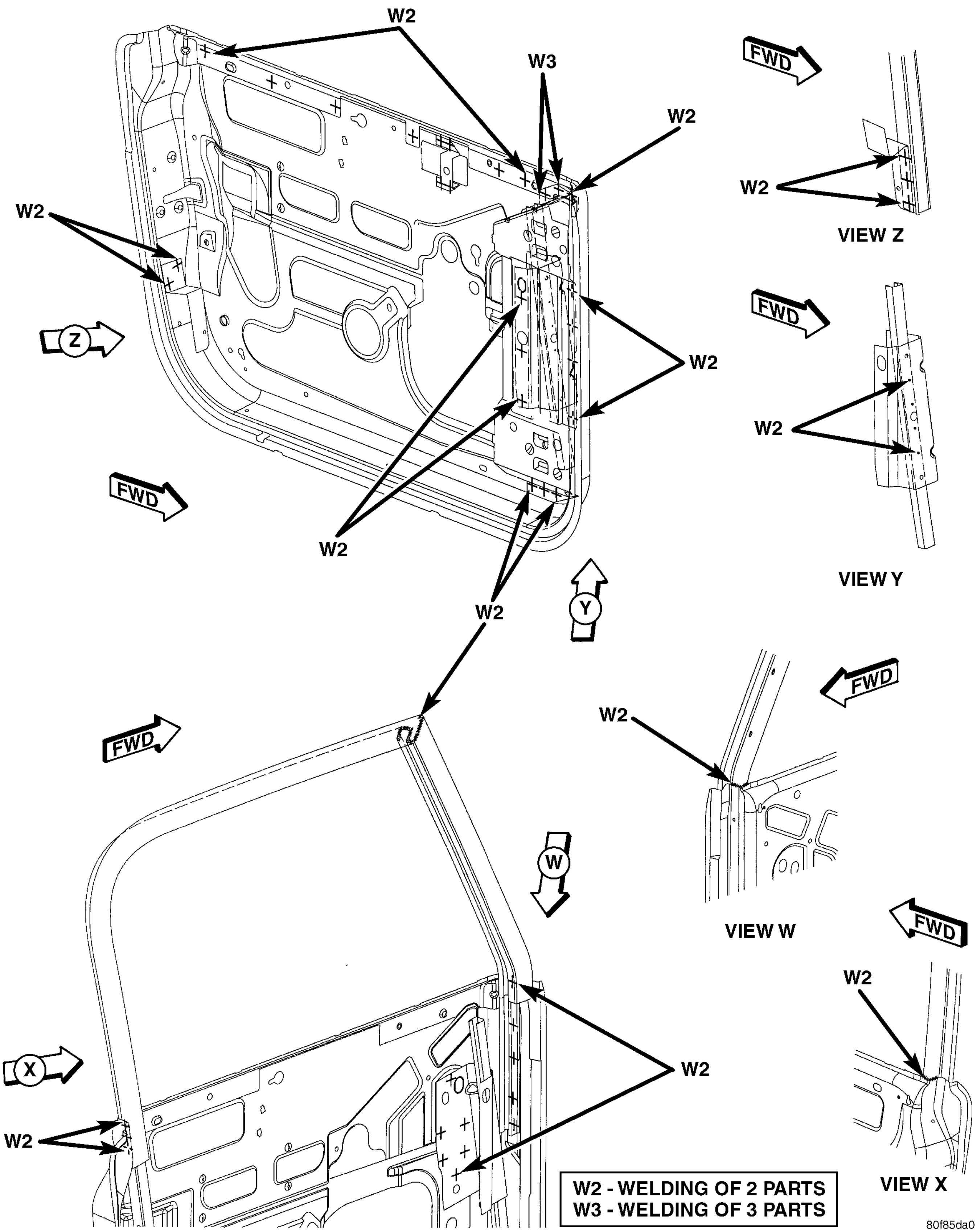

Fig. 60 FULL DOOR ASSEMBLY (1 OF 2)

WELD LOCATIONS (Continued)

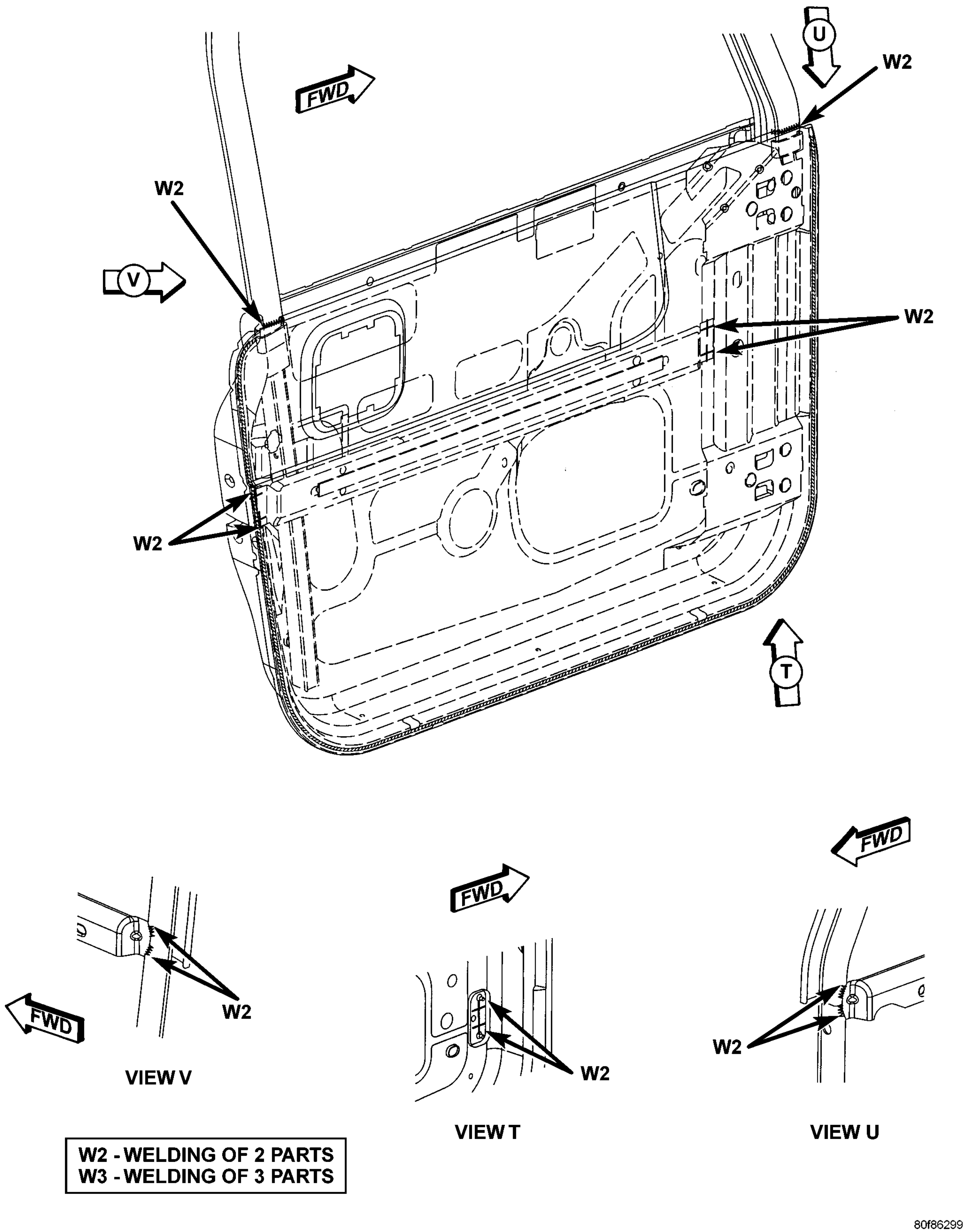

Fig. 61 FULL DOOR ASSEMBLY (2 OF 2)

WELD LOCATIONS (Continued)

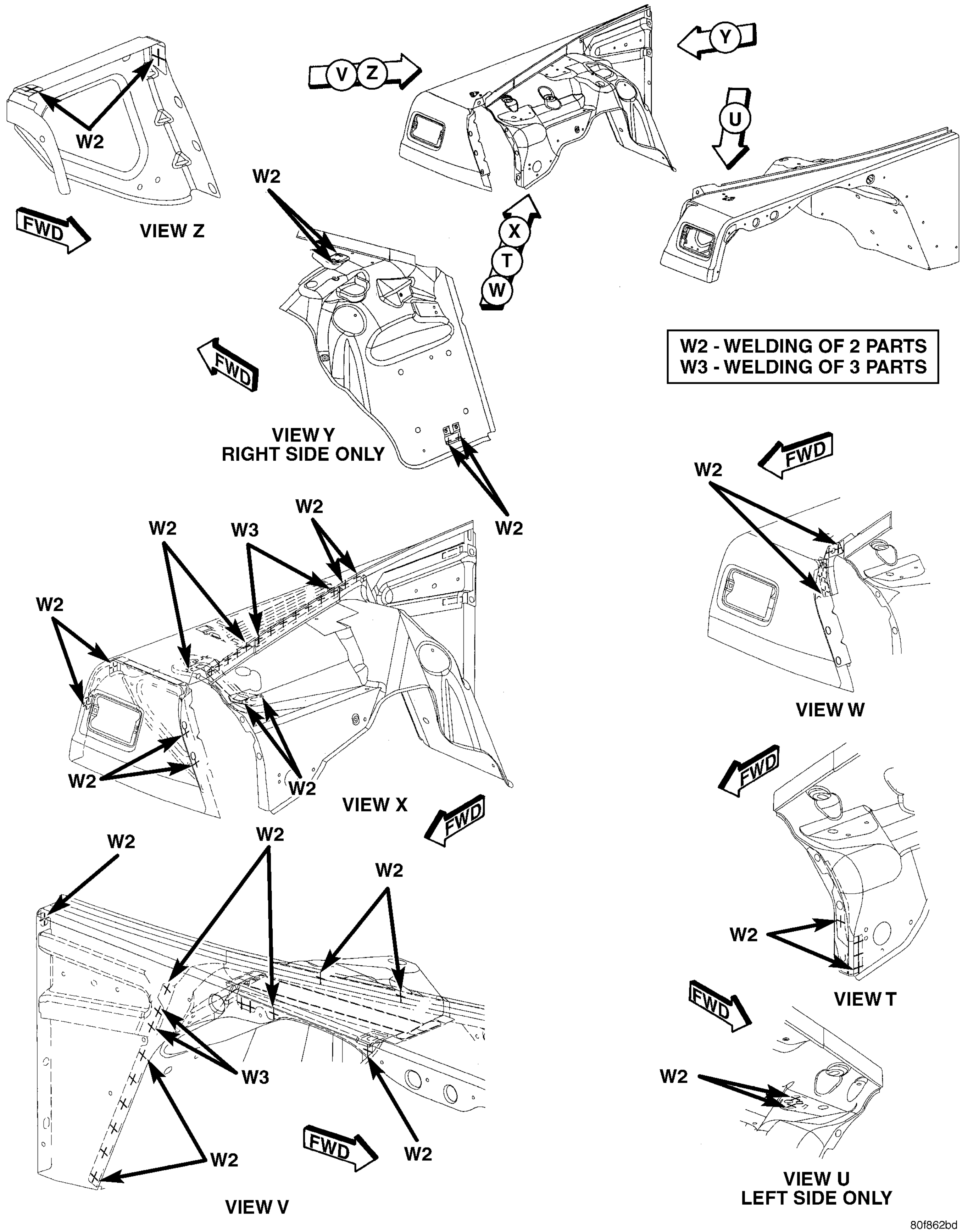

Fig. 62 FRONT FENDER ASSEMBLY

WELD LOCATIONS (Continued)

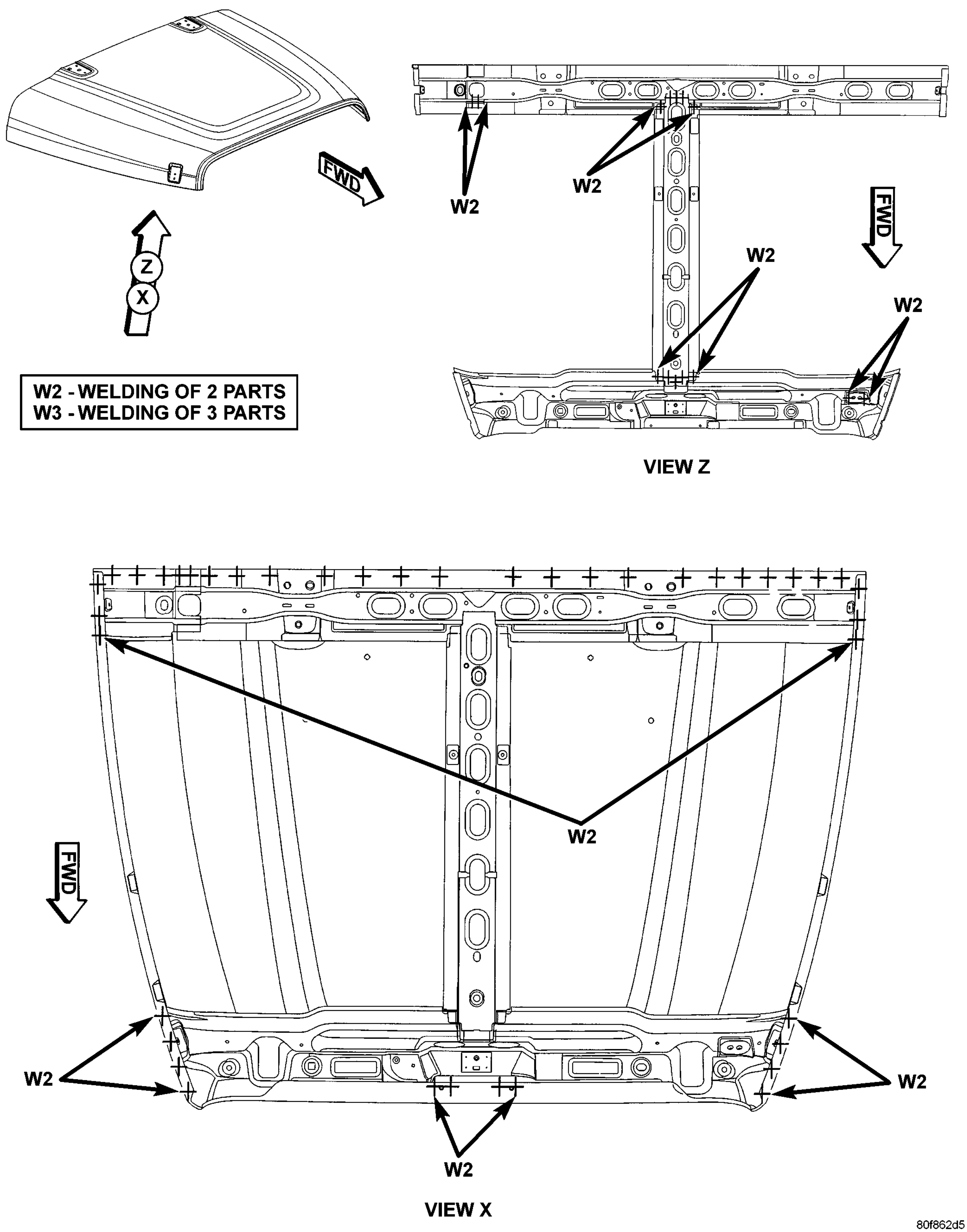

Fig. 63 HOOD ASSEMBLY

WELD LOCATIONS (Continued)

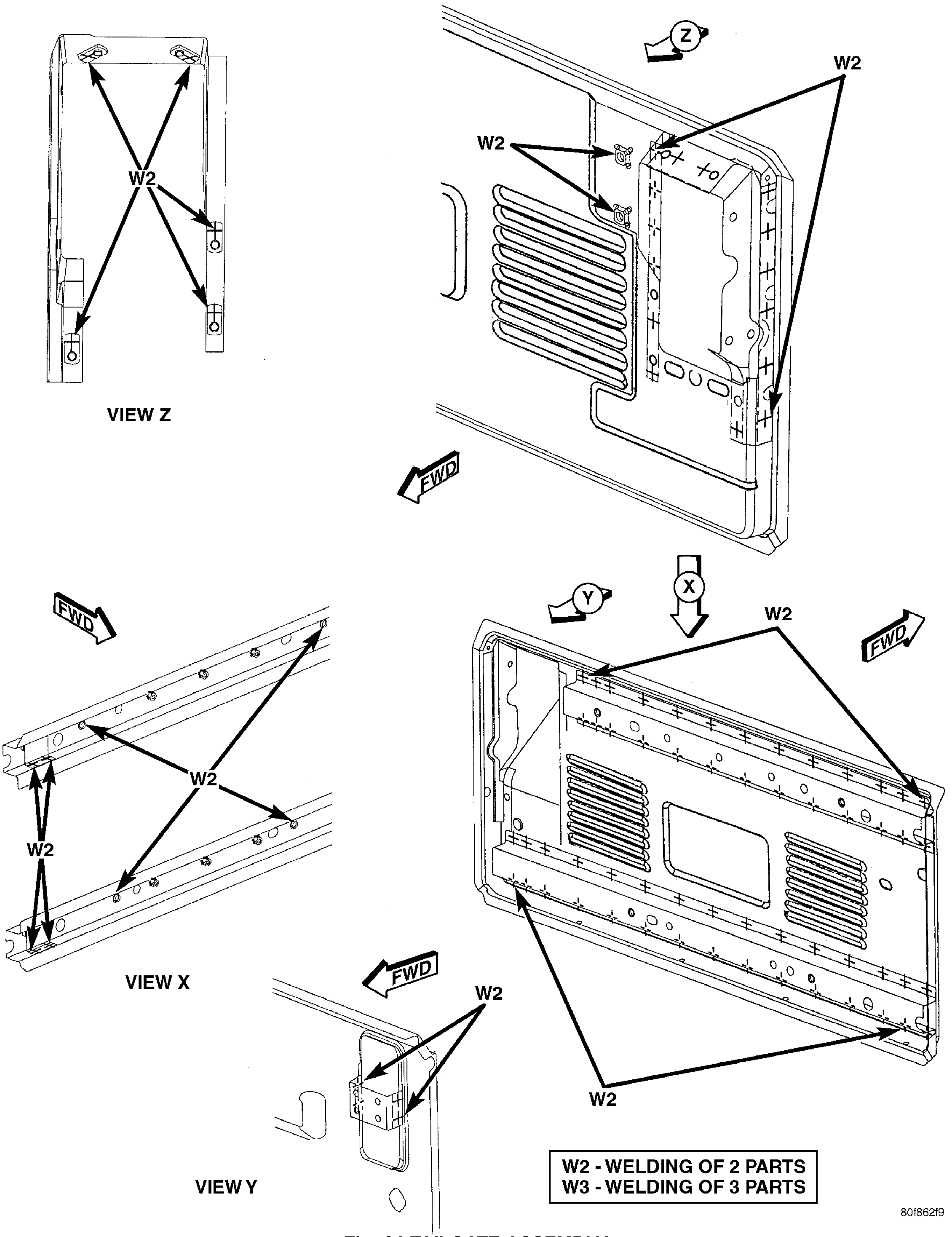

Fig. 64 TAILGATE ASSEMBLY

WELD LOCATIONS (Continued)

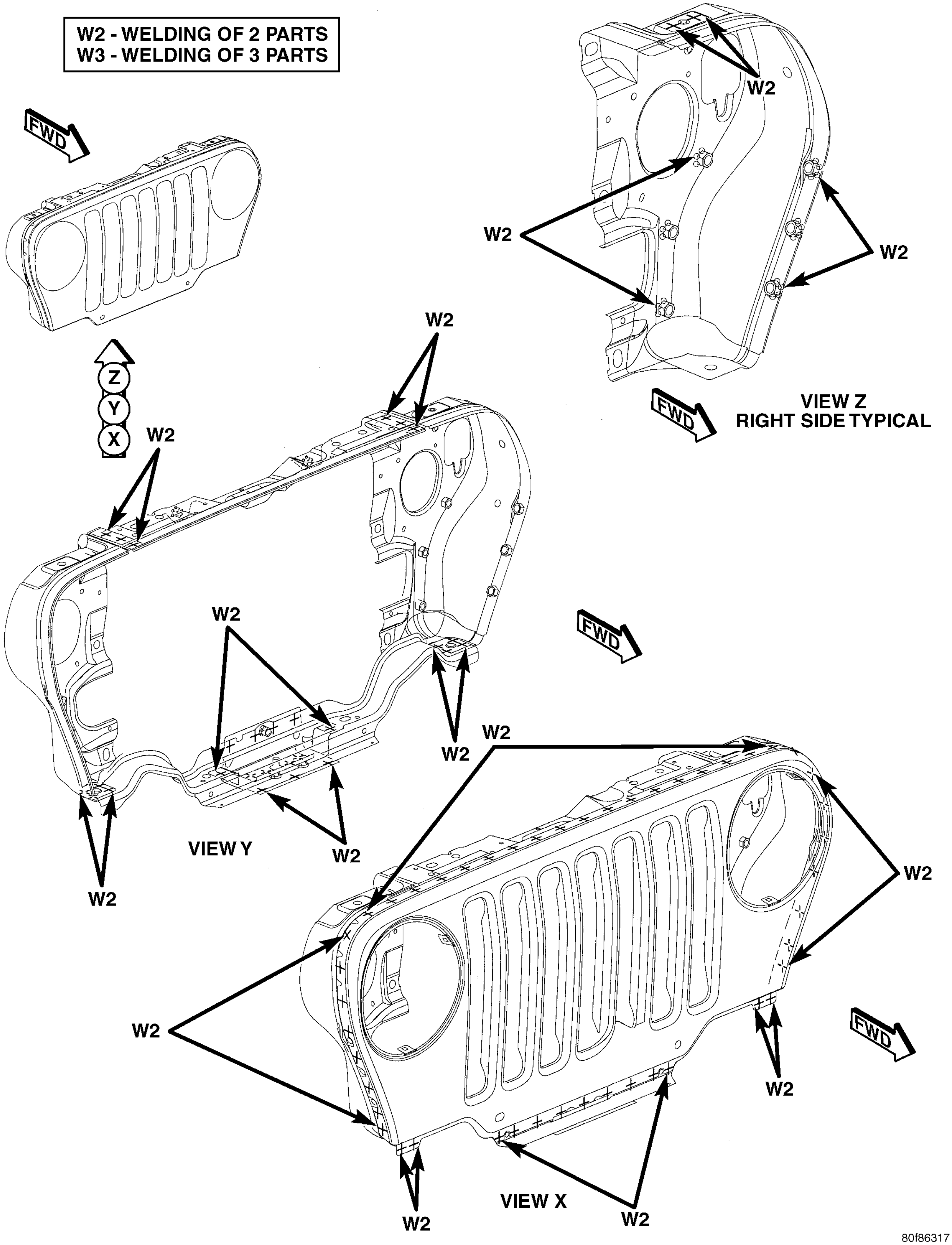

Fig. 65 RADIATOR GUARD ASSEMBLY

WELD LOCATIONS (Continued)

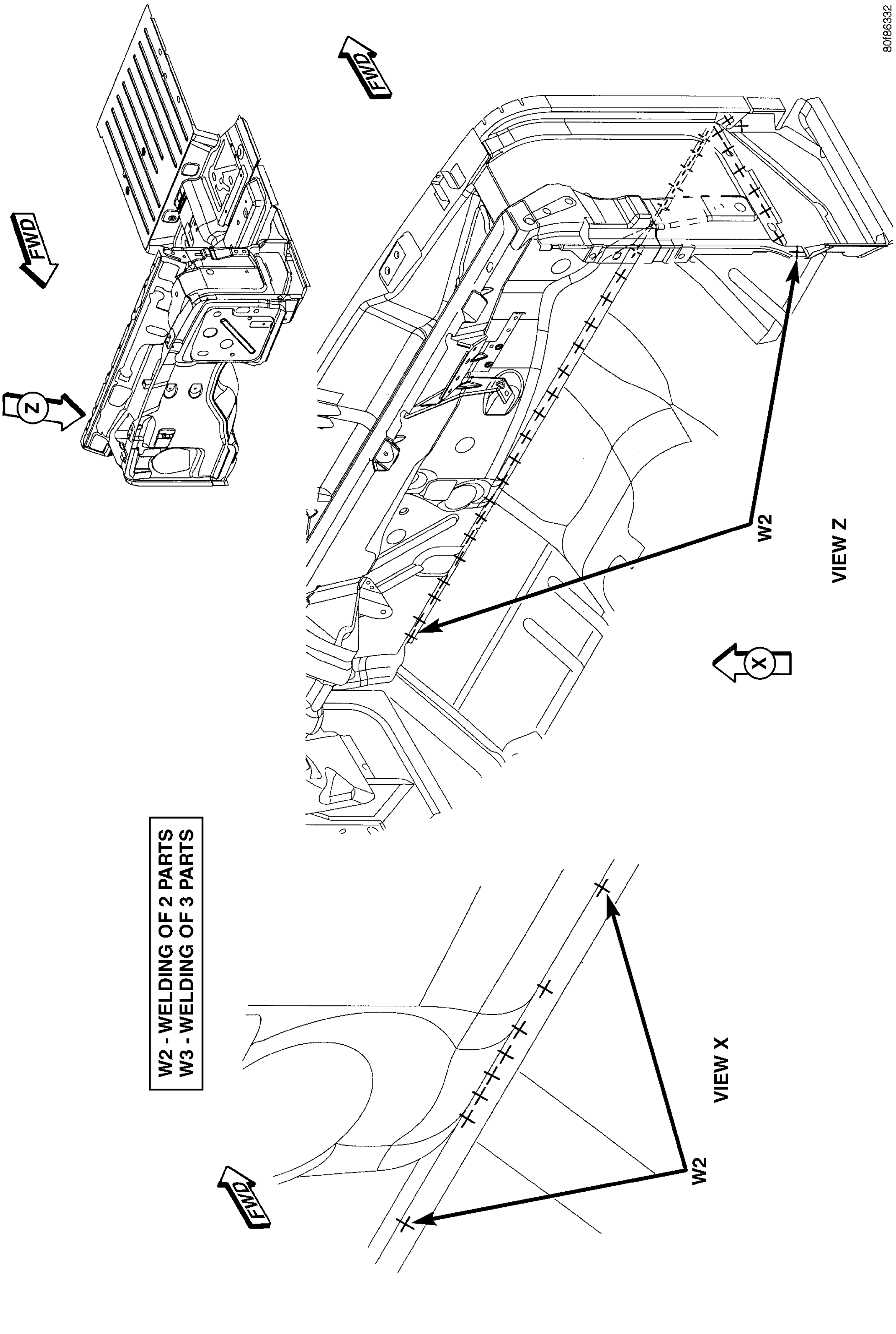

Fig. 66 DASH, COWL AND FLOOR ASSEMBLY - LEFT HAND DRIVE

WELD LOCATIONS (Continued)

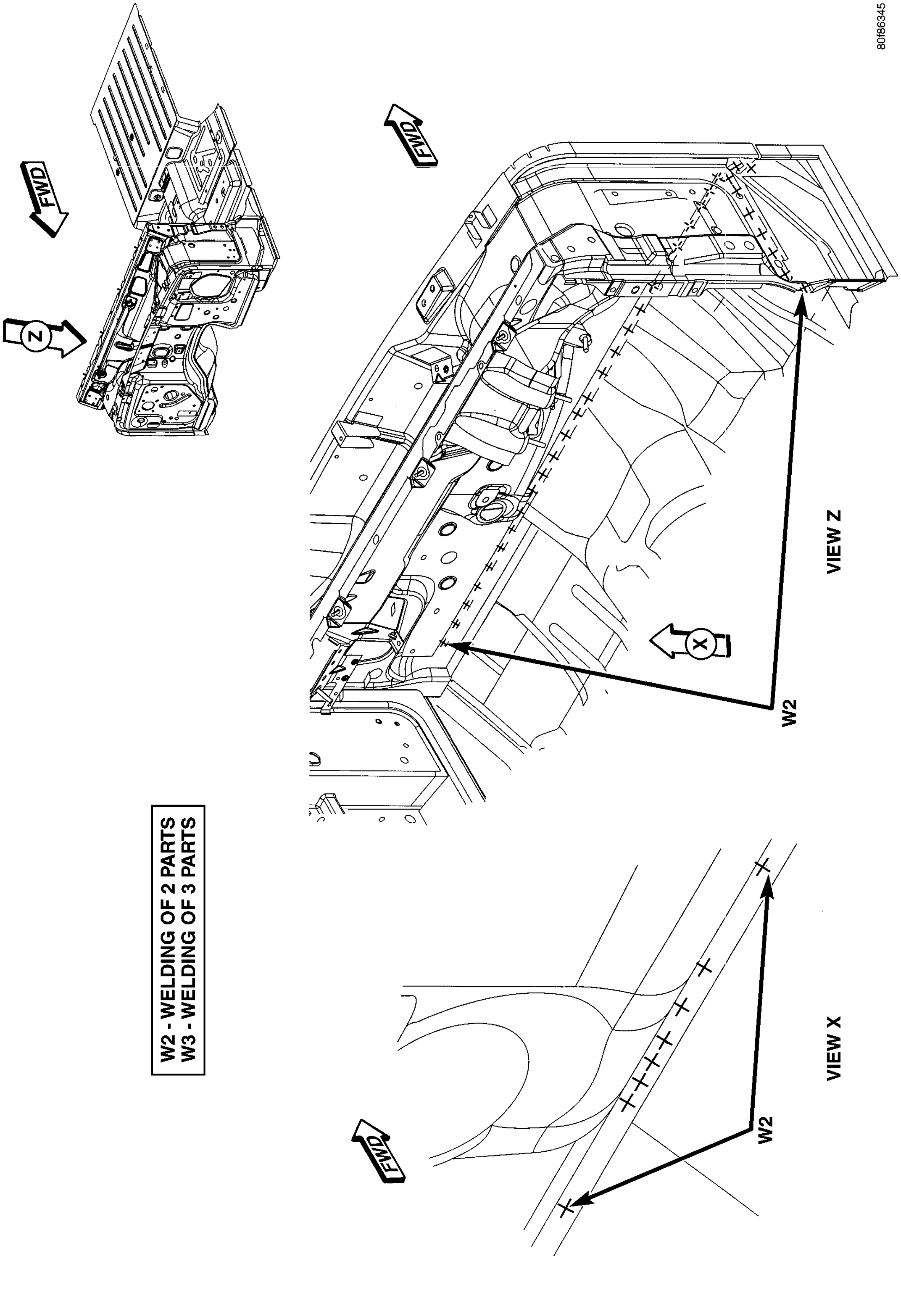

Fig. 67 DASH, COWL AND FLOOR ASSEMBLY - RIGHT HAND DRIVE

WELD LOCATIONS (Continued)

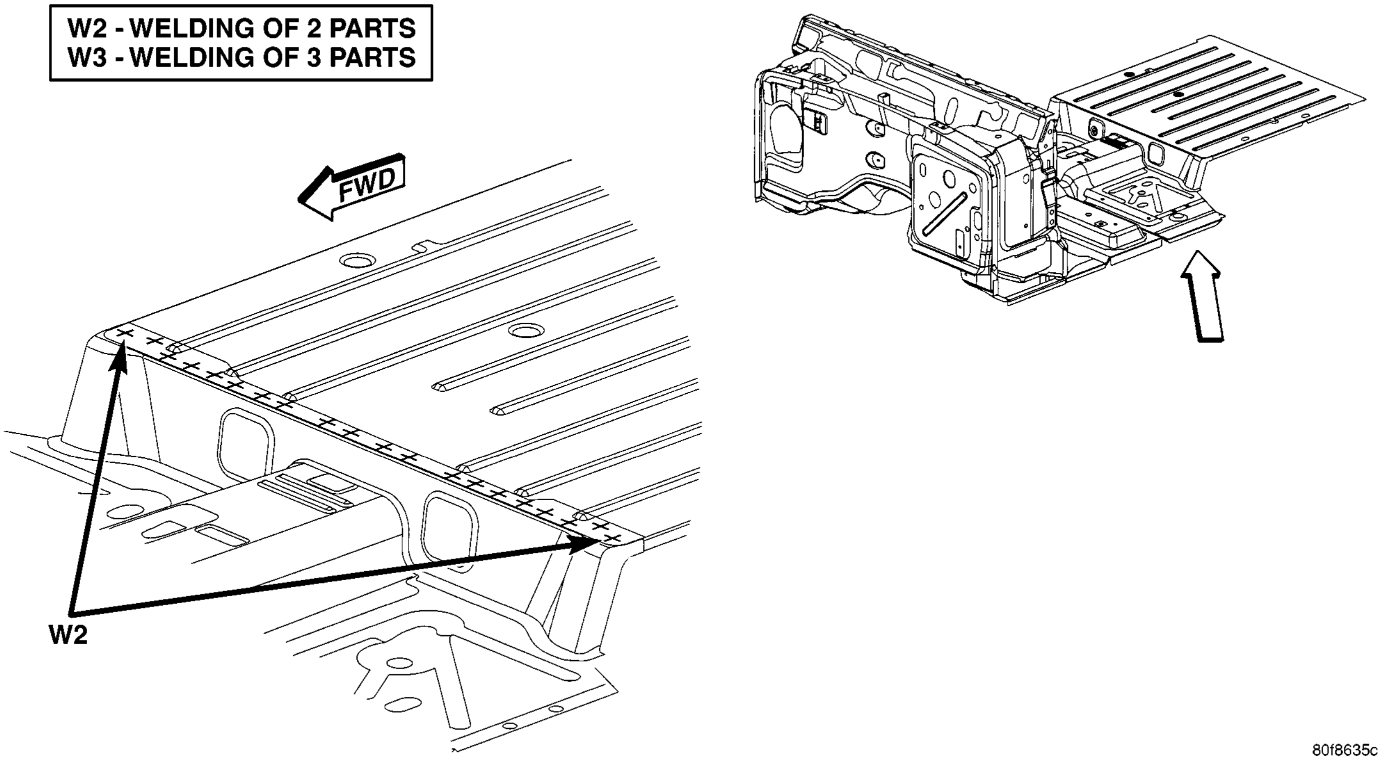

Fig. 68 FRONT AND REAR FLOOR PAN

WELD LOCATIONS (Continued)

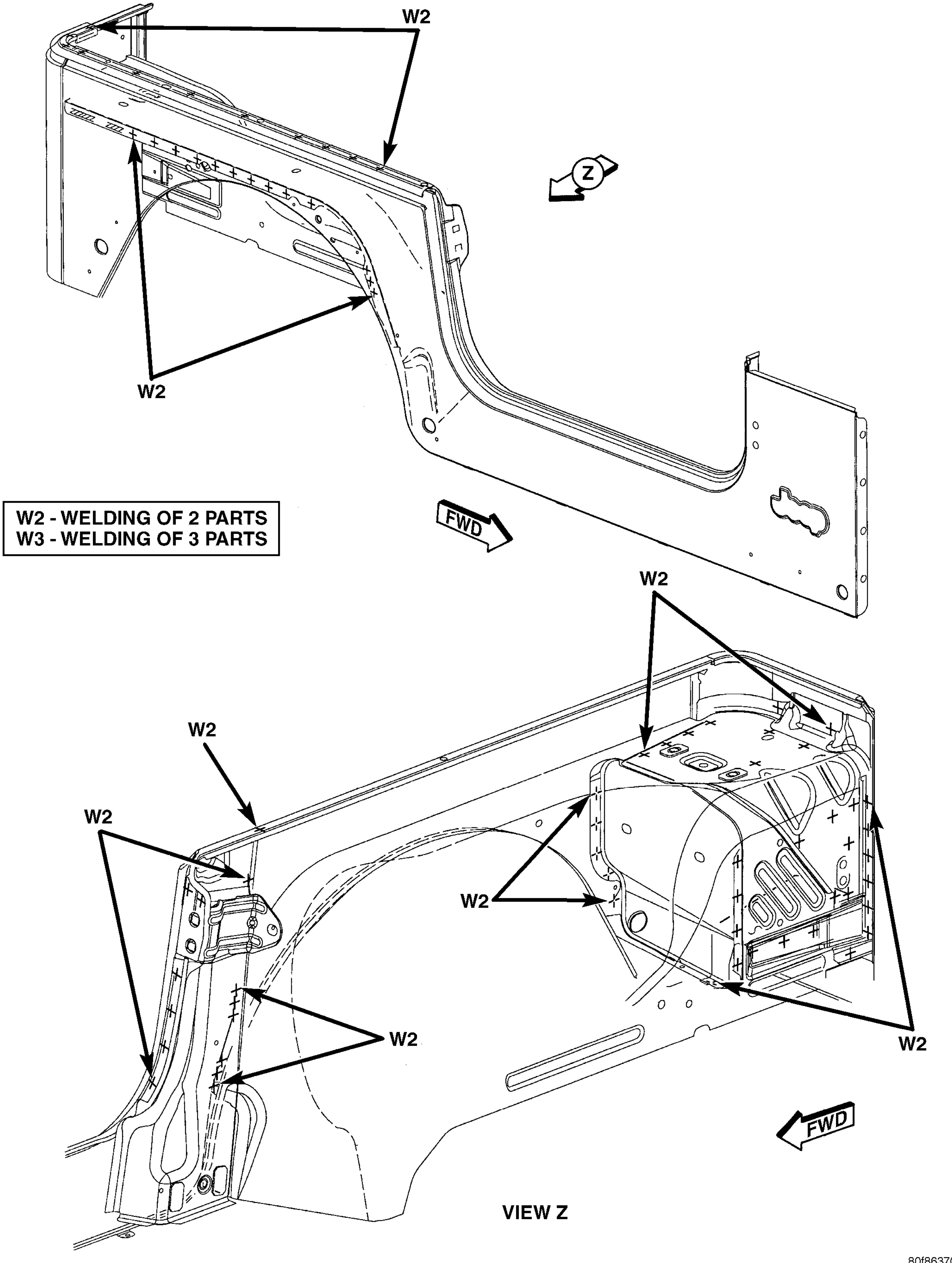

Fig. 69 BODY SIDE (1 OF 2)

WELD LOCATIONS (Continued)

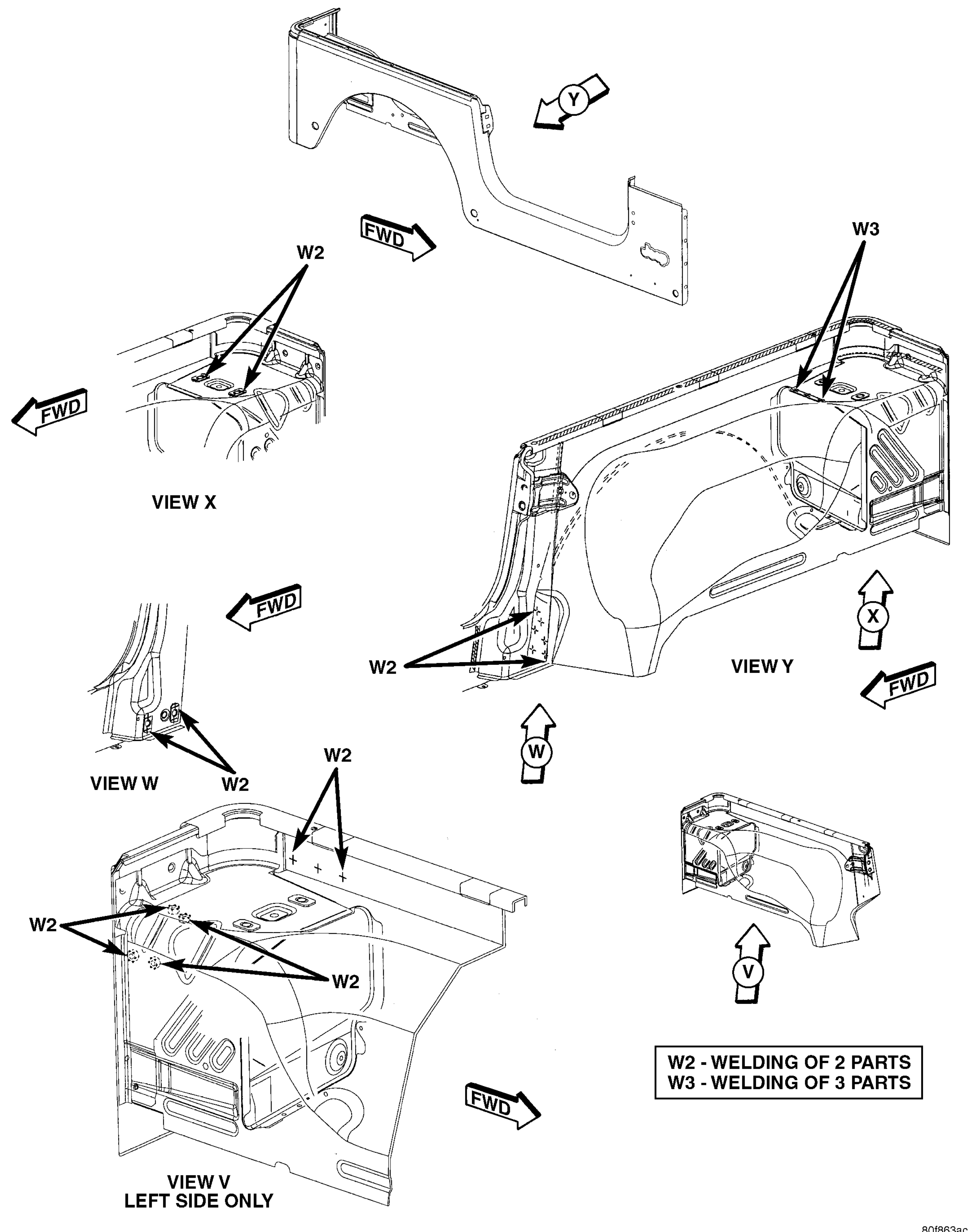

Fig. 70 BODY SIDE (2 OF 2)

WELD LOCATIONS (Continued)

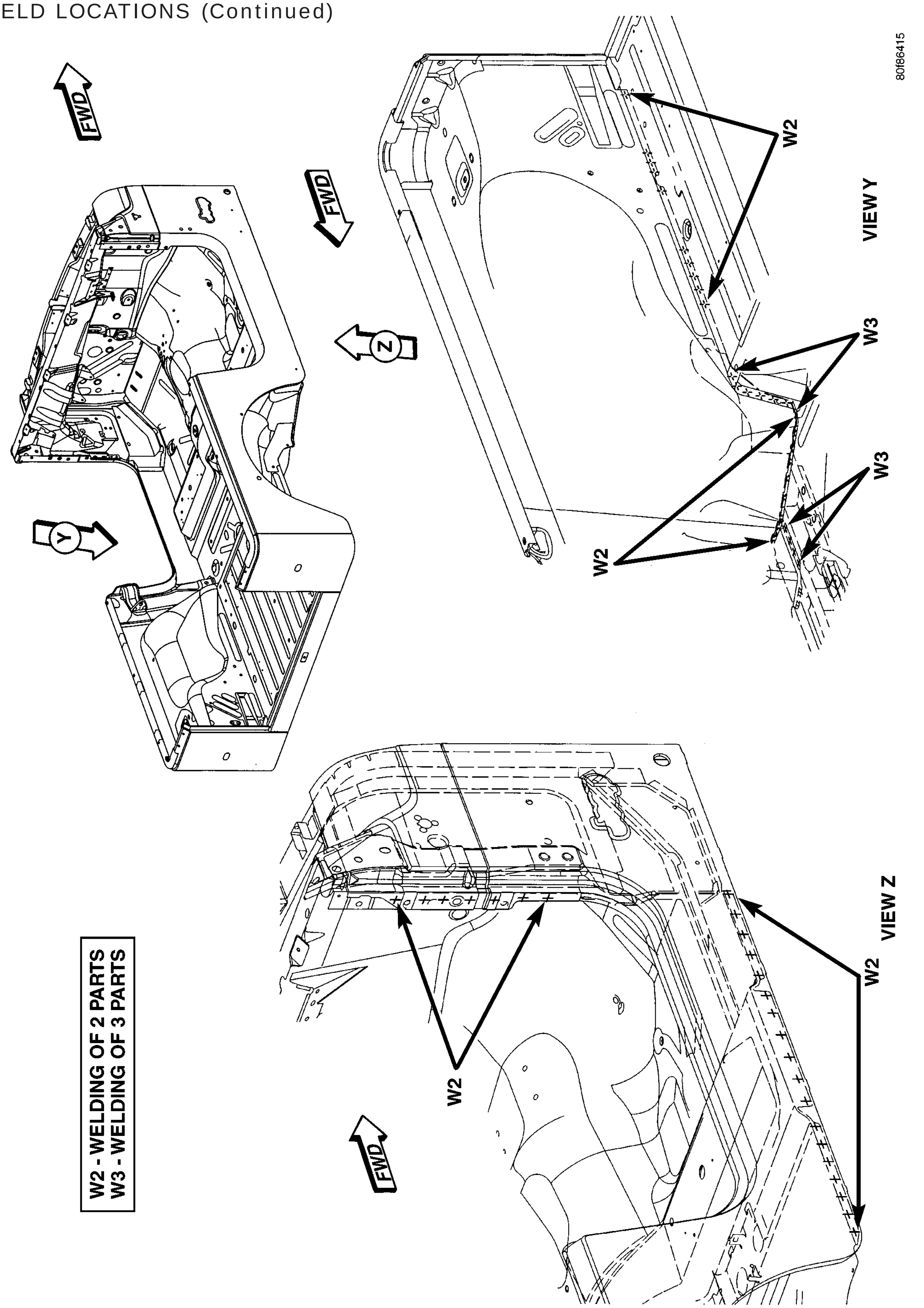

Fig. 71 BODY COMPLETE (1 OF 4)

WELD LOCATIONS (Continued)

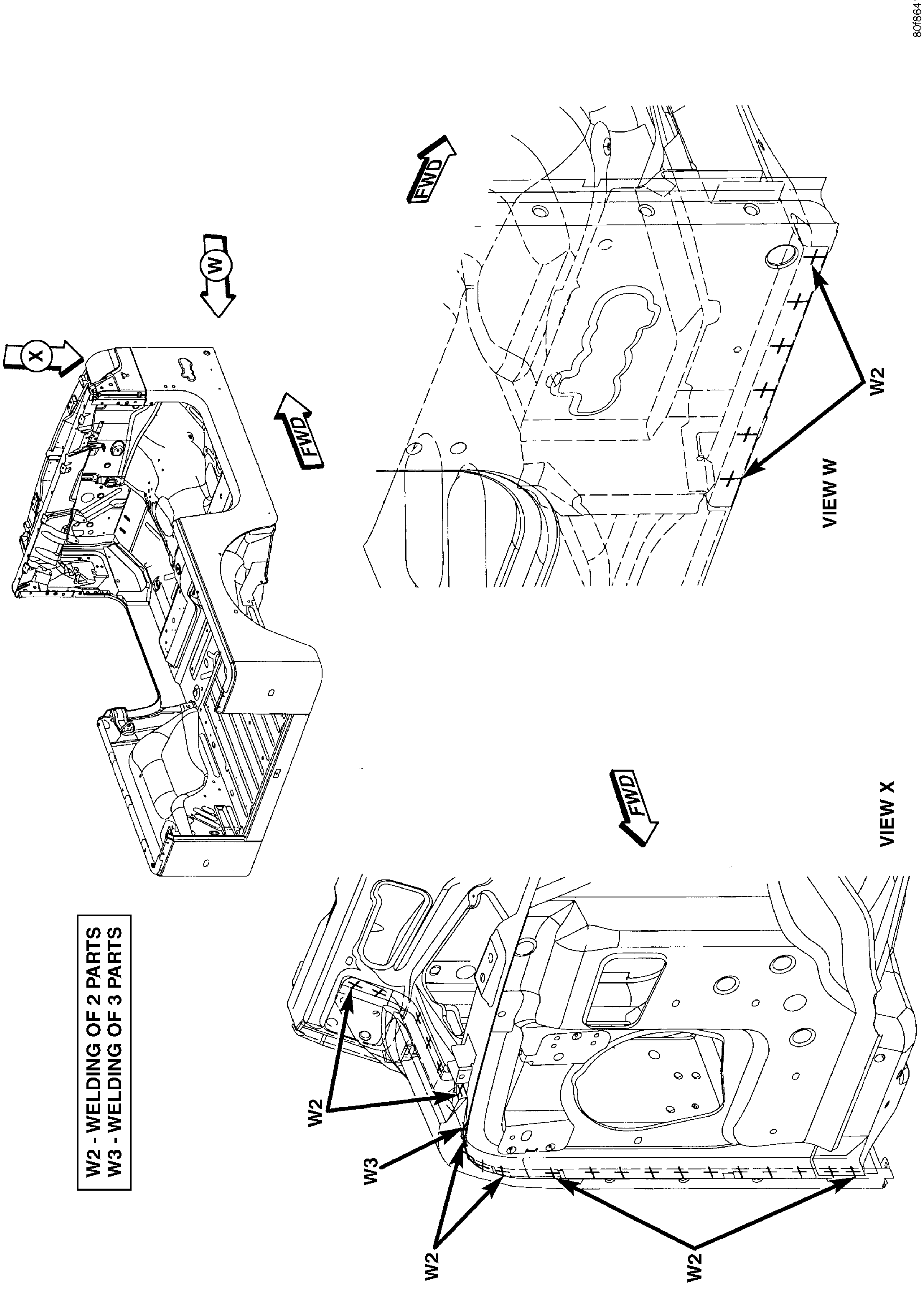

Fig. 72 BODY COMPLETE (2 OF 4)

WELD LOCATIONS (Continued)

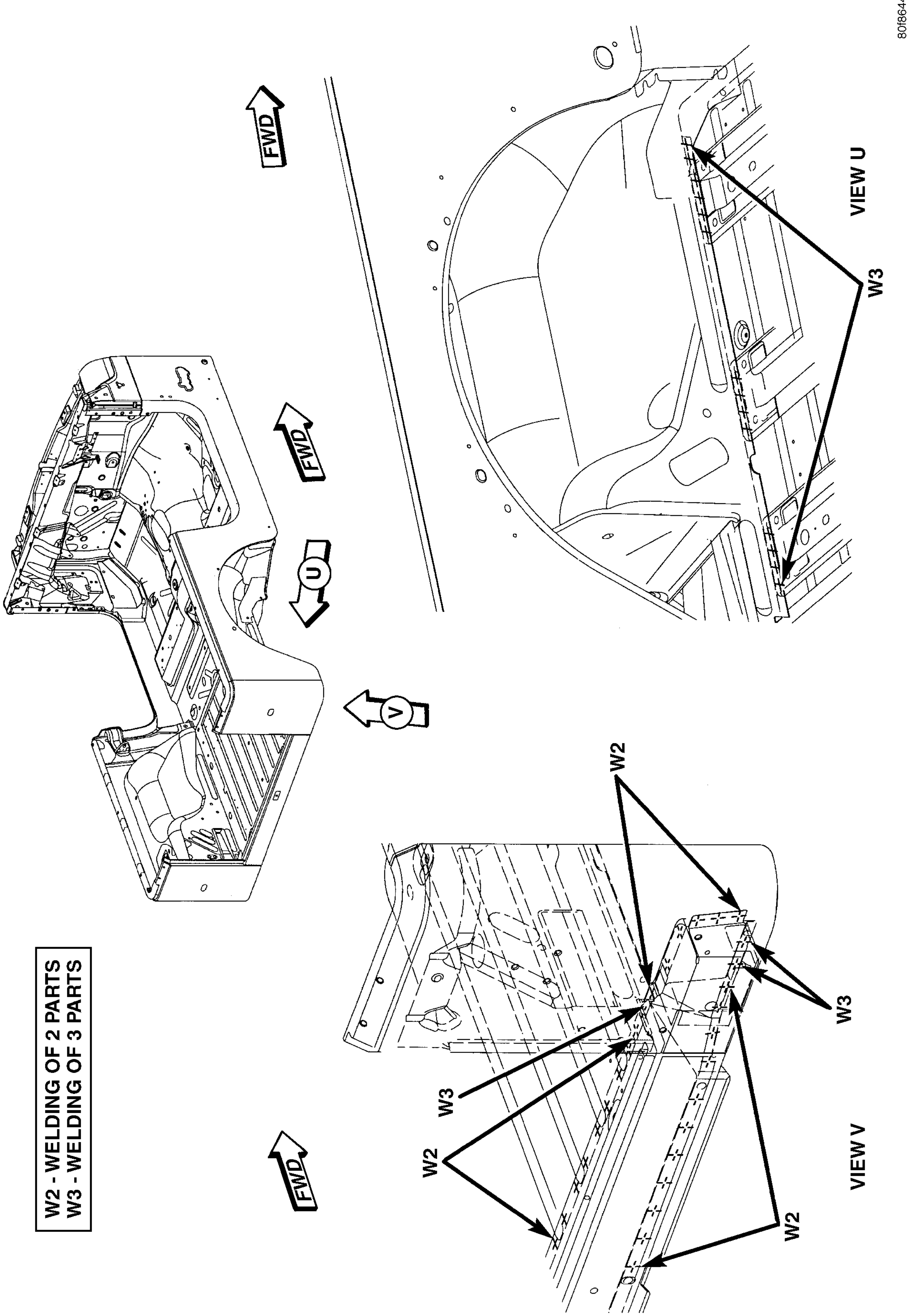

Fig. 73 BODY COMPLETE (3 OF 4)

WELD LOCATIONS (Continued)

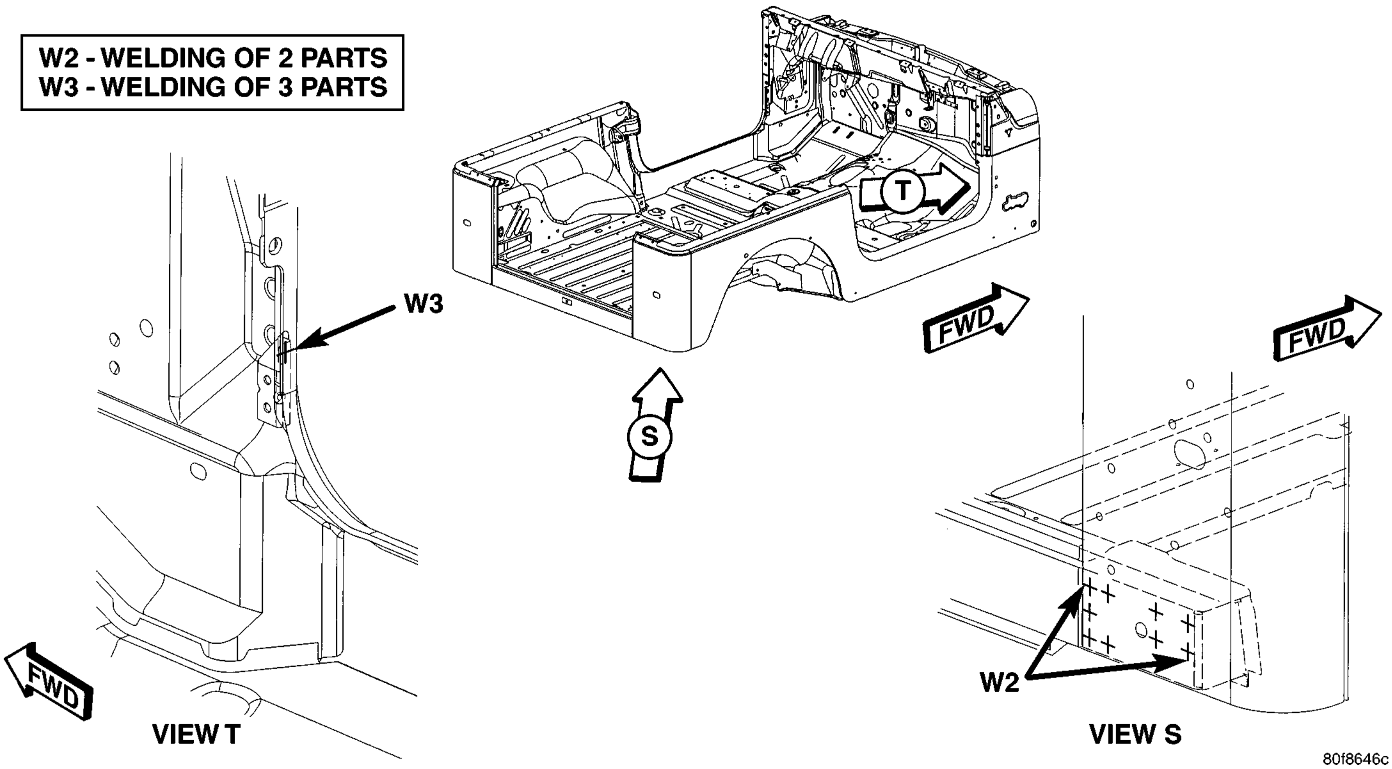

Fig. 74 BODY COMPLETE (4 OF 4)

WELD LOCATIONS (Continued)

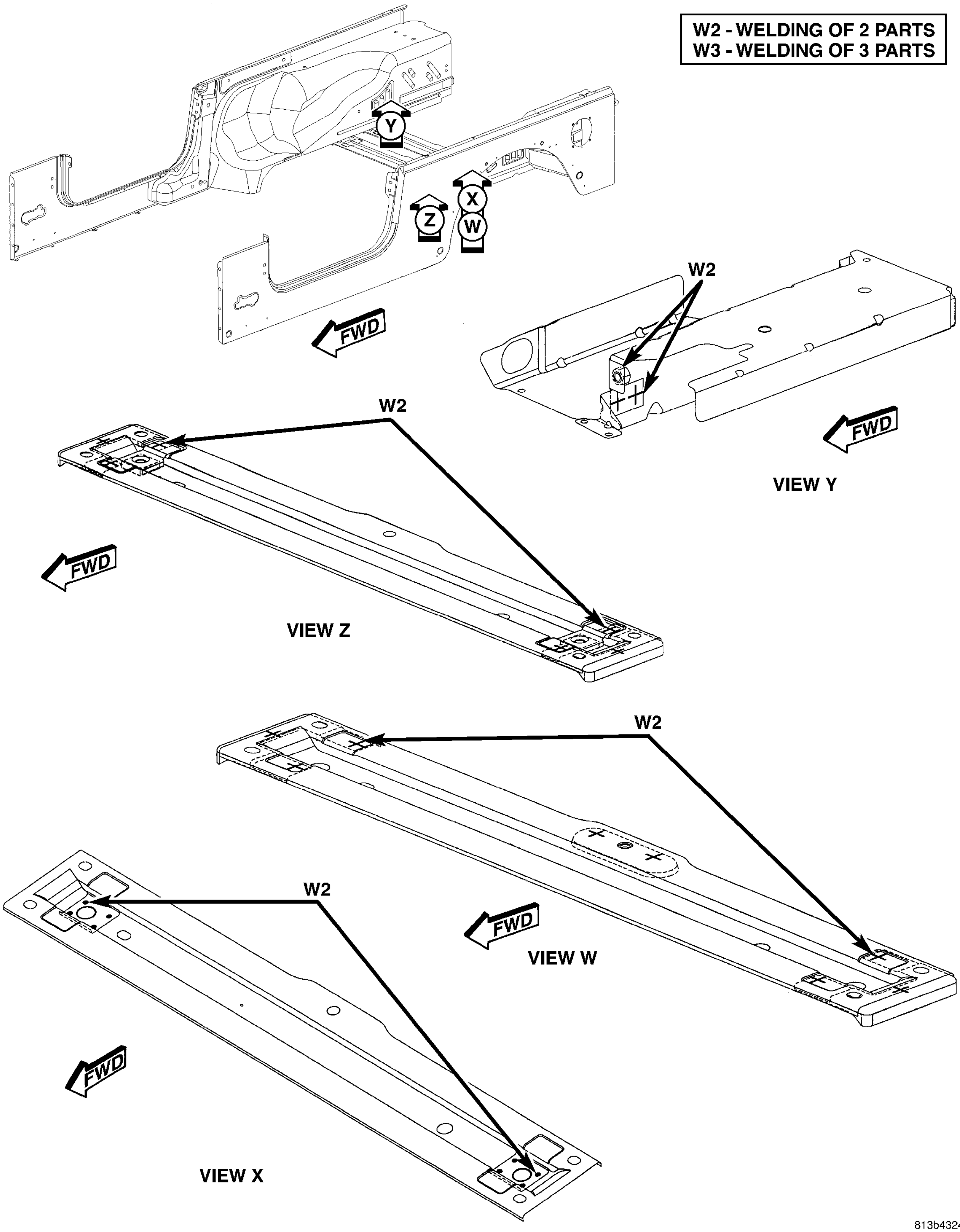

Fig. 75 BODY COMPLETE LONG WHEEL BASE (LWB) (1 OF 3)

WELD LOCATIONS (Continued)

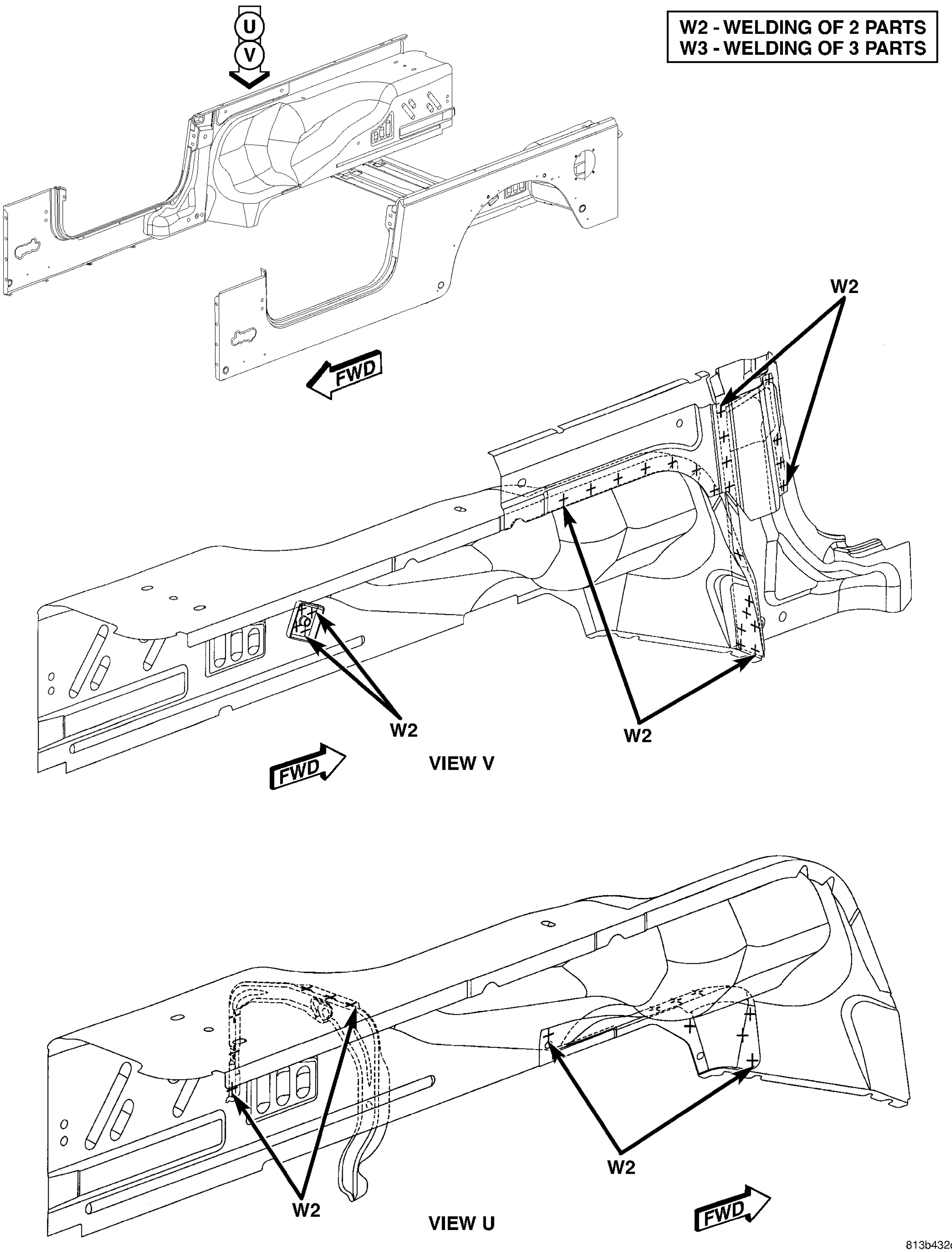

Fig. 76 BODY COMPLETE LWB (2 OF 3)

WELD LOCATIONS (Continued)

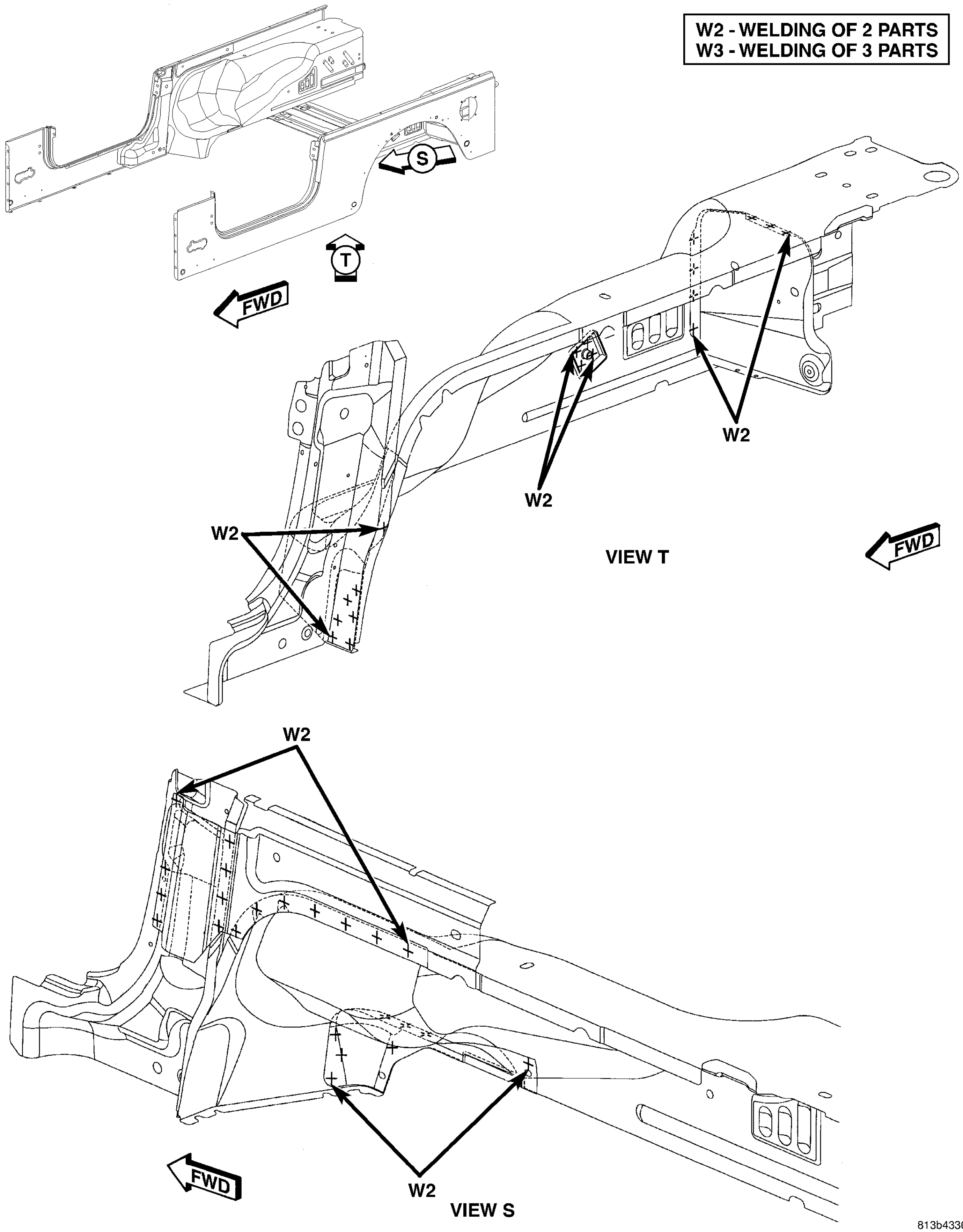

Fig. 77 BODY COMPLETE LWB (3 OF 3)

WELD LOCATIONS (Continued)

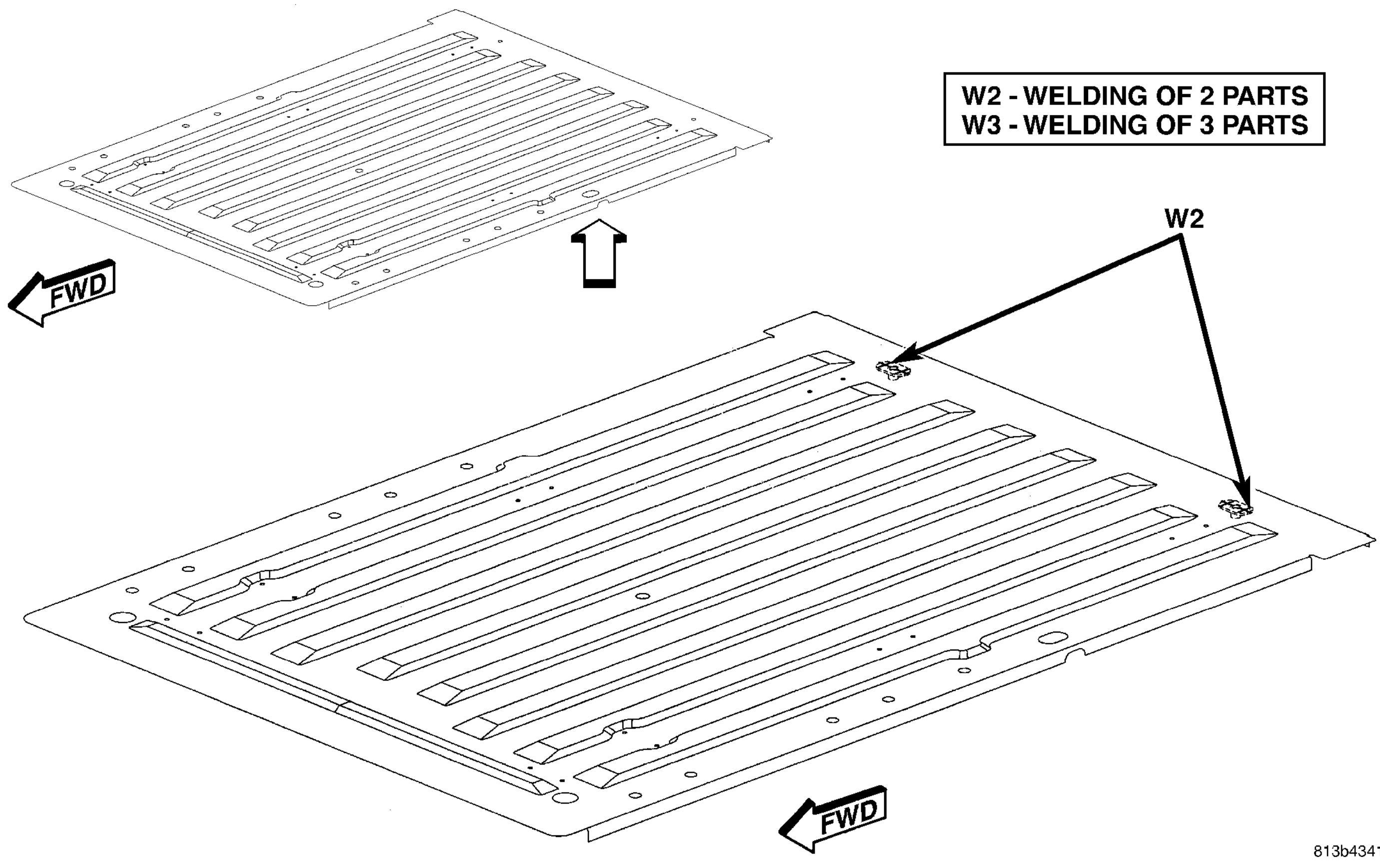

Fig. 78 REAR FLOOR LWB (1 OF 3)

WELD LOCATIONS (Continued)

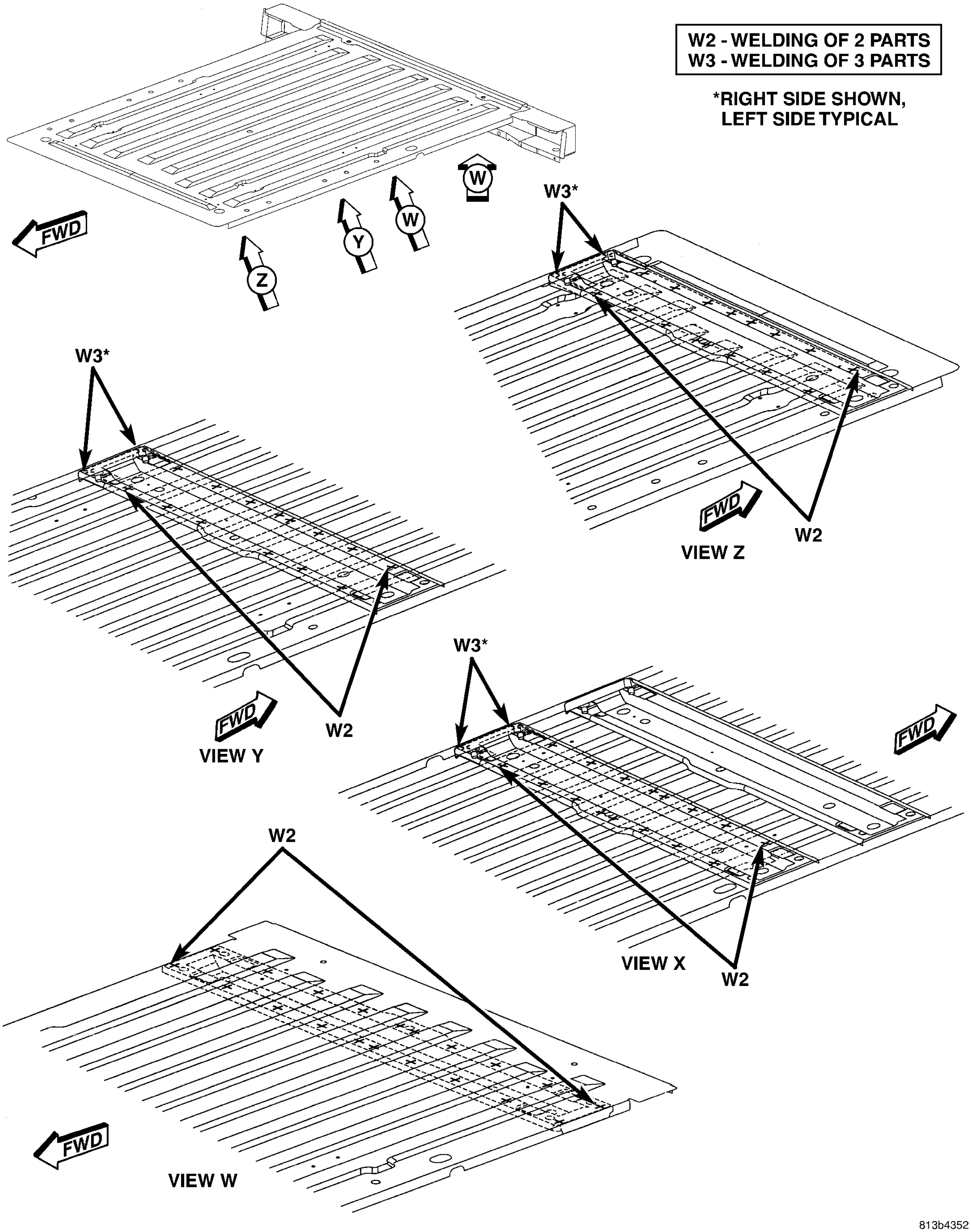

Fig. 79 REAR FLOOR LWB (2 OF 3)

WELD LOCATIONS (Continued)

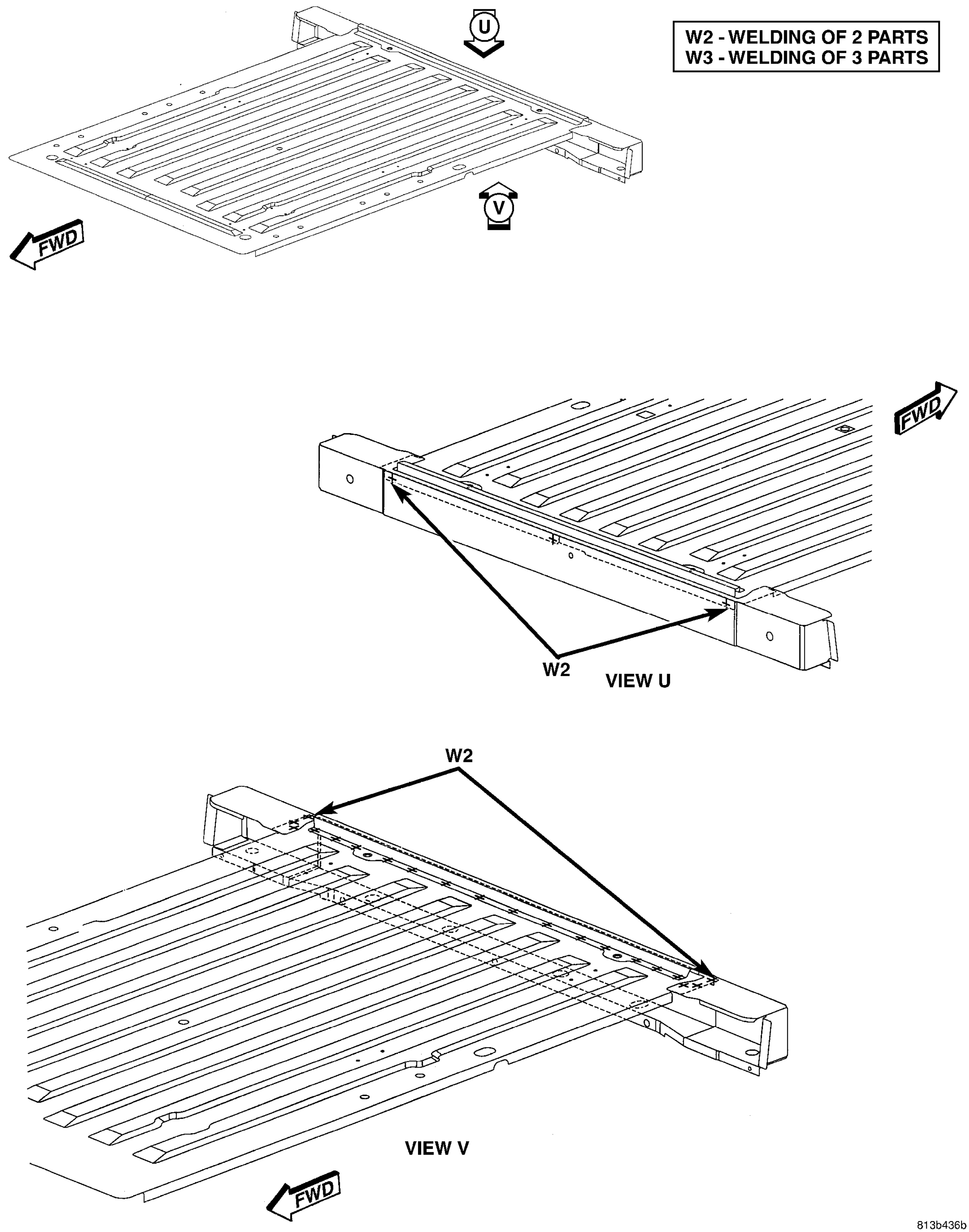

Fig. 80 REAR FLOOR LWB (3 OF 3)

WELD LOCATIONS (Continued)

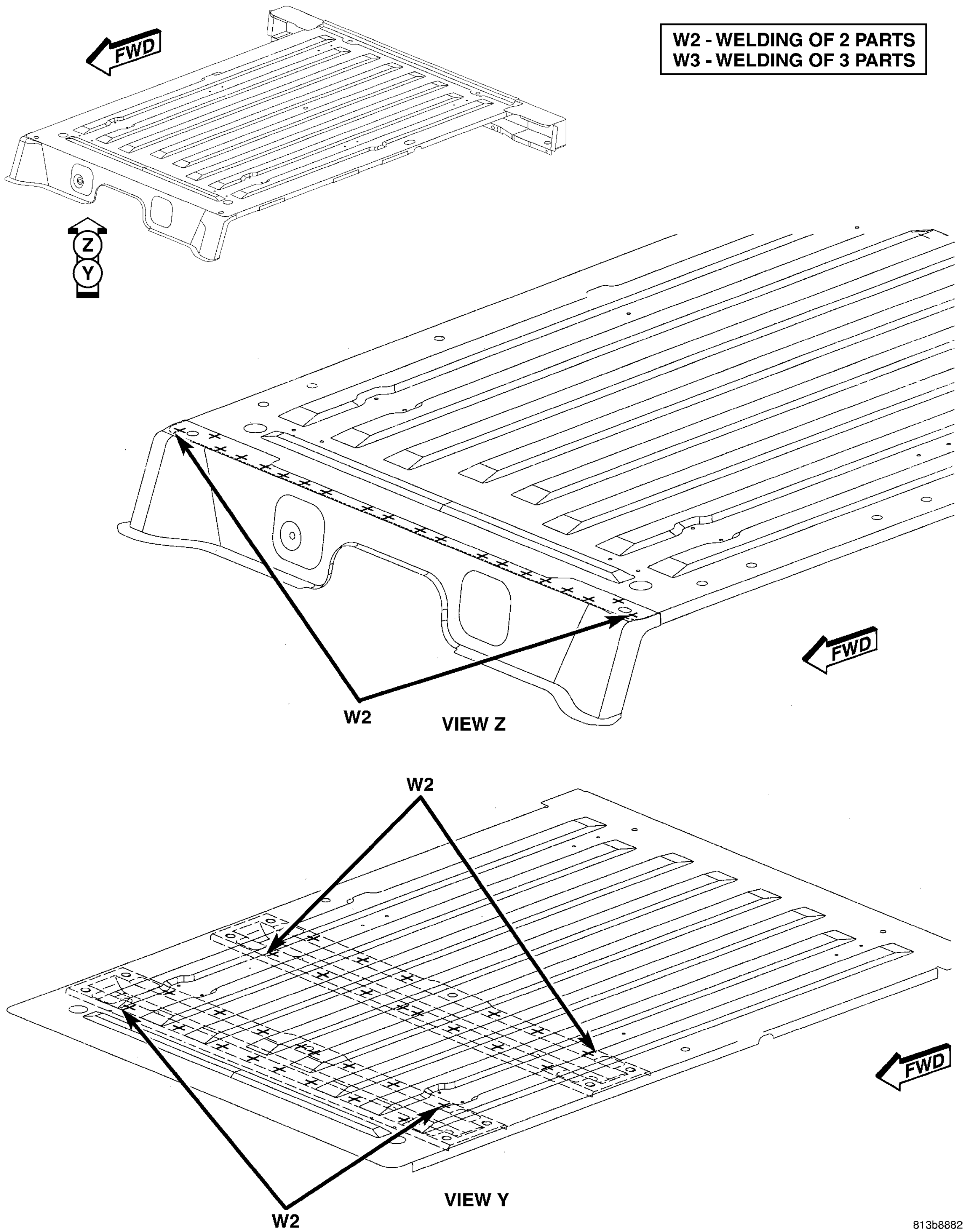

Fig. 81 UNDERBODY COMPLETE LWB (1 OF 3)

WELD LOCATIONS (Continued)

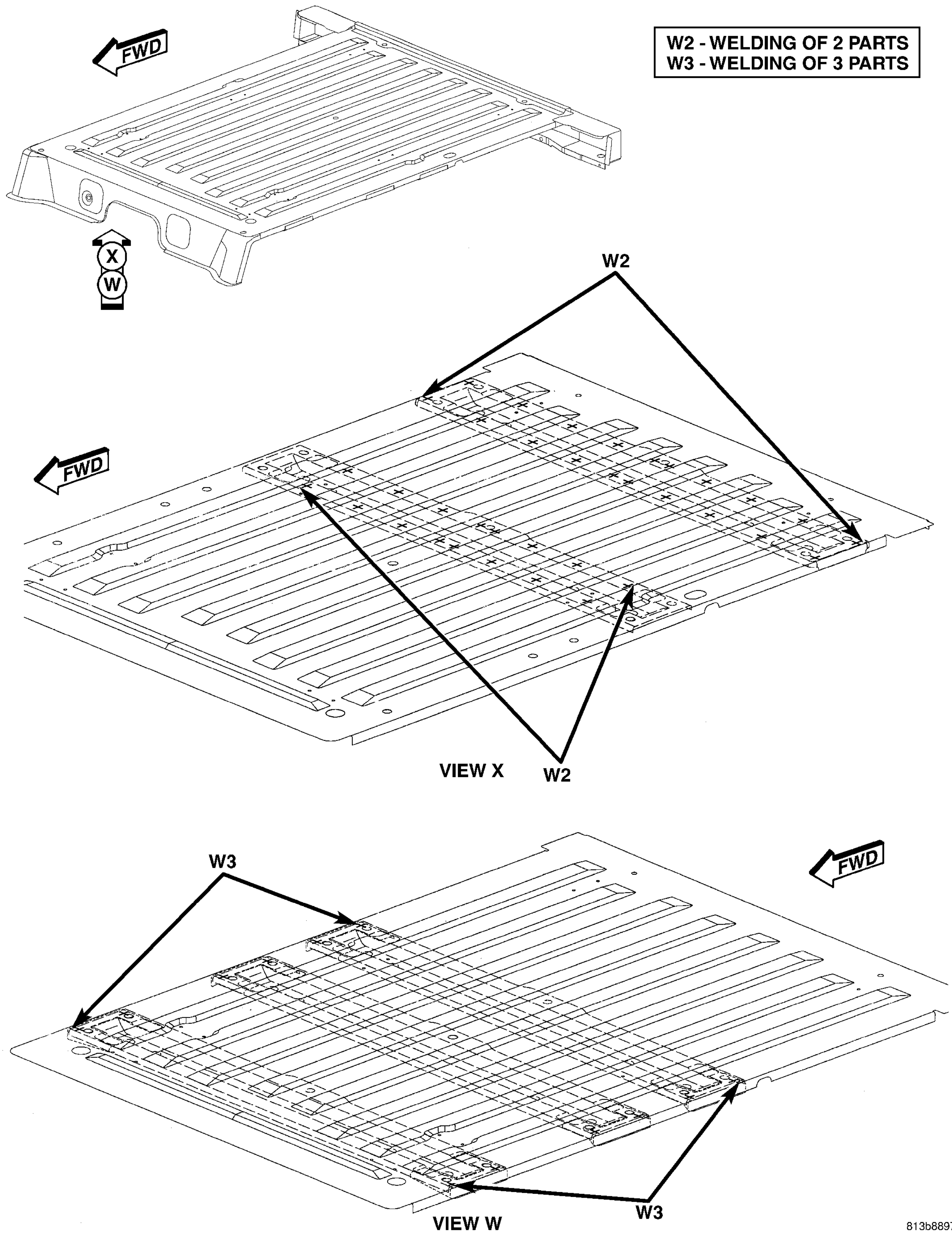

Fig. 82 UNDERBODY COMPLETE LWB (2 OF 3)

WELD LOCATIONS (Continued)

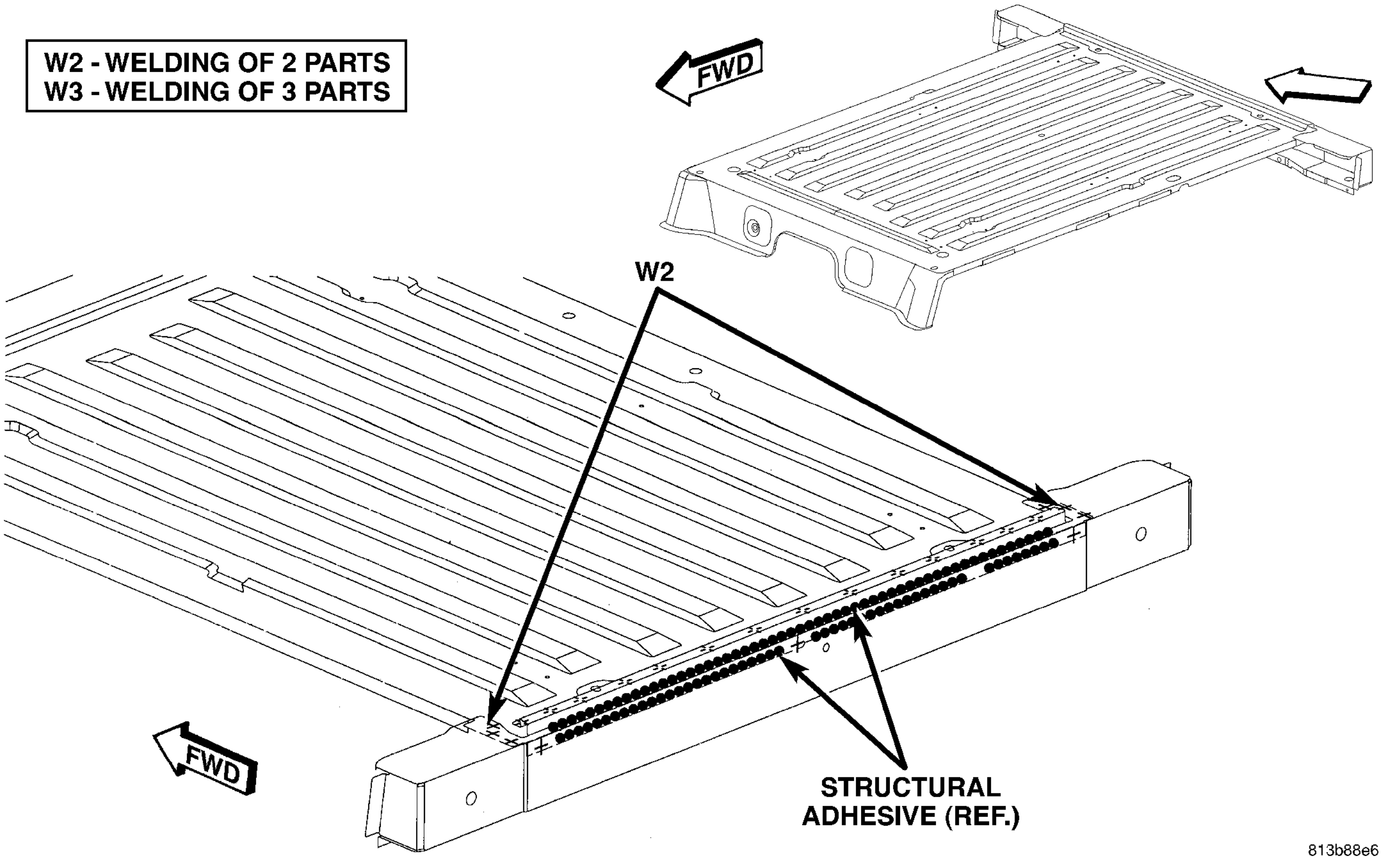

Fig. 83 UNDERBODY COMPLETE LWB (3 OF 3)

WELD LOCATIONS (Continued)

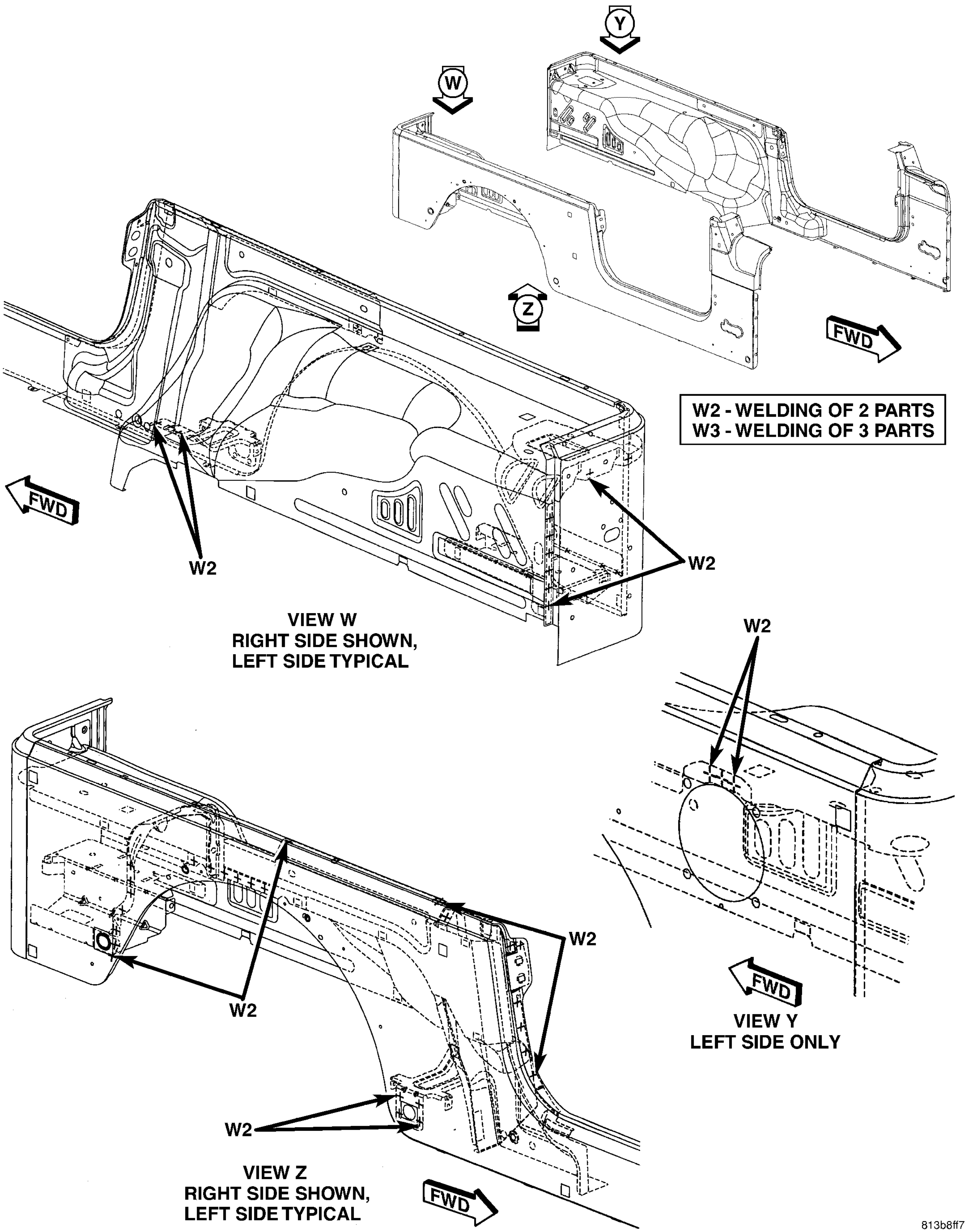

Fig. 84 BODY SIDE COMPLETE LWB (1 OF 2)

WELD LOCATIONS (Continued)

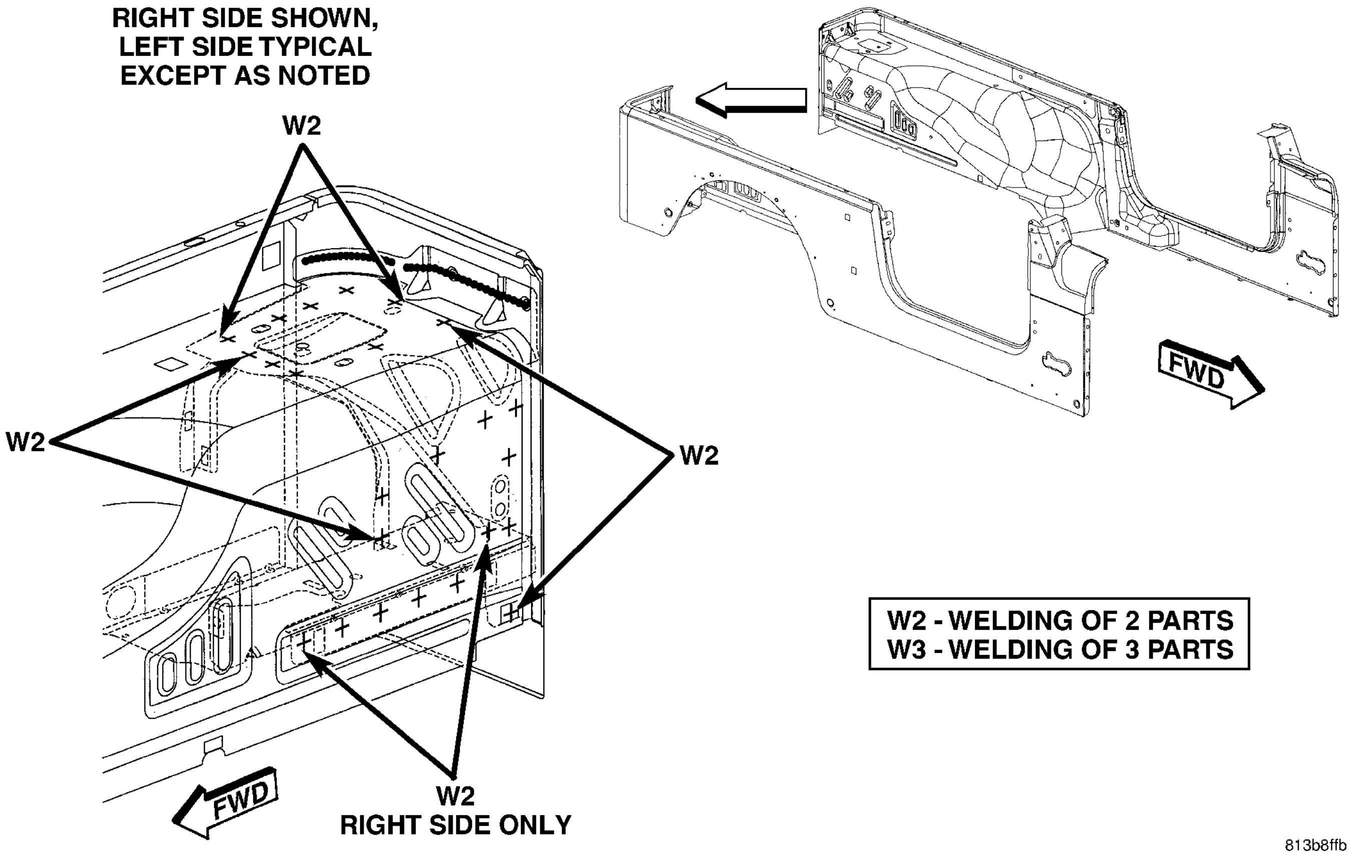

Fig. 85 BODY SIDE COMPLETE LWB (2 OF 2)

WELD LOCATIONS (Continued)

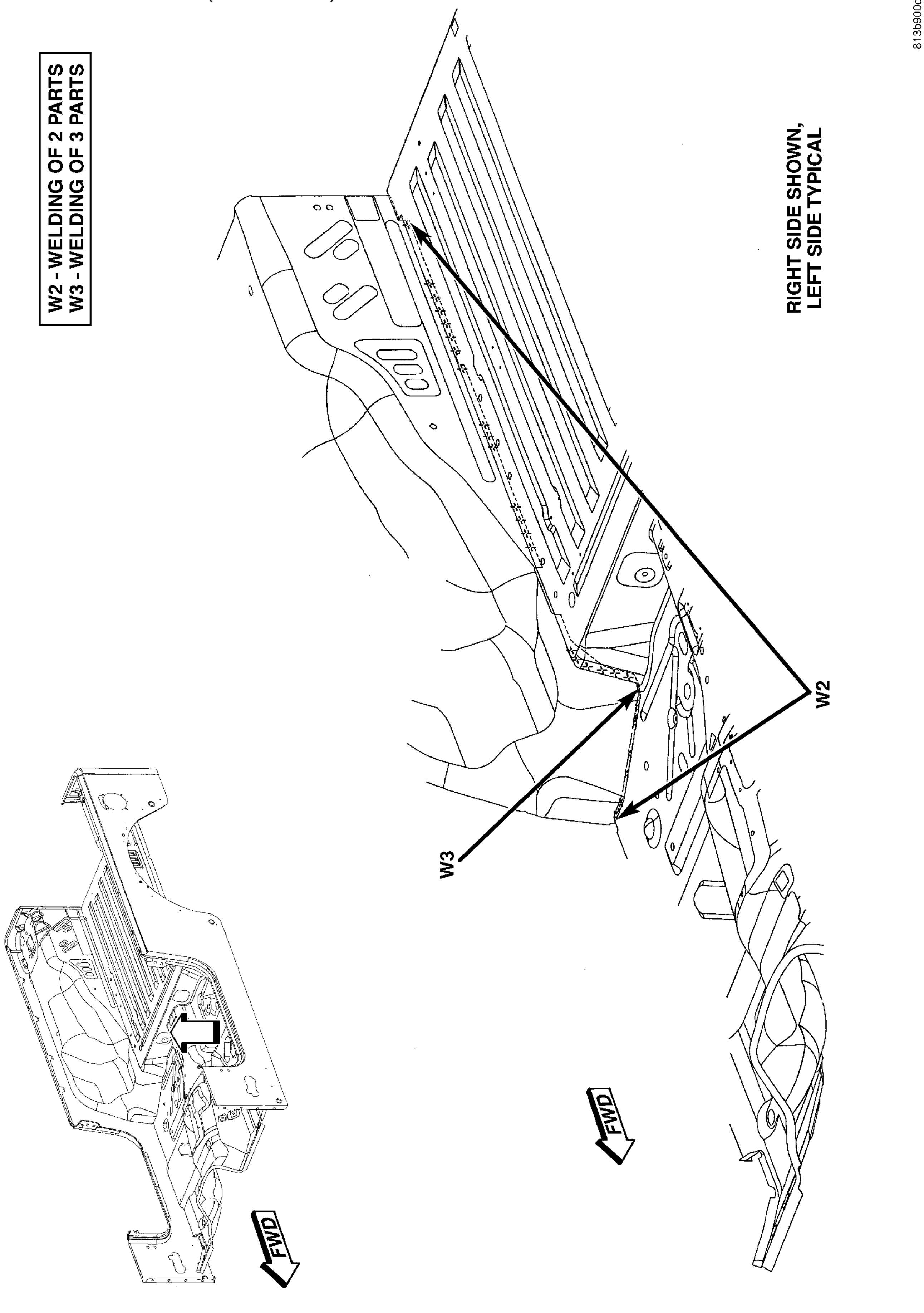

Fig. 86 BODY COMPLETE LWB (1 OF 4)

WELD LOCATIONS (Continued)

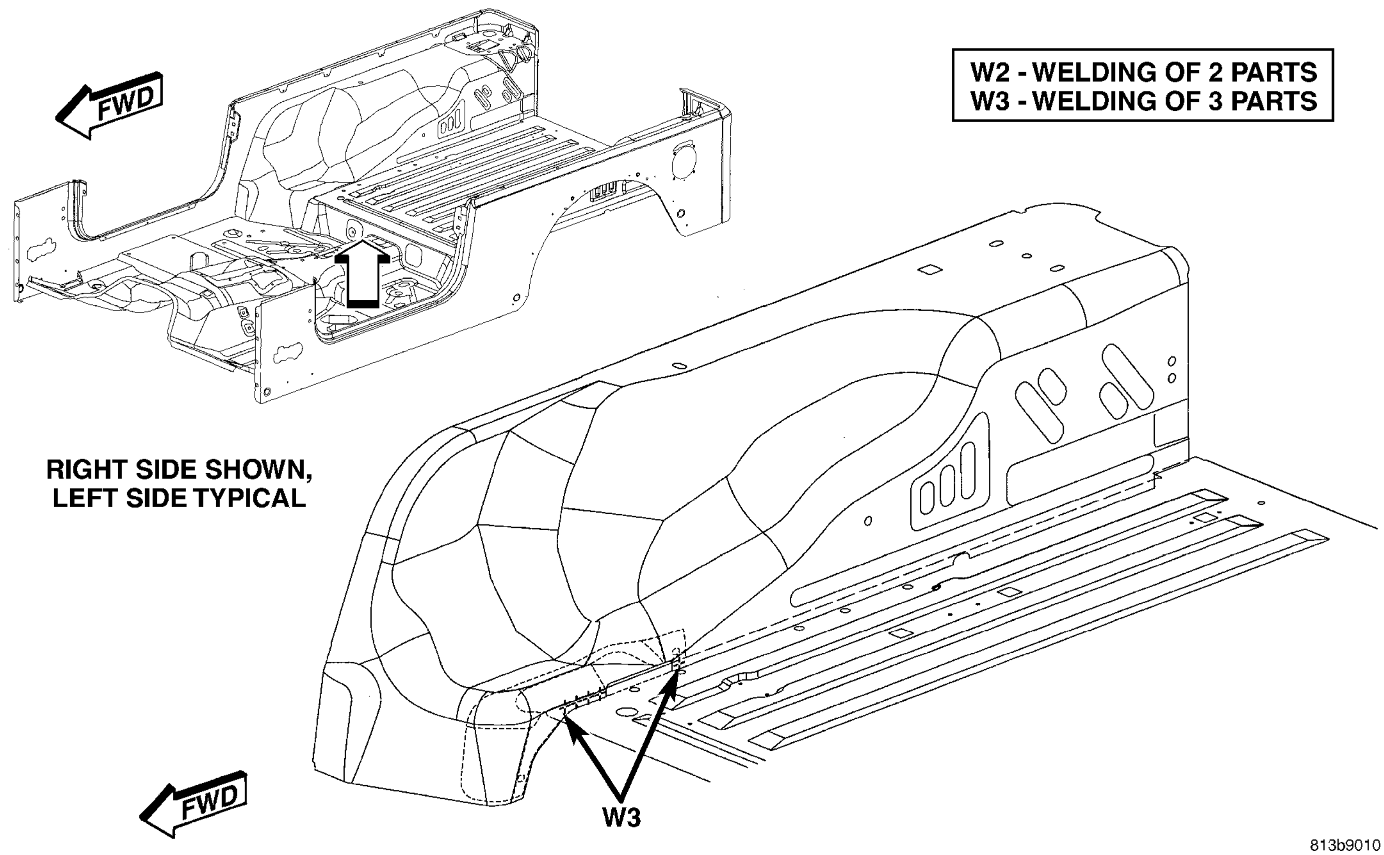

Fig. 87 BODY COMPLETE LWB (2 OF 4)

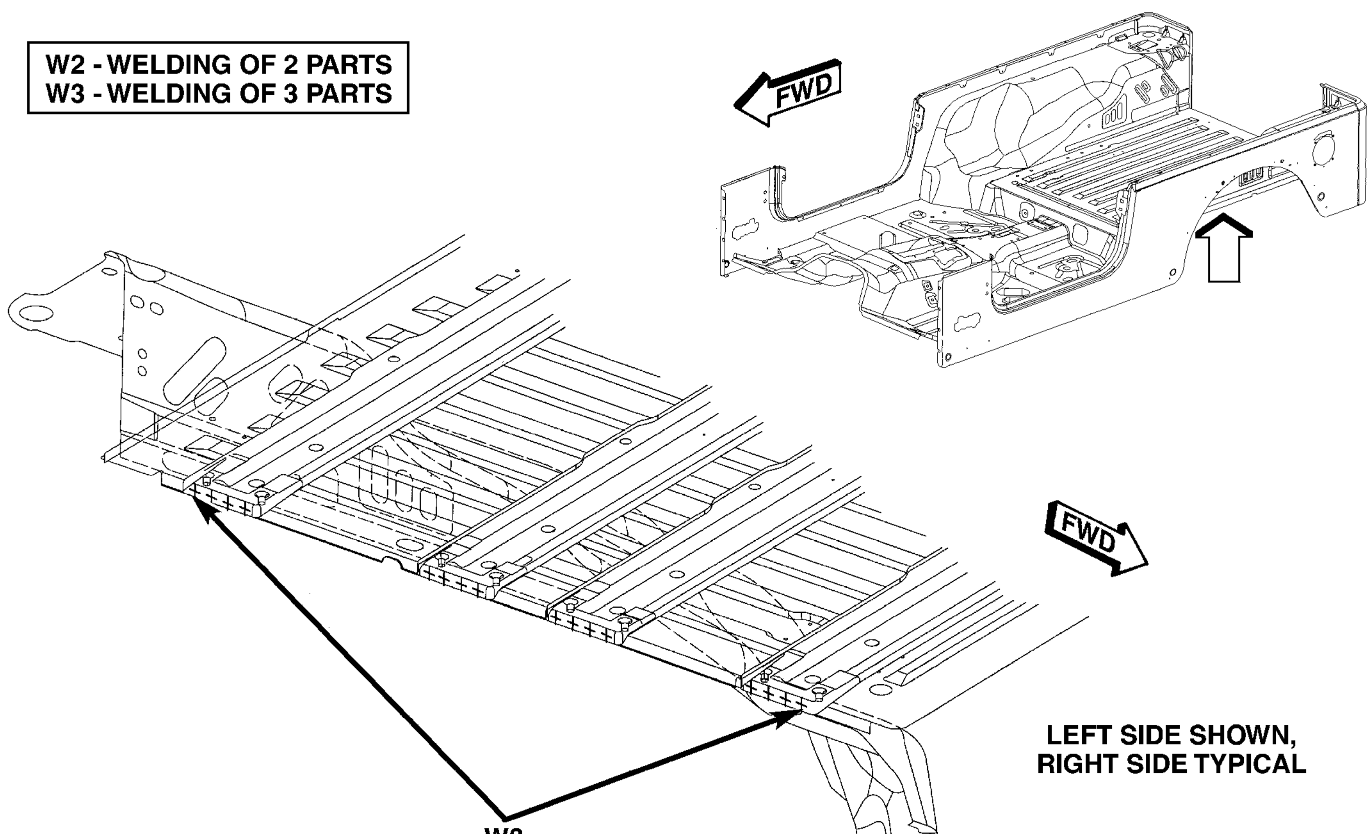

Fig. 88 BODY COMPLETE LWB (3 OF 4)

WELD LOCATIONS (Continued)

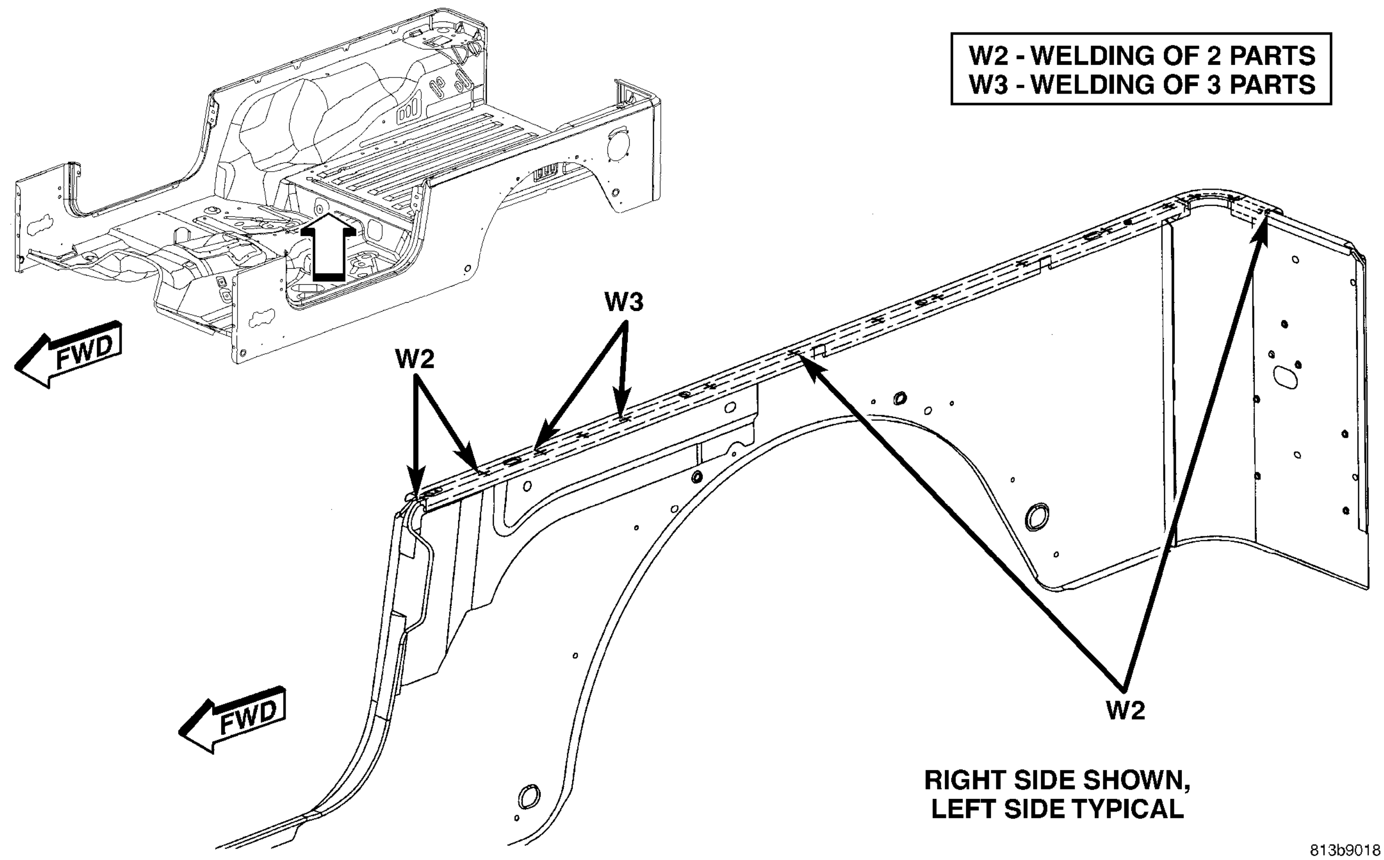

Fig. 89 BODY COMPLETE LWB (4 OF 4)

HEATING & AIR CONDITIONING

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HEATING & AIR CONDITIONING

DESCRIPTION

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain the performance level of the heating-air conditioning system, the engine cooling system must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the radiator, thermostat, radiator hoses and the engine coolant pump. Refer to Cooling for more information before opening or attempting any service to the engine cooling system.

HEATER AND AIR CONDITIONER

A manually controlled single zone type heating-air conditioning system or a manually controlled heater-only system is available on this model (depending on market).

All vehicles are equipped with a common heater, ventilation and air conditioning (HVAC) housing (Fig. 1). The system combines air conditioning, heating and ventilation capabilities in a single unit mounted within the passenger compartment under the instrument panel. The HVAC housing includes:

- Blower motor
- Blower motor resistor block
- Recirculation door and actuator (A/C system only)
- Heater core
- Evaporator coil (A/C system only)
- Blend door and actuator (A/C system only)
- Defrost, floor and panel/demist doors and actuators

On heater-only systems, the evaporator coil and recirculating air door are omitted from the housing.

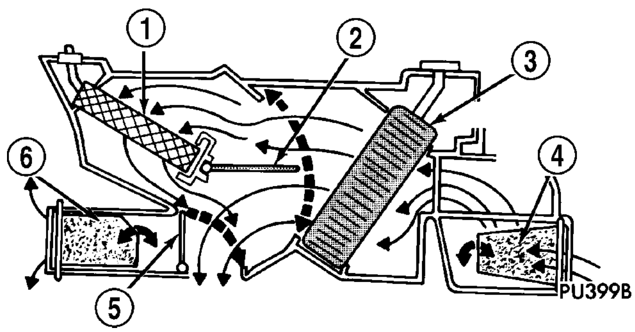

Fig. 1 Common Blend-Air HVAC System - Typical

1 - HEATER CORE
2 - BLEND-AIR DOOR
3 - EVAPORATOR (A/C SYSTEM ONLY)
4 - RECIRCULATING AIR DOOR (A/C SYSTEM ONLY)
5 - FLOOR/PANEL DOOR
6 - FLOOR/DEFROST DOOR

Based upon the system and mode selected, conditioned air can exit the heater-only or heater-A/C system housing through one or a combination of the three main housing outlets: defrost, panel or floor. The defrost outlet is located on the top of the housing, the panel outlet is located on the face of the housing and the floor outlet is located on the bottom of the housing. Once the conditioned air exits the unit housing, it is further directed through molded plastic ducts to the various outlets in the vehicle interior. These outlets and their locations are as follows:

- **Defroster Outlet** - A single large defroster outlet is located in the center of the instrument panel top cover, near the base of the windshield.
- **Side Window Demister Outlets** - There are two side window demister outlets, one is located at each outboard end of the instrument panel top cover, near the belt line at the A-pillars.

HEATING & AIR CONDITIONING (Continued)

• **Panel Outlets -** There are four panel outlets in the instrument panel, one located near each outboard end of the instrument panel facing the rear of the vehicle and two located near the top of the instrument panel center bezel.

• **Front Floor Outlets -** There are two front floor outlets, one located above each side of the floor panel center tunnel near the dash panel.

OPERATION

The heating and air conditioning systems pulls outside (ambient) air through the cowl opening at the base of the windshield, then into the plenum chamber above the heating, ventilation and air conditioning (HVAC) housing. On models equipped with air conditioning, the air passes through the evaporator coil. Air flow can be directed either through or around the heater core. This is done by adjusting the blend door with the temperature control knob on the A/C-heater control panel located the instrument panel. The air flow can then be directed from the panel, floor and defrost outlets in various combinations using the mode control knob located on the A/C-heater control panel. Air flow velocity can be adjusted with the blower speed selector located on the A/C-heater control panel.

NOTE: It is important to keep the air intake opening clear of debris. Leaf particles and other debris that is small enough to pass through the cowl opening screen can accumulate within the HVAC housing. The closed, warm, damp and dark environment created within the housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh intake-air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C operation if the air intake opening is not kept clear of debris.

Both the heater-only and heater-air conditioner systems are blend-air type systems. In a blend-air system, a blend door controls the amount of unconditioned air (or cooled air from the evaporator coil on models with air conditioning) that is allowed to flow through, or around, the heater core. The temperature control knob determines the discharge air temperature by actuating an electric motor, which operates the blend door. This allows an almost immediate control of the output air temperature of the system.

On air conditioned vehicles, the outside air intake can be shut off by selecting the Recirculation Mode with the mode control knob. This will operate a vacuum actuated recirculating air door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The air conditioning compressor can be engaged by turning the mode control knob clockwise from the Off position. It can also be engaged by placing the mode control in the mix to defrost positions. This will remove heat and humidity from the air before it is directed through or around the heater core. The mode control knob on the A/C-heater control panel is used to also direct the conditioned air to the selected system outlets. The mode control switch uses engine vacuum to control the mode doors, which are operated by vacuum actuators.

The defroster outlet receives airflow from the HVAC housing through the molded plastic defroster duct, which is snapped onto the housing defroster outlet and secured by two mounting tabs to the dash panel. The airflow from the defroster outlet is directed by fixed vanes in the defroster outlet grille and cannot be adjusted. The defroster outlet grille is integral to the instrument panel top cover.

The side window demister outlets receive airflow from the HVAC housing through the molded plastic defroster duct and two molded plastic demister hoses. The airflow from the side window demister outlets is directed by fixed vanes in the demister outlet grilles and cannot be adjusted. The side window demister outlet grilles are integral to the instrument panel. The demisters direct air from the HVAC housing through the outlets located on the top corners of the instrument panel. The demisters operate when the mode control knob is positioned in the floor-defrost and defrost-only settings. Some air may be noticeable from the demister outlets when the mode control is in the bi-level to floor positions.

The panel outlets receive airflow from the HVAC housing through a molded plastic main panel duct, center panel duct and two end panel ducts. The two end panel ducts direct airflow to the left and right instrument panel outlets, while the center panel duct directs airflow to the two center panel outlets. Each of these outlets can be individually adjusted to direct the flow of air.

The floor outlets receive airflow from the HVAC housing through the floor distribution duct. The front floor outlets are integral to the molded plastic floor distribution duct, which is secured to the bottom of the housing. The floor outlets cannot be adjusted.

The available air conditioner system is designed for the use of non-CFC, R-134a refrigerant. This air conditioning system uses a fixed orifice tube in the liquid line near the condenser outlet to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, the compressor clutch is cycled on and off by an A/C low pressure switch mounted on the accumulator.

HEATING & AIR CONDITIONING (Continued)

DIAGNOSIS AND TESTING

A/C PERFORMANCE

The air conditioning system is designed to remove heat and humidity from the air entering the passenger compartment. The evaporator, located in the heater-A/C unit, is cooled to temperatures near the freezing point. As warm damp air passes over the fins in the evaporator, moisture in the air condenses to water, dehumidifying the air. Condensation on the evaporator fins reduces the evaporators ability to absorb heat. During periods of high heat and humidity, an air conditioning system will be less effective. With the instrument control set to Recirculation mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

A/C PERFORMANCE TEST

Review Safety Warnings and Cautions before performing this procedure (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION). Air temperature in test room and on vehicle must be 21° C (70° F) minimum for this test.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) Connect a tachometer and a manifold gauge set.

(2) Set the mode control to the Recirculation Mode position, the temperature control to the full cool position and the blower to the highest speed position.

(3) Start the engine and hold at 1,000 rpm with the A/C compressor clutch engaged.

(4) The engine should be warmed up to operating temperature with the doors closed and windows open.

(5) Insert a thermometer in the driver's side center panel A/C-heater outlet and operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, unplug the A/C low pressure switch wire harness connector from the switch located on the accumulator (Fig. 2). Place a jumper wire across the terminals of the A/C low pressure switch wire harness connector.

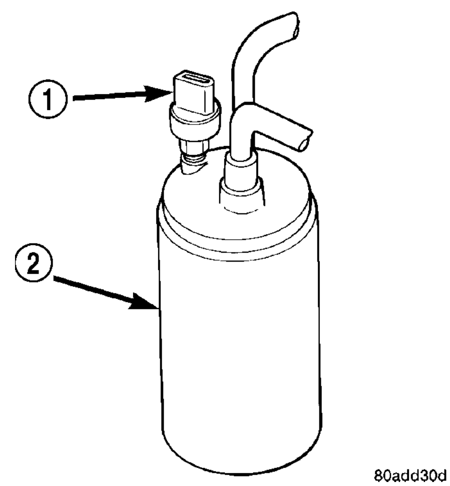

Fig. 2 A/C Low Pressure Switch - Typical

1 - A/C LOW PRESSURE SWITCH
2 - ACCUMULATOR

(7) With the A/C compressor clutch engaged, compare the discharge air temperature and the compressor discharge pressure.

(8) If the discharge air temperature fails to meet the specifications in the A/C Performance Temperature chart, refer to the Pressure Diagnosis Chart.

HEATING & AIR CONDITIONING (Continued)

PERFORMANCE TEMPERATURE AND PRESSURE

Ambient Air Temperature	21° C (70° F)	27° C (80° F)	32° C (90° F)	38° C (100° F)	43° C (110° F)
Air Temperature at Center Panel Outlet	-3 to 3° C (27 to 38° F)	1 to 7° C (33 to 44° F)	3 to 9° C (37 to 48° F)	6 to 13° C (43 to 55° F)	10 to 18° C (50 to 64° F)
Evaporator Inlet Pressure at Charge Port	179 to 241 kPa (26 to 35 psi)	221 to 283 kPa (32 to 41 psi)	262 to 324 kPa (38 to 47 psi)	303 to 365 kPa (44 to 53 psi)	345 to 414 kPa (50 to 60 psi)
Compressor Discharge Pressure	1240 to 1655 kPa (180 to 240 psi)	1380 to 1790 kPa (200 to 260 psi)	1720 to 2070 kPa (250 to 300 psi)	1860 to 2345 kPa (270 to 340 psi)	2070 to 2690 kPa (300 to 390 psi)

(9) Compare the compressor discharge pressure to the Performance Temperature and Pressure chart. If the compressor discharge pressure is high, see the Pressure Diagnosis chart.

PRESSURE DIAGNOSIS

Condition	Possible Causes	Correction
Rapid compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Faulty fuse.	2. Check the fuses in the Power Distribution Center and the fuse block. Repair the shorted circuit or component and replace the fuses, if required. Refer to Group 8.
	3. Faulty A/C compressor clutch coil.	3. See A/C Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required.
	4. Faulty A/C compressor clutch relay.	4. See A/C Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required.
	5. Improperly installed or faulty A/C low pressure switch.	5. See A/C Low Pressure Switch in this group. Test the low pressure switch and tighten or replace, if required.
	6. Faulty A/C high pressure switch.	6. See A/C High Pressure switch in this group. Test the high pressure switch and replace, if required.
	7. Faulty Powertrain Control Module (PCM).	7. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.

HEATING & AIR CONDITIONING (Continued)

Condition	Possible Causes	Correction
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required.
	2. Blend-air door motor improperly installed or faulty.	2. See Blend-Air Door Motor in this group. Inspect the motor for proper operation and replace, if required.
	3. Blend-air door inoperative or sealing improperly.	3. See Blend-Air Door in this group. Inspect the blend-air door for proper operation and sealing and correct, if required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	2. Refrigerant flow through the accumulator is restricted.	2. See Accumulator in this group. Replace the restricted accumulator, if required.
	3. Refrigerant flow through the evaporator coil is restricted.	3. See A/C Evaporator Coil in this group. Replace the restricted evaporator coil, if required.
	4. Faulty compressor.	4. See A/C Compressor in this group. Replace the compressor, if required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. Condenser air flow restricted.	1. Check the A/C condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Clean, repair, or replace components as required.
	2. Inoperative radiator cooling fan.	2. Test the radiator cooling fan and replace, if required. Refer to Group 7.
	3. Refrigerant system overcharged.	3. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required.
	4. Air in the refrigerant system.	4. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
	5. Engine overheating.	5. Test the engine cooling system and repair, if required. Refer to Group 7.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping.	1. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. Refer to Group 7.
	2. Faulty fixed orifice tube.	2. See A/C Fixed Orifice Tube in this group. Replace the liquid line, if required.
	3. Faulty A/C compressor.	3. See A/C Compressor in this group. Replace the compressor, if required.

HEATING & AIR CONDITIONING (Continued)

Condition	Possible Causes	Correction
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines.	1. See Liquid Line and Suction and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required.
	2. Restricted refrigerant flow through the fixed orifice tube.	2. See A/C Fixed Orifice Tube in this group. Replace the liquid line, if required.
	3. Restricted refrigerant flow through the A/C condenser.	3. See A/C Condenser in this group. Replace the restricted condenser, if required.

HEATER PERFORMANCE

Review Safety Warnings and Cautions before performing this procedure (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

Check the coolant level, drive belt tension, vacuum line connections, radiator air flow and fan operation. Start engine and allow to warm up to normal temperature.

WARNING: DO NOT REMOVE RADIATOR CAP WHEN ENGINE IS HOT, PERSONAL INJURY CAN RESULT.

If vehicle has been run recently, wait 15 minutes before removing cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system stabilizes, remove the cap completely.

MAXIMUM HEATER OUTPUT: TEST AND ACTION

Engine coolant is provided to the heater system by two heater hoses. With the engine idling at normal operating temperature, set the temperature control to maximum heat, the mode control to the floor position, and the blower in the highest speed position. Using a test thermometer, check the temperature of the air being discharged from the floor outlets. Compare the test thermometer reading to the Temperature Reference Chart.

TEMPERATURE REFERENCE CHART

Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

Both of the heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose. If the coolant return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the heater system. If both heater hoses are cool to the touch, inspect the engine cooling system (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).

OBSTRUCTED COOLANT FLOW Possible locations or causes of obstructed coolant flow are as follows:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- Plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is insufficient, a mechanical problem may exist.

MECHANICAL PROBLEMS Possible causes of insufficient heat due to mechanical problems are as follows:

- Obstructed cowl air intake.
- Obstructed heater system outlets.
- Blend-air door not functioning properly.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob on the A/C-heater control panel, the following could require service:

- Blend-air door binding.
- Faulty blend-air door motor.
- Faulty A/C-heater control.
- Faulty related wiring harness or connectors.
- Improper engine coolant temperature.

HEATING & AIR CONDITIONING (Continued)

SPECIFICATIONS

HEATING AND A/C SYSTEM

REFRIGERANT SYSTEM CHARGE

The R-134a refrigerant system charge capacity for this vehicle can be found on the underhood Specification Label.

A/C SYSTEM

Item	Description	Notes
Compressor	Denso 10PA17	ND-8 PAG Oil
Freeze–up Control	Low pressure clutch cycling switch	Input to PCM, accumulator mounted - cycles clutch off below -1° C (30° F), cycles back on above 7.2° C (45° F)
Low psi Control	Low pressure clutch cycling switch	Accumulator mounted - opens below 172 kPa (25 psi) - resets above 276 kPa (40 psi)
High psi Control	High pressure cut out switch	Discarge line mounted - opens at discharge pressure above 3100 - 3375 kPa (450 - 490 psi) - resets at 1860 - 2275 kPa (270 - 330 psi)
Compressor Clutch Coil Draw	2.0 - 3.7 amps @ 12V ± 0.5V @ 21° C (70° F)	
Compressor Clutch Air Gap	0.35 - 0.65 mm (0.014 - 0.026 in)	

FASTENER TORQUE

Description	N·m	Ft. Lbs.	In. Lbs.
A/C Compressor Shaft Bolt	13	–	115
A/C Compressor Mounting Bolts (4.0L)	45-65	35-50	–
A/C Compressor Rear Brace Bolts (4.0L)	40-55	30-40	–
A/C Compressor Mounting Bolts (2.4L)	28	21	–
A/C-heater Control Screws	2.2	–	20
Accumulator Retaining Band Bolt	4.5	–	40
Blend Door Actuator Screws	1.1	–	10
Blower Motor Switch Screw	2.2	–	20
Blower Motor Resistor Block Screws	2.2	–	20
Center Panel Duct Screws	2.2	–	20

HEATING & AIR CONDITIONING (Continued)

Description	N·m	Ft. Lbs.	In. Lbs.
Discharge Line to Compressor	25.4	20	–
Discharge Line to Condenser Nut	12	–	105
End Panel Duct Screws	2.2	–	20
Evaporator Tube Clamp Screw	2.2	–	20
Floor Distribution Duct Screws	2.2	–	20
HVAC Housing Screws	2.2	–	20
HVAC Housing Outboard Screw	3.4	–	30
HVAC Housing Stud Nuts	6.2	–	55
Liquid Line to Condenser Nut	12	–	105
Lower Condenser Bracket Screws	2.2	–	20
Main Panel Duct Screws	2.2	–	20
Refrigerant Line Support Bracket Bolt	28	21	–
Radiator Shroud Screws	8	–	72
Recirculation Housing Screws	2.2	–	20
Suction Lines to Accumulator Nut	2.2	–	20
Suction Line to Compressor	25.4	20	–
Upper Condenser Mounting Bracket Screws	2.2	–	20
Vacuum Reservoir Screw	2.2	–	20

CONTROLS

TABLE OF CONTENTS

A/C COMPRESSOR CLUTCH/ COIL

DESCRIPTION

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 1). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is keyed to the compressor shaft and secured with a retainer. These components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt.

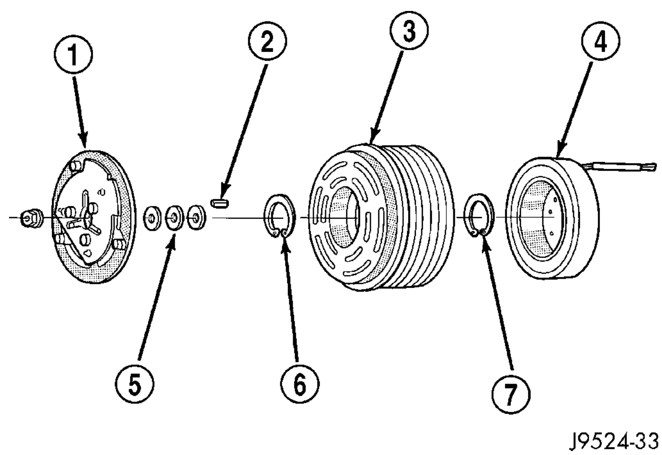

Fig. 1 A/C Compressor Clutch - Typical

1 - CLUTCH PLATE
2 - SHAFT KEY
3 - PULLEY
4 - COIL
5 - CLUTCH SHIMS
6 - SNAP RING
7 - SNAP RING

OPERATION

When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

A/C compressor clutch engagement is controlled by the following components:

- A/C-heater mode control switch
- A/C low pressure switch
- A/C high pressure switch
- A/C compressor clutch relay
- Powertrain Control Module (PCM)

The PCM may delay compressor clutch engagement for up to thirty seconds.

DIAGNOSIS AND TESTING

A/C COMPRESSOR CLUTCH/COIL

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds. Begin testing of a suspected compressor clutch coil problem by performing the preliminary checks.

PRELIMINARY CHECKS

(1) If the compressor clutch will not engage, verify the refrigerant charge level (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE). If the refrigerant charge level is OK, go to Step 2. If the refrigerant charge level is not OK, adjust the refrigerant charge as required.

(2) If the a/c compressor clutch still will not engage, disconnect the headlamp and dash wire harness connector for the A/C pressure transducer and check for battery current at the connector with the engine running and the heater-A/C control set to the A/C mode. If OK, go to TESTS. If not OK, refer to the Body Diagnostic Procedures to perform further diagnosis.

A/C COMPRESSOR CLUTCH/COIL (Continued)

TESTS

(1) Verify the battery state of charge (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - DIAGNOSIS AND TESTING).

(2) Connect an ammeter (0 to 10 ampere scale selected) in series with the clutch coil feed terminal. Connect a voltmeter (0 to 20 volt scale selected) to measure voltage across the battery and the clutch coil.

(3) With the A/C-heater control in any A/C mode and the blower at the lowest speed, start the engine and allow it to run at a normal idle speed.

(4) The compressor clutch should engage immediately, and the clutch coil voltage should be within two volts of the battery voltage. If the coil voltage is not within two volts of battery voltage, test the clutch coil feed circuit for excessive voltage drop. If the compressor clutch does not engage, refer to Body Diagnostic Procedures to perform further diagnosis.

The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the fuse block and the Power Distribution Center (PDC)
- A/C-heater mode control switch
- A/C Compressor clutch relay
- A/C High pressure switch
- A/C Low pressure switch
- Powertrain Control Module (PCM)

(5) With the ambient temperature at 21° C (70° F), the compressor clutch coil is acceptable if the current draw is 2.0 to 3.7 amperes at 11.5 to 12.5 volts at the clutch coil. If the voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the voltage reads below 12.5 volts.

(a) If the compressor clutch coil current reading is zero, the coil is open and must be replaced.

(b) If the compressor clutch coil current reading is four amperes or more, the coil is shorted and must be replaced.

REMOVAL

NOTE: The compressor clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) and (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove the bolt that secures the compressor clutch to the compressor shaft (Fig. 2). A band-type oil filter wrench may be used to secure the clutch during bolt removal.

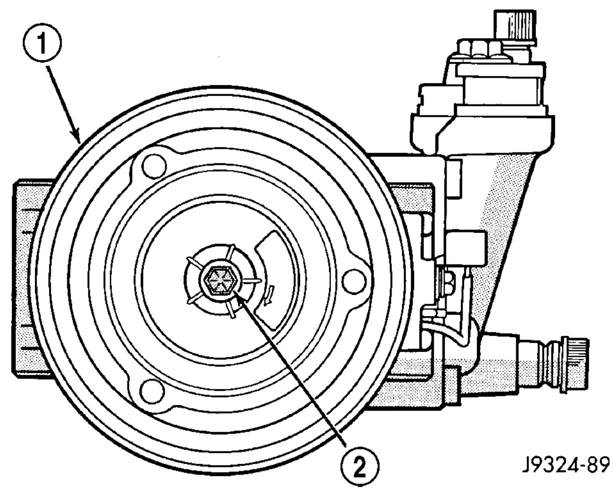

Fig. 2 A/C Compressor Shaft Bolt

1 - COMPRESSOR CLUTCH PLATE
2 - COMPRESSOR SHAFT BOLT

A/C COMPRESSOR CLUTCH/COIL (Continued)

(4) Tap the clutch plate with a plastic mallet to release it from the splines on the compressor shaft. Remove the clutch plate and shim(s) from the compressor shaft (Fig. 3).

NOTE: Use care not to lose any of the shim(s).

CAUTION: Do not use screwdrivers between the clutch plate assembly and pulley to remove front plate as this may damage the front plate assembly.

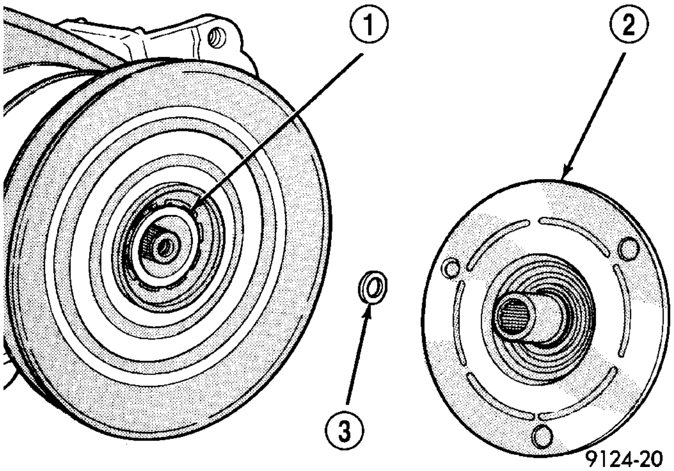

Fig. 3 Clutch Plate and Shim(s)

1 - COMPRESSOR SHAFT
2 - CLUTCH PLATE
3 - CLUTCH PLATE SHIM

(5) Remove the external snap ring that secures the compressor clutch pulley to the nose of the compressor front housing with snap ring pliers (Special Tool C-4574) or equivalent and slide the pulley assembly off of the compressor (Fig. 4).

(6) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing.

(7) Remove the external snap ring that secures the compressor clutch coil to the nose of the compressor front housing with snap ring pliers and slide the coil assembly off of the compressor (Fig. 5).

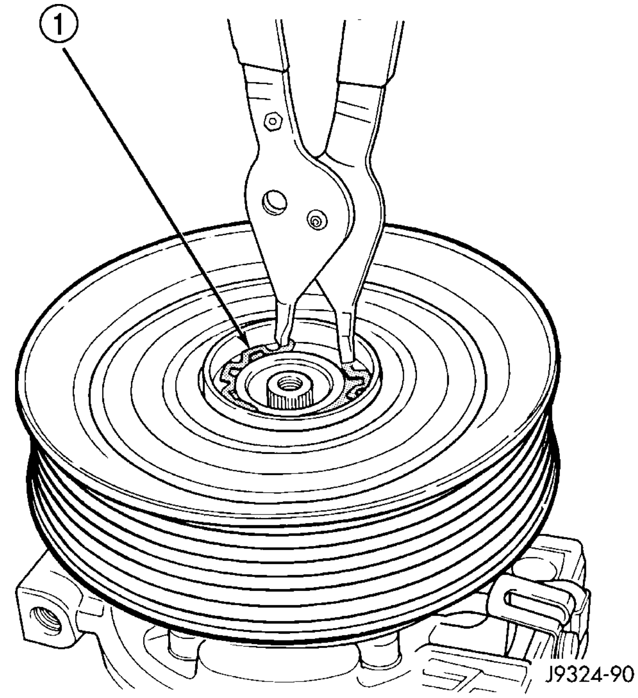

Fig. 4 Pulley Snap Ring

1 - SNAP RING

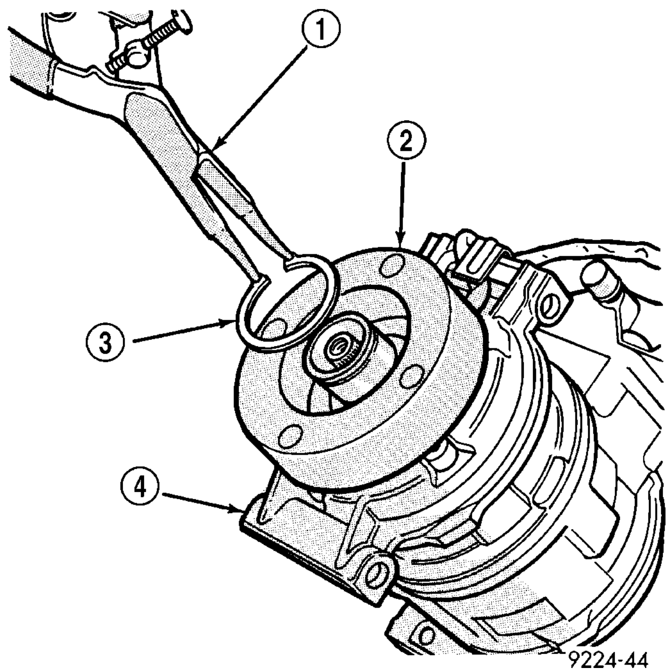

Fig. 5 Clutch Coil Snap Ring

1 - SNAP RING PLIERS
2 - CLUTCH COIL
3 - SNAP RING
4 - COMPRESSOR

A/C COMPRESSOR CLUTCH/COIL (Continued)

INSPECTION

NOTE: The compressor clutch can be serviced in the vehicle. The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement.

Examine the friction surfaces of the clutch pulley and the clutch plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for refrigerant oil. Remove the felt wick from around the shaft inside the nose of the compressor front housing. If the felt is saturated with refrigerant oil, the compressor shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

INSTALLATION

(1) Align the dowel pin on the back of the clutch field coil with the hole in the compressor front housing and press the field coil into place over the nose of the compressor.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Install the clutch field coil and snap ring with snap ring pliers (Special Tool C-4574). The bevel side of the snap ring must be facing outward. Also, both eyelets of the snap ring must be to the right or left of the pin on the compressor. Press in on the snap ring to be certain that it is properly seated in the groove.

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(4) Install the pulley assembly onto the compressor. If necessary, place a block of wood on the friction surface and tap gently with a hammer (Fig. 6).

CAUTION: Do not mar the pulley friction surface.

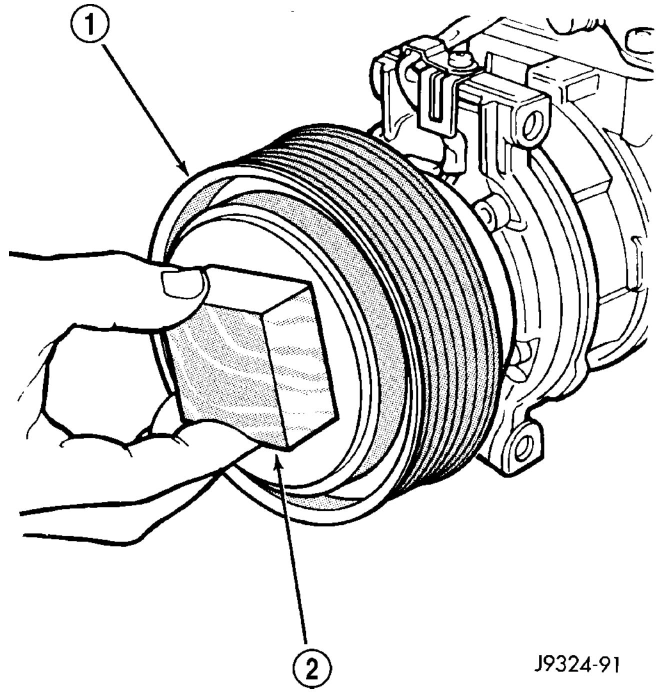

Fig. 6 Pulley Assembly - Install

1 - PULLEY ASSEMBLY
2 - WOOD BLOCK

(5) Install the pulley assembly retaining snap ring (bevel side outward) with snap ring pliers (Special Tool C-4574). Press in on the snap ring to be certain that it is properly seated in the groove.

(6) If the original clutch plate assembly and pulley assembly are to be reused, the old shim(s) can be used. If not, place a stack of shim(s) equal to the old shim(s) on the shaft against the shoulder.

(7) Install the clutch plate assembly onto the shaft.

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is still correct. Spin the pulley before performing a final check of the air gap.

A/C COMPRESSOR CLUTCH/COIL (Continued)

(8) With the clutch plate assembly tight against the shim(s), measure the air gap between the clutch plate and the pulley face with feeler gauges. The air gap should be between 0.35 to 0.65 mm (0.014 to 0.026 in.). If the proper air gap is not obtained, add or subtract shims as needed until the desired air gap is obtained.

(9) Install the compressor shaft bolt. Tighten the bolt to 13 N·m (115 in. lbs.).

(10) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) or (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Reconnect the battery negative cable.

CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the A/C-heater control to the A/C Recirculation Mode, the blower motor switch in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

A/C COMPRESSOR CLUTCH RELAY

DESCRIPTION

The A/C compressor clutch relay (Fig. 7) is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay. The A/C compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for A/C compressor clutch relay identification and location.

The black, molded plastic case is the most visible component of the A/C compressor clutch relay. Five male spade-type terminals extend from the bottom of the base to connect the relay to the vehicle electrical system, and the ISO designation for each terminal is molded into the base adjacent to each terminal. The ISO terminal designations are as follows:

- **30 (Common Feed)** - This terminal is connected to the movable contact point of the relay.

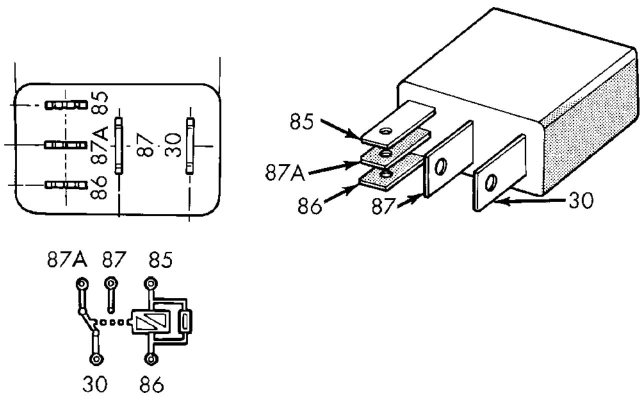

Fig. 7 A/C Compressor Clutch Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

- **85 (Coil Ground)** - This terminal is connected to the ground feed side of the relay control coil.
- **86 (Coil Battery)** - This terminal is connected to the battery feed side of the relay control coil.
- **87 (Normally Open)** - This terminal is connected to the normally open fixed contact point of the relay.
- **87A (Normally Closed)** - This terminal is connected to the normally closed fixed contact point of the relay.

The A/C compressor clutch relay cannot be adjusted or repaired. If the relay is damaged or faulty, it must be replaced.

OPERATION

The A/C compressor clutch relay is an electromechanical switch that uses a low current input from the Powertrain Control Module (PCM) to control the high current output to the Compressor clutch electromagnetic coil. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. The resistor or diode is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

A/C COMPRESSOR CLUTCH RELAY (Continued)

The A/C compressor clutch relay terminals are connected to the vehicle electrical system through a receptacle in the PDC. The inputs and outputs of the A/C compressor clutch relay include:

- The common feed terminal (30) receives a battery current input from a fuse in the PDC through a fused B(+) circuit at all times.
- The coil ground terminal (85) receives a ground input from the PCM through the A/C compressor clutch relay control circuit only when the PCM electronically pulls the control circuit to ground.
- The coil battery terminal (86) receives a battery current input from a fuse in the fuse block module through a fused ignition switch output (run-start) circuit only when the ignition switch is in the On or Start positions.
- The normally open terminal (87) provides a battery current output to the compressor clutch coil through the A/C compressor clutch relay output circuit only when the A/C compressor clutch relay coil is energized.
- The normally closed terminal (87A) is not connected to any circuit in this application, but provides a battery current output only when the A/C compressor clutch relay coil is de-energized.

Refer to the appropriate wiring information for diagnosis and testing of the micro-relay and for complete HVAC wiring diagrams.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 8).

(3) Refer to the fuse and relay layout label affixed to the underside of the PDC cover for A/C compressor clutch relay identification and location.

(4) Remove the A/C compressor clutch relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for A/C compressor clutch relay location.

(2) Position the A/C compressor clutch relay in the proper receptacle in the PDC.

(3) Align the A/C compressor clutch relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the A/C compressor clutch relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

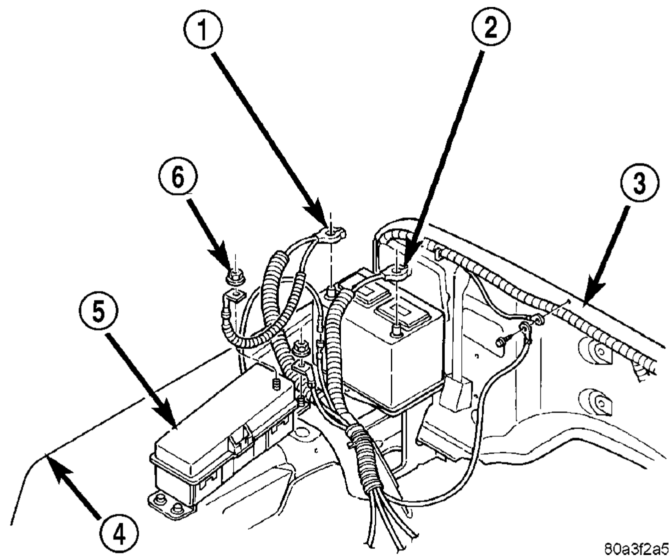

Fig. 8 Power Distribution Center - LHD Shown, RHD Typical

1 - BATTERY POSITIVE CABLE
2 - BATTERY NEGATIVE CABLE
3 - DASH PANEL
4 - INNER FENDER
5 - POWER DISTRIBUTION CENTER (PDC)
6 - NUT

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

A/C HEATER CONTROL

DESCRIPTION

Both the heater-only and heater-A/C systems use a combination of mechanical, electrical, and vacuum controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more information on the suggested operation and use of these controls.

The heater-only or heater-A/C system control panel is located at the center of the instrument panel. The control panel contains rotary-type knobs. There is a blower motor speed control, mode control and temperature control.

The blower motor and mode control switch, control knobs and illumination lamps are available for service replacement.

A/C HEATER CONTROL (Continued)

DIAGNOSIS AND TESTING

VACUUM CONTROL SYSTEM

Vacuum control is used to operate the mode doors in the HVAC housing. Testing of the heater-A/C mode control switch operation will determine if the vacuum and mechanical controls are functioning. However, it is possible that a vacuum control system that operates correctly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be caused by leaks in the vacuum system, or a faulty vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem isn't a disconnected vacuum supply tube at the engine intake manifold vacuum tap or the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707-B) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 9), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.). Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

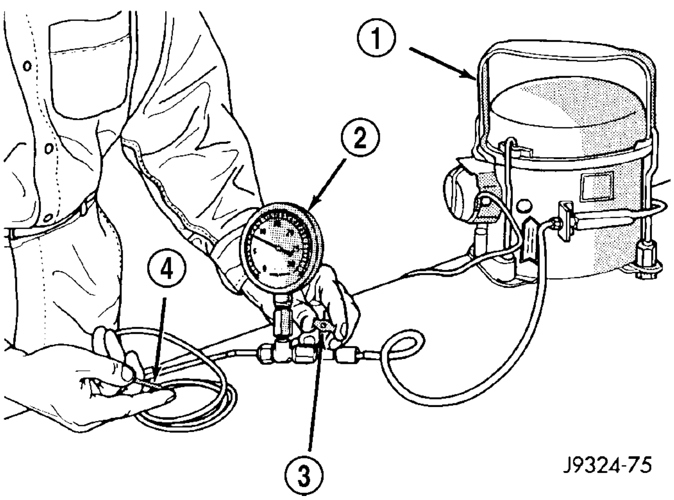

Fig. 9 Adjust Vacuum Test Bleed Valve

1 - VACUUM PUMP TOOL C-4289
2 - VACUUM TEST SET C-3707
3 - BLEED VALVE
4 - PROBE

VACUUM CHECK VALVE

(1) Remove the vacuum check valve. The valve is located in the (black) vacuum supply tube at the intake manifold vacuum tap.

(2) Connect the test set vacuum supply hose to the heater-A/C system (natural color) side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum (black color) side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

HEATER-A/C CONTROLS

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (black) tube in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the heater-A/C mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See the procedure in Locating Vacuum Leaks.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

A/C HEATER CONTROL (Continued)

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum harness connector at the back of the A/C-heater control.

(2) Connect the test set vacuum hose probe to each port in the vacuum harness connector, one port at a time, and pause after each connection (Fig. 10). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty mode control switch. If not OK, go to Step 3.

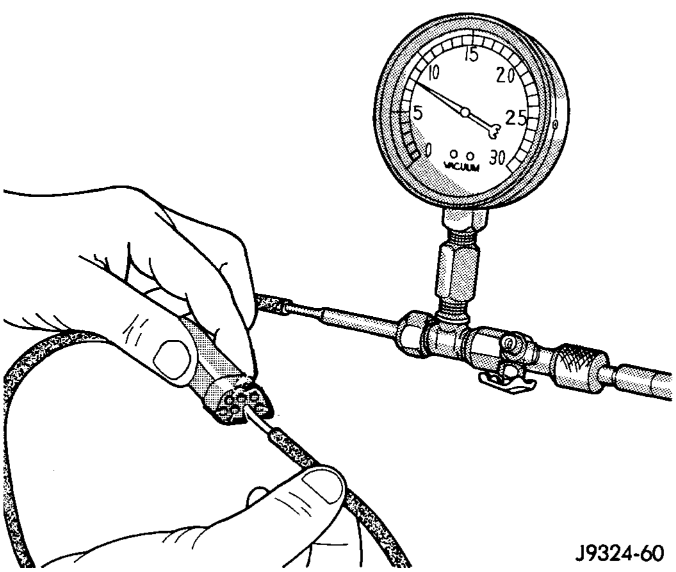

Fig. 10 Vacuum Circuit Test

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, refer to the Vacuum Circuit charts (Fig. 11) and (Fig. 12).

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components.

(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 mm (1/8 in.) inside diameter rubber hose.

A/C HEATER CONTROL (Continued)

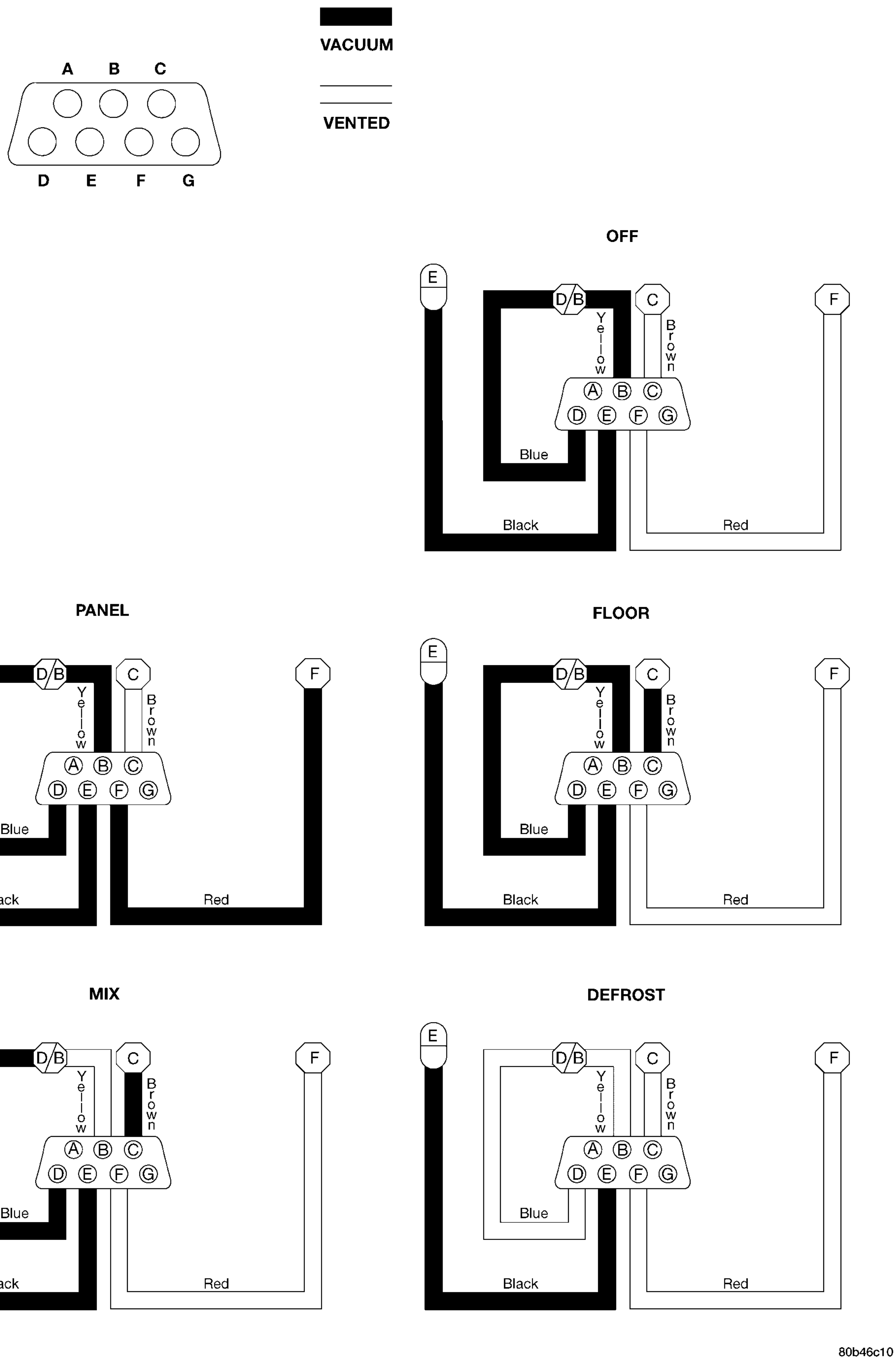

Fig. 11 Vacuum Circuits - Heater Only

A/C HEATER CONTROL (Continued)

A - NOT USED
B - DEFROST ACTUATOR, FULL POSITION (YELLOW)
C - FLOOR ACTUATOR (BROWN)
D - DEFROST ACTUATOR, MID-POSITION (BLUE)
E - VACUUM SUPPLY, RESERVOIR (BLACK)
F - PANEL ACTUATOR (RED)
G - NOT USED

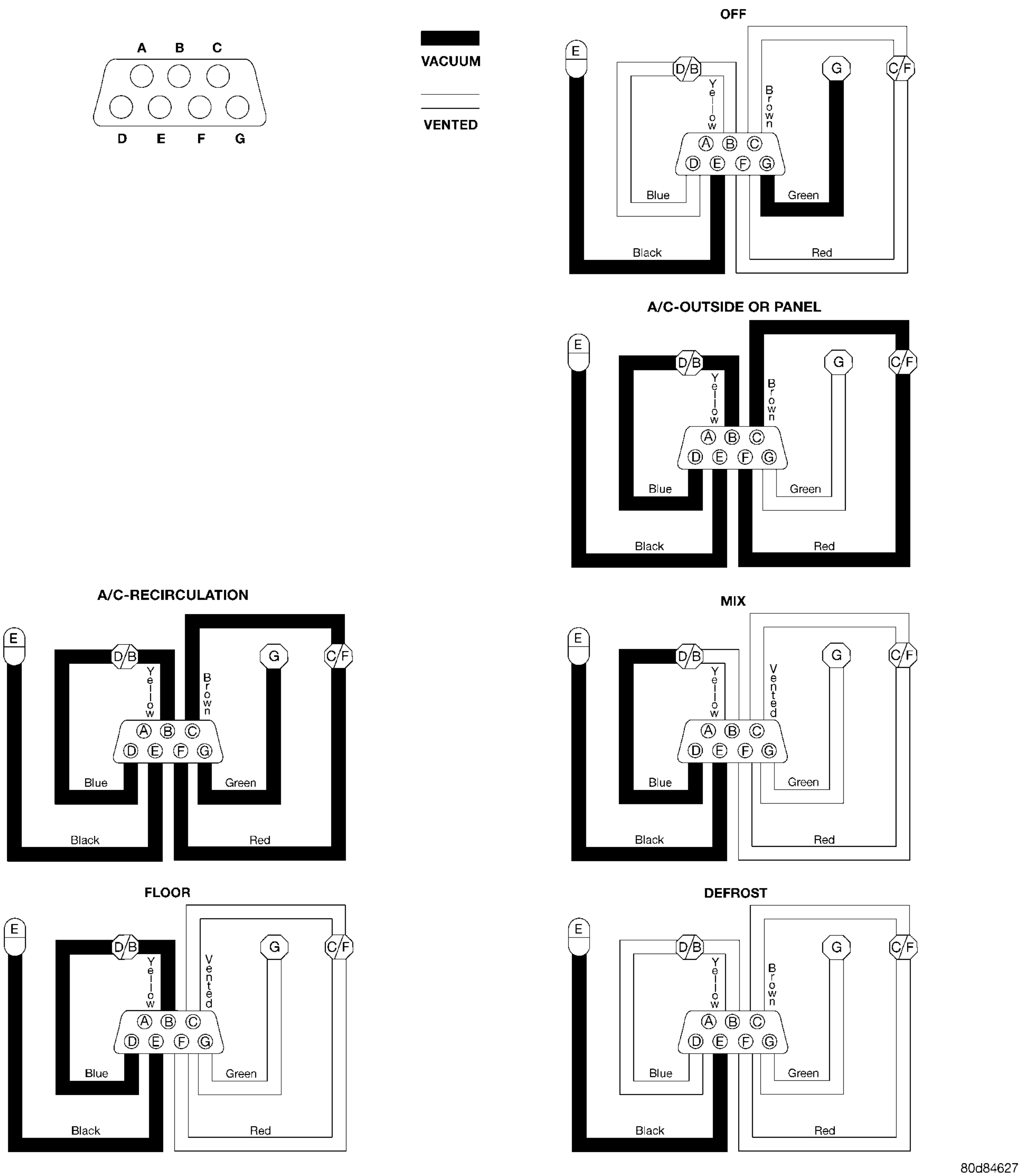

Fig. 12 Vacuum Circuits - Heater-A/C

A - NOT USED
B - DEFROST ACTUATOR (YELLOW)
C - FLOOR ACTUATOR (BROWN)
D - DEFROST ACTUATOR, MID-POSITION (BLUE)
E - VACUUM SUPPLY, RESERVOIR (BLACK)
F - PANEL ACTUATOR (RED)
G - RECIRCULATION ACTUATOR (GREEN)

A/C HEATER CONTROL (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Remove the center bezel from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).

(4) Reach through the instrument panel glove box opening to access and disconnect the two halves of the A/C-heater control vacuum harness connector (Fig. 13).

(5) Remove the two screws that secure the A/C-heater control to the instrument panel.

(6) Pull the A/C-heater control away from the instrument panel to access the connections on the back of the control.

(7) Disconnect the three wire harness connectors from the back of the A/C-heater control (Fig. 14).

(8) Remove the A/C-heater control from the instrument panel.

INSTALLATION

(1) Connect the three wire harness connectors to the A/C-heater control.

(2) Position the A/C-heater control onto the instrument panel and install the retaining screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reach through the instrument panel glove box opening and reconnect the A/C-heater vacuum harness connector.

(4) Install the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(5) Install the center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

(6) Reconnect the battery negative cable.

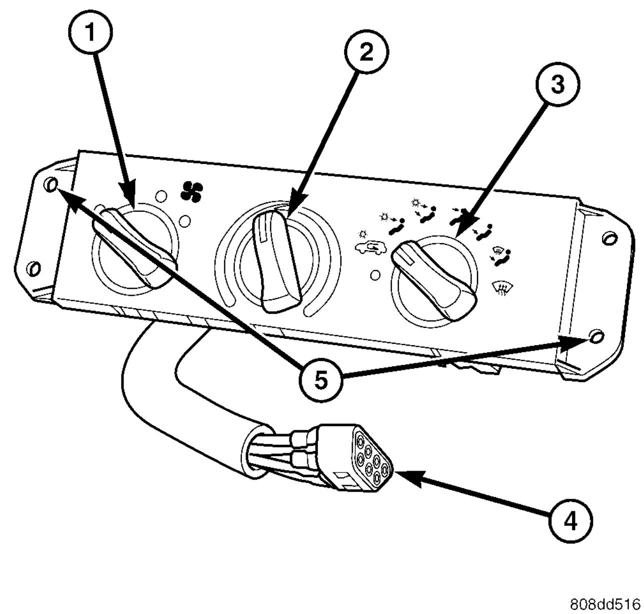

Fig. 13 A/C-Heater Control - Typical

1 - BLOWER MOTOR CONTROL
2 - TEMPERATURE CONTROL
3 - MODE CONTROL
4 - VACUUM HARNESS CONNECTOR
5 - MOUNTING SCREW LOCATIONS

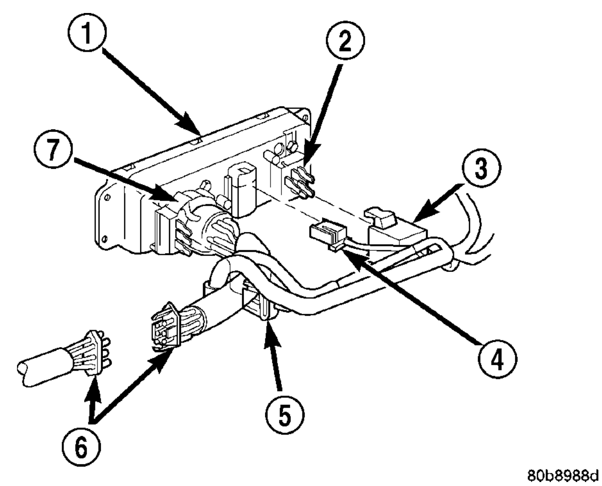

Fig. 14 A/C-Heater Control Connections - Typical

1 - A/C-HEATER CONTROL
2 - BLOWER MOTOR SWITCH
3 - BLOWER MOTOR SWITCH CONNECTOR
4 - TEMPERATURE/ILLUMINATION CONNECTOR
5 - MODE SWITCH CONNECTOR
6 - VACUUM HARNESS
7 - MODE SWITCH

A/C HIGH PRESSURE SWITCH

DESCRIPTION

The A/C high pressure switch is mounted on a fitting located on the discharge line near the A/C compressor. The A/C high pressure switch turns off the A/C compressor if the refrigerant system pressure exceeds 3100 - 3375 kPa (450 - 490 psi). The A/C high pressure switch fitting on the discharge line is equipped with an O-ring seal and contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system.

OPERATION

The A/C high pressure switch is electrically connected in series with the A/C low pressure switch between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the A/C compressor clutch on and off. This prevents compressor operation when the discharge line pressure approaches high levels.

The A/C high pressure switch contacts open when the discharge line pressure rises above 3100 to 3375 kPa (450 to 490 psi). The switch contacts close when the discharge line pressure drops to 1860 to 2275 kPa (270 to 330 psi).

The A/C high pressure switch is a factory-calibrated unit which cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

A/C HIGH PRESSURE SWITCH

Before performing diagnosis of the A/C high pressure switch, verify that the refrigerant system has the correct refrigerant charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the A/C high pressure switch.

(3) Check for continuity between the two terminals of the A/C high pressure switch. There should be continuity. If OK, test and repair the A/C high pressure switch circuit as required. If not OK, replace the switch.

REMOVAL

NOTE: It is not necessary to discharge the refrigerant system to replace the A/C high pressure switch.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the A/C high pressure switch (Fig. 15).

(3) Remove the A/C high pressure switch from the discharge line fitting.

(4) Remove the O-ring seal from the discharge line fitting and discard.

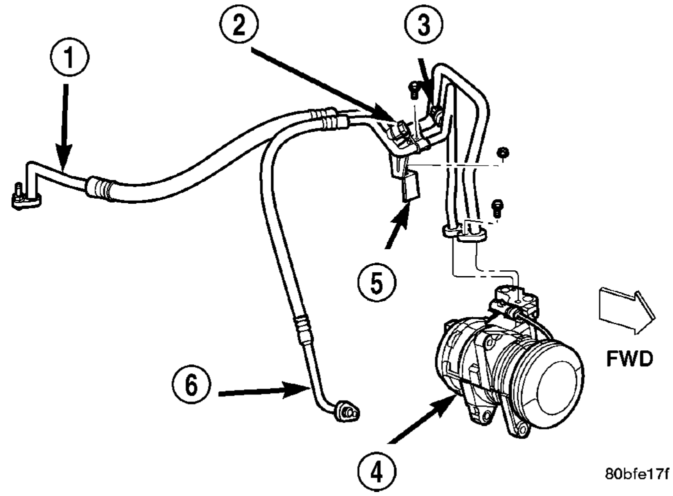

Fig. 15 A/C High Pressure Switch - Typical

1 - SUCTION LINE
2 - SERVICE PORT
3 - A/C HIGH PRESSURE SWITCH
4 - A/C COMPRESSOR
5 - MOUNTING BRACKET
6 - DISCHARGE LINE

INSTALLATION

NOTE: Replace the O-ring seal before installing the A/C high pressure switch.

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-rings as they are made of a special material for the R-134a refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(2) Install and tighten the A/C high pressure switch onto the discharge line fitting. The switch should be hand-tightened securely onto the discharge line fitting.

(3) Connect the wire harness connector into the A/C high pressure switch.

(4) Reconnect the battery negative cable.

A/C LOW PRESSURE SWITCH

DESCRIPTION

The A/C low pressure switch is a single pole, single throw, pressure actuated switch that is installed in a threaded port into the suction passage of the accumulator. The switch is located on the top of the accumulator in a fitting that contains a Schrader type valve, which allows the switch to be serviced without discharging the refrigerant system. The accumulator fitting is equipped with a O-ring to seal the switch plumbing connection.

The A/C low pressure switch is a factory calibrated unit. The switch cannot be adjusted or repaired and if faulty or damaged it must be replaced.

OPERATION

The A/C low pressure switch monitors the pressure of the refrigerant leaving the accumulator to the compressor. The A/C low pressure switch is electrically connected in series with the A/C-heater control mode switch and the A/C high pressure switch, between ground and the Powertrain Control Module (PCM). The A/C low pressure switch contact opens or closes the path the ground, signaling the PCM to turn the A/C compressor clutch on and off. This regulates the refrigerant system pressure and controls evaporator coil temperature. Controlling the evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing air conditioning system air flow.

The A/C low pressure switch contacts are open when the suction pressure is approximately 172 kPa (25 psi) or lower. The switch contacts will close when the suction pressure rises to approximately 276 kPa (40 psi) or above. Lower ambient temperatures, below approximately -1° C (30° F), will also cause the switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

DIAGNOSIS AND TESTING

A/C LOW PRESSURE SWITCH

Before performing diagnosis of the A/C low pressure switch, be certain that the switch is properly installed on the accumulator fitting. If the switch is not properly installed, it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure.

(1) Verify that the refrigerant system has the correct refrigerant charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) With gear selector in park or neutral and park brake set, start engine and allow to idle.

(3) Place the A/C-heater mode control switch in any A/C position.

(4) Raise hood and disconnect the wire harness connector from the A/C low pressure switch.

(5) Using a suitable jumper wire, install the wire between the two terminal cavities of the A/C low pressure switch wire harness connector. The A/C compressor clutch should engage.

(6) If the A/C compressor clutch does not engage, the A/C compressor clutch, A/C compressor clutch relay, A/C-heater mode control switch, A/C high pressure switch, PCM, fuses or related wiring circuits may be defective (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION - DIAGNOSIS AND TESTING).

(7) If the A/C compressor clutch does engage, connect a manifold gauge set to the low side refrigerant system service port (Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

(8) Check for continuity between the two terminals of the A/C low pressure switch. There should be continuity with a suction pressure reading of 276 kPa (40 psi) or above, and no continuity with a suction pressure reading of 172 kPa (25 psi) or below. If OK, test and repair the A/C compressor clutch, A/C compressor clutch relay, A/C-heater mode control switch, A/C high pressure switch, PCM, fuses or related wiring circuits as required. If not OK, replace the faulty A/C low pressure switch.

REMOVAL

NOTE: Note: It is not necessary to discharge the refrigerant system to replace the A/C low pressure switch.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the A/C low pressure switch (Fig. 16).

(3) Remove the A/C low pressure switch from the fitting on the top of the accumulator.

(4) Remove the O-ring seal from the accumulator fitting and discard.

INSTALLATION

NOTE: Replace the O-ring seal before installing the A/C low pressure switch.

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the accumulator fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

A/C LOW PRESSURE SWITCH (Continued)

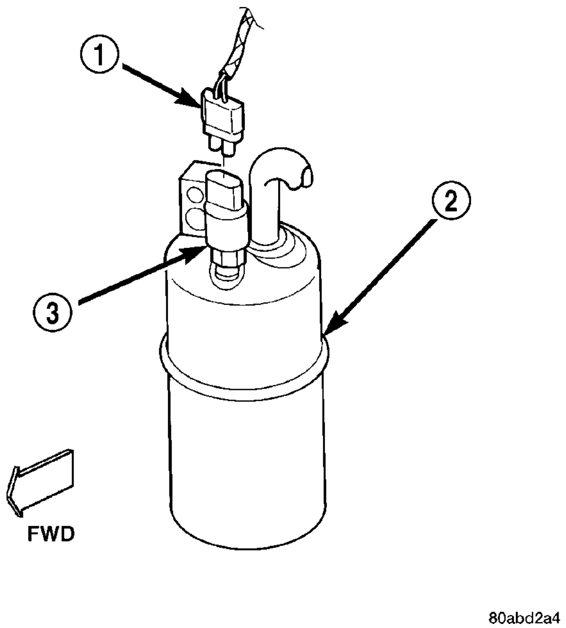

Fig. 16 A/C Low Pressure Switch - Typical

1 - WIRE HARNESS CONNECTOR
2 - ACCUMULATOR
3 - A/C LOW PRESSURE SWITCH

(2) Install and tighten the A/C low pressure switch on the accumulator fitting. The switch should be hand-tightened securely onto the accumulator fitting.

(3) Connect the wire harness connector to the A/C low pressure switch.

(4) Reconnect the battery negative cable.

BLEND DOOR ACTUATOR

DESCRIPTION

The blend door actuator is a motor/geartrain assembly which mechanically positions the blend door. The actuator is mounted to the bottom of the HVAC housing in the center.

OPERATION

The mode door actuator is connected to the A/C-heater control through the vehicle electrical system by a dedicated three-wire lead and connector of the HVAC wire harness. The mode door actuator can move the mode door in two directions. The position of the mode door actuator is controlled by a potentiometer in the A/C-heater control. The blend door actuator cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the electrical connector of blend door actuator (Fig. 17).

(3) Remove the three screws that secure the blend door actuator to the HVAC housing.

(4) Remove the blend door actuator from the HVAC housing.

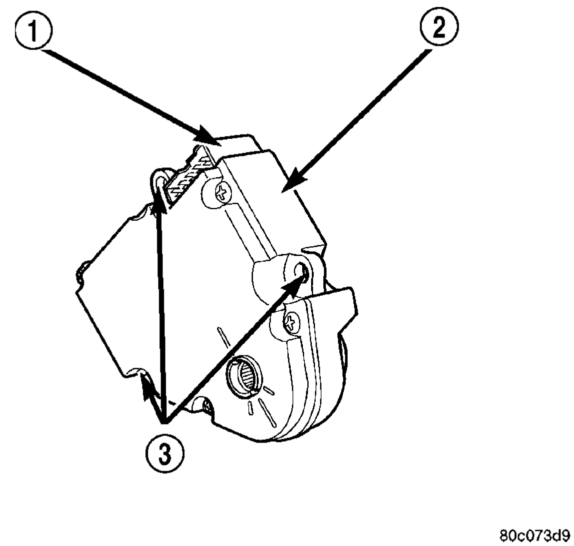

Fig. 17 Blend Door Actuator

1 - ELECTRICAL CONNECTOR
2 - BLEND DOOR ACTUATOR
3 - MOUNTING POINTS

INSTALLATION

(1) Position the blend door actuator onto the HVAC housing. If necessary, rotate the actuator slightly to align the splines on the actuator output sleeve with those on the blend door linkage.

(2) Install and tighten the screws that secures the blend door actuator to the housing. Tighten the screws to 1.1 N·m (10 in. lbs.).

(3) Connect the HVAC wire harness connector to the blend door actuator.

(4) Reconnect the battery negative cable.

BLOWER MOTOR RELAY

DESCRIPTION

The blower motor relay (Fig. 18) is a International Standards Organization (ISO)-type relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is a electromechanical device that switches battery current from a fuse in the power distribution center (PDC) directly to the blower motor. The relay is energized when the relay coil is provided a voltage signal by the ignition switch. The blower motor relay is located in the PDC in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for blower motor relay identification and location.

The blower motor relay cannot be adjusted or repaired. If the relay is damaged or faulty, it must be replaced.

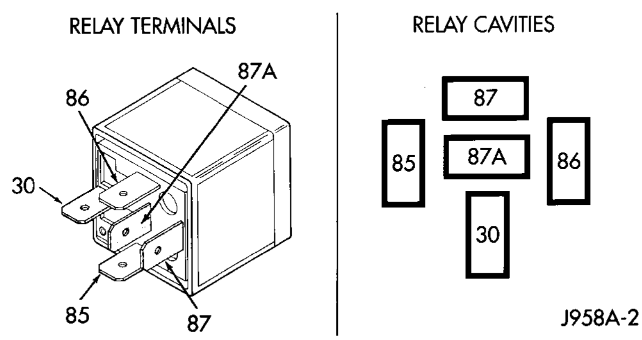

Fig. 18 Blower Motor Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

OPERATION

When the blower motor switch is in any position except off, and the ignition is turned on, the blower motor relay is energized and provides battery feed to the blower motor from a fuse in the Power Distribution Center (PDC) in the engine compartment.

The blower motor relay coil is controlled by a voltage signal from the A/C-heater control.

The blower motor relay is installed in a wire harness connector located near the passenger side outboard end of the HVAC housing in the passenger compartment, next to the HVAC wire harness connector.

Refer to the appropriate wiring information for diagnosis and testing of the blower motor relay and for complete HVAC wiring diagrams.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Locate the blower motor relay through the instrument panel glove box opening. The relay is mounted upright and to the right of the instrument panel harness (Fig. 19).

(4) Remove the blower motor relay from its wire harness connector.

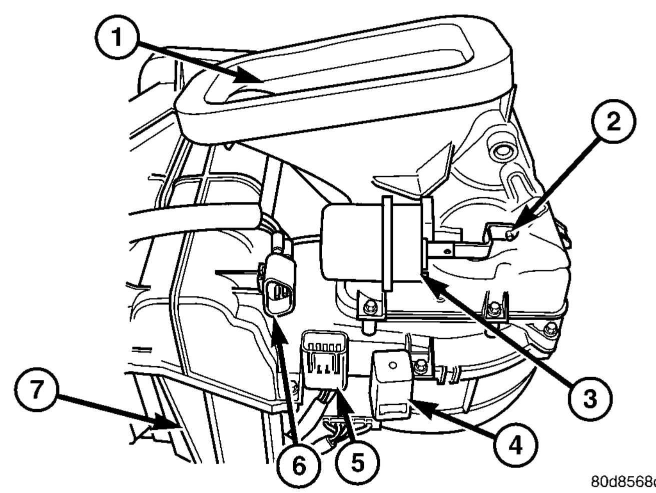

Fig. 19 Blower Motor Relay

1 - AIR INTAKE
2 - RECIRCULATION DOOR LINKAGE
3 - RECIRCULATION DOOR ACTUATOR
4 - BLOWER MOTOR RELAY
5 - HVAC ELECTRICAL CONNECTOR
6 - HVAC VACUUM CONNECTOR
7 - HVAC HOUSING

BLOWER MOTOR RELAY (Continued)

INSTALLATION

(1) Align the blower motor relay terminals with the terminal cavities in the wire harness connector.

(2) Push down firmly on the blower motor relay until the terminals are fully seated in the connector receptacles.

(3) Reinstall the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(4) Reconnect the battery negative cable.

BLOWER MOTOR RESISTOR BLOCK

DESCRIPTION

The blower motor resistor is mounted to the side of the HVAC housing near the blower motor on the passenger side of the vehicle behind the instrument panel. It can be accessed for service by removing the glove box from the instrument panel.

OPERATION

The resistor has multiple resistor wires, each of which will reduce the current flow to the blower motor to change the blower motor speed by changing the resistance in the blower motor ground path. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

BLOWER MOTOR RESISTOR BLOCK

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For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Disconnect the wire harness connector from the blower motor resistor block.

(4) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor, blower motor or blower motor relay as required. If not OK, replace the faulty blower motor resistor block.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: Stay clear of the blower motor and resistor block (Hot). Do not operate the blower motor with the resistor block removed.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Pull out the lock on the blower motor resistor wire harness connector to unlock the connector latch (Fig. 20).

BLOWER MOTOR RESISTOR BLOCK (Continued)

(4) Depress the latch on the blower motor resistor wire harness connector and disconnect the connector from the resistor.

(5) Remove the two screws that secure the blower motor resistor block to the HVAC housing.

(6) Remove the resistor block from the HVAC housing.

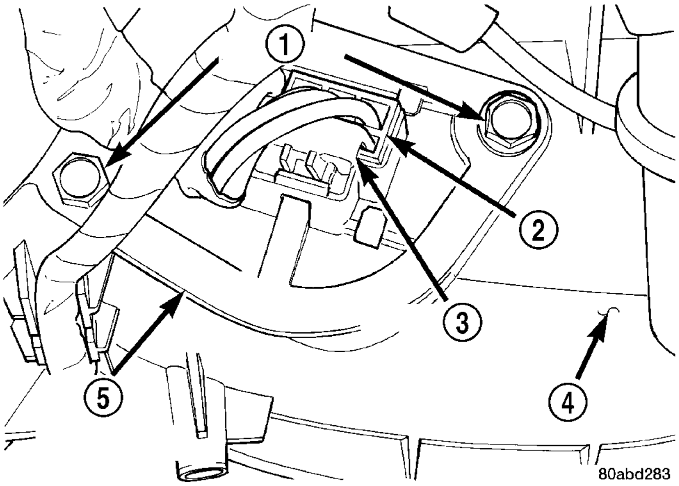

Fig. 20 Blower Motor Resistor Block- Typical

1 - SCREW (2)
2 - WIRE HARNESS CONNECTOR
3 - CONNECTOR LOCK
4 - HVAC HOUSING
5 - BLOWER MOTOR RESISTOR BLOCK

INSTALLATION

(1) Position the blower motor resistor block into the HVAC housing.

(2) Install the two screws that secure the resistor block to the HVAC housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Connect the wire harness connector to the resistor block.

(4) Push in the lock on the blower motor resistor wire harness connector to lock the connector latch.

(5) Install the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(6) Reconnect the battery negative cable.

BLOWER MOTOR SWITCH

DESCRIPTION

The blower motor for the heater-only or heater-A/C system is controlled by a rotary-type blower motor switch, mounted in the A/C-heater control panel. The switch allows the selection of four different blower motor speeds and includes an Off position.

OPERATION

The blower motor switch provides a blower motor ground path through the A/C-heater mode control switch. The blower motor switch directs this ground path through or around the blower motor resistor wires, as required to achieve the selected blower motor speed.

The blower motor switch cannot be repaired and, if faulty or damaged, it must be replaced. The blower motor switch knob is available for service replacement.

DIAGNOSIS AND TESTING

BLOWER MOTOR SWITCH

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the A/C-heater control from the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL). Check for continuity between the ground circuit cavity of the A/C-heater wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

BLOWER MOTOR SWITCH (Continued)

(3) With the A/C-heater control wire harness connector disconnected, place the A/C-heater mode control switch in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the A/C-heater control as you move the blower motor switch to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the A/C-heater control connector and the blower motor resistor as required. If not OK, replace the faulty A/C-heater control unit.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the blower motor switch knob off of the switch stem from the front of the A/C-heater control.

(3) Remove the A/C-heater control from the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).

(4) Remove the screw that secures the blower motor switch to the rear of the A/C-heater control (Fig. 21).

(5) Remove the blower motor switch from the A/C-heater control.

INSTALLATION

(1) Position the blower motor switch into the rear of the A/C-heater control.

(2) Install the screw that secures the blower motor switch to the A/C-heater control. Tighten the screw to 2.2 N·m (20 in. lbs.).

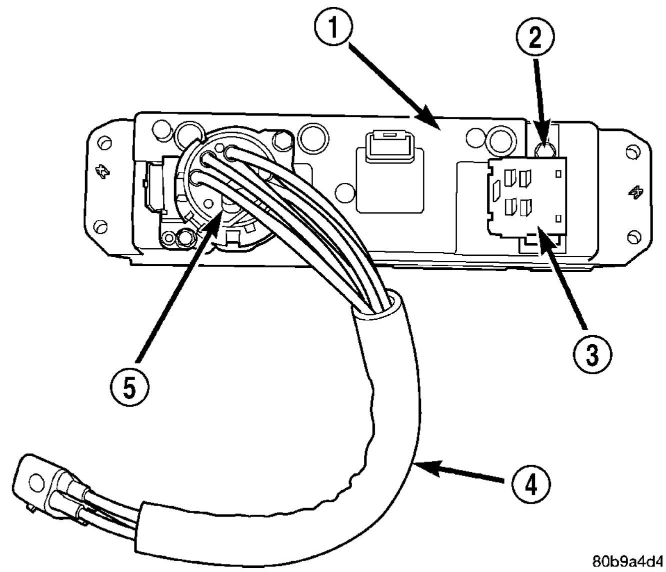

Fig. 21 Blower Motor Switch

1 - A/C-HEATER CONTROL
2 - SCREW
3 - BLOWER MOTOR SWITCH
4 - VACUUM HARNESS
5 - MODE CONTROL SWITCH

(3) Install the A/C-heater control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - INSTALLATION).

(4) Install the blower motor switch knob onto the switch stem on the front of the A/C-heater control.

(5) Reconnect the battery negative cable.

MODE DOOR ACTUATOR

DESCRIPTION

The actuators used to operate the defrost, floor and panel/demister doors in the HVAC housing are two-position vacuum operated. When vacuum is supplied by the A/C-heater control to the defrost, floor or panel/demister actuators, the actuator linkage is pulled into the actuator, which moves the mode door lever and mode door to one of the two positions. The actuator for the floor and panel/demister doors are spring loaded, so when vacuum is released from the actuator, the linkage moves the mode door back to its static position. The actuator for the defroster door is vacuum operated in both directions. The defrost, floor or panel/demister actuators are not serviceable and must be replaced if found to be defective.

MODE DOOR ACTUATOR (Continued)

REMOVAL

DEFROST DOOR ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knee blocker from the instrument panel.

(3) Unplug the two vacuum harness connectors from the defrost door actuator (Fig. 22).

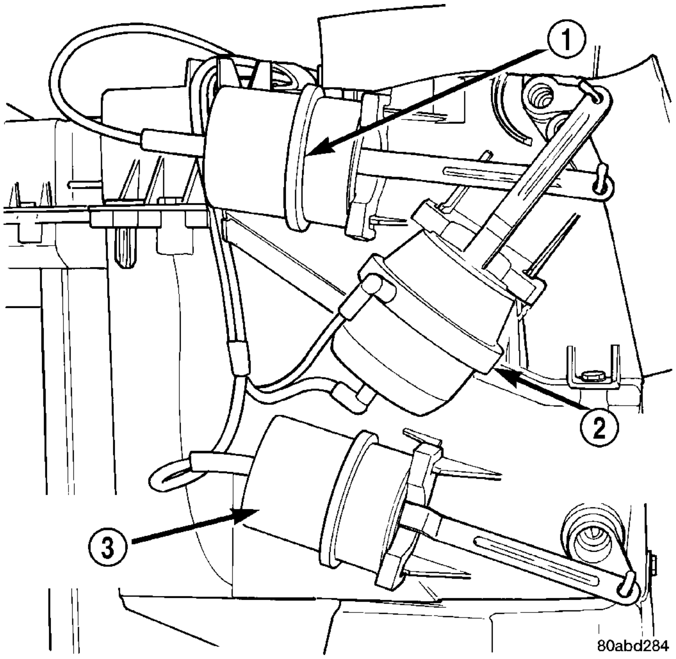

Fig. 22 Defrost, Floor, and Panel/Demist Door Vacuum Actuators - Typical

1 - PANEL/DEMIST DOOR ACTUATOR
2 - DEFROST DOOR ACTUATOR
3 - FLOOR DOOR ACTUATOR

(4) Insert a trim stick or another suitable wide flat-bladed tool into the latch hole on the HVAC housing actuator mount (Fig. 23). Gently pry the actuator latch while pulling firmly outwards on the actuator to remove the actuator from the mount.

(5) Rotate and tilt the vacuum actuator as required to disengage the hole on the end of the actuator link from the hooked pin on the end of the defrost door lever.

(6) Remove the defrost door vacuum actuator from the vehicle.

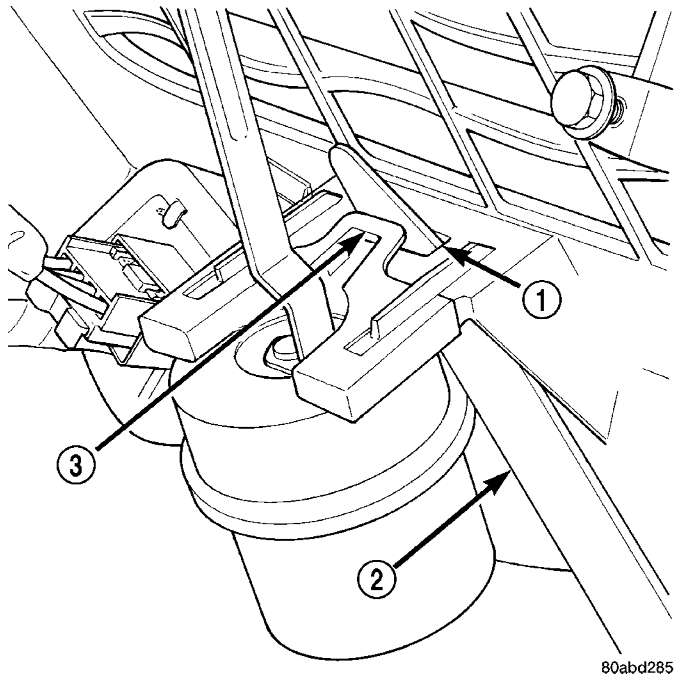

Fig. 23 Vacuum Actuator Remove/Install - Typical

1 - ACTUATOR MOUNT LATCH HOLE
2 - TRIM STICK
3 - ACTUATOR LATCH

FLOOR DOOR ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knee blocker from the instrument panel.

MODE DOOR ACTUATOR (Continued)

(3) Remove the defrost door actuator from the HVAC housing.

(4) Unplug the vacuum harness connector from the floor door actuator (Fig. 22).

(5) Insert a trim stick or another suitable wide flat-bladed tool into the latch hole on the HVAC housing actuator mount (Fig. 23). Gently pry the actuator latch while pulling firmly outwards on the actuator to remove the actuator from the mount.

(6) Rotate and tilt the vacuum actuator as required to disengage the hole on the end of the actuator link from the hooked pin on the end of the floor door lever.

(7) Remove the floor door vacuum actuator from the vehicle.

PANEL/DEMIST DOOR ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knee blocker from the instrument panel.

(3) Unplug the vacuum harness connector from the panel/demist door actuator (Fig. 22).

(4) Remove the push nut fastening the panel/demist door vacuum actuator linkage to the panel/demist door lever.

(5) Insert a trim stick or another suitable wide flat-bladed tool into the latch hole on the HVAC housing actuator mount (Fig. 23). Gently pry the actuator latch while pulling firmly outwards on the actuator to remove the actuator from the mount.

(6) Remove the panel/demist door vacuum actuator from the vehicle.

INSTALLATION

DEFROST DOOR ACTUATOR

(1) Rotate and tilt the vacuum actuator as required to engage the hole on the end of the actuator link to the hooked pin on the end of the defrost door lever.

(2) Push the actuator onto the mounting boss until its snaps into the locked position.

(3) Connect the two vacuum hoses to the actuator.

(4) Install the instrument panel knee blocker.

(5) Reconnect the battery negative cable.

FLOOR DOOR ACTUATOR

(1) Rotate and tilt the vacuum actuator as required to engage the hole on the end of the actuator link to the hooked pin on the end of the floor door lever.

(2) Push the actuator onto the mounting boss until it snaps into the locked position.

(3) Connect the vacuum hose to the actuator.

(4) Install the defrost door actuator.

(5) Install the instrument panel knee blocker.

(6) Reconnect the battery negative cable.

PANEL/DEMIST DOOR ACTUATOR

(1) Push the actuator onto the mounting boss until it snaps into the locked position.

(2) Engage the hole on the end of the actuator link to the pin on the end of the panel/demist door lever and install the push nut.

(3) Connect the vacuum hose to the actuator.

(4) Install the instrument panel knee blocker.

(5) Reconnect the battery negative cable.

RECIRCULATION DOOR ACTUATOR

DESCRIPTION

The actuator used to operate the recirculation door in the HVAC housing is two-position vacuum operated. When vacuum is supplied by the A/C-heater mode control to the recirculation door actuator, the actuator linkage is pulled into the actuator, which moves the recirculation door lever and door to the recirculation position. The actuator is spring loaded, so when vacuum is released from the actuator, the linkage moves the recirculation door back to its static position.

The recirculation door actuator is not serviceable and must be replaced if found to be defective.

RECIRCULATION DOOR ACTUATOR (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The recirculation door and actuator are used only on models equipped with air conditioning.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Remove the dash side panel (end cap).

(4) Remove the speaker.

(5) Remove the right vent duct.

(6) Unplug the vacuum harness connector from the recirculation door actuator (Fig. 24).

(7) Insert a trim stick or another suitable wide flat-bladed tool into the latch hole on the HVAC housing actuator mount (Fig. 25). Gently pry the actuator latch while pulling firmly outwards on the actuator to remove the actuator from the mount.

(8) Rotate and tilt the vacuum actuator as required to disengage the hole on the end of the actuator link from the hooked pin on the end of the recirculation door lever.

(9) Remove the recirculation door vacuum from the vehicle.

INSTALLATION

(1) Rotate and tilt the vacuum actuator as required to engage the hole on the end of the actuator link to the hooked pin on the end of the recirculation door lever.

(2) Push the actuator onto the mounting boss until it snaps into the locked position.

(3) Connect the vacuum hose to the actuator.

(4) Install the right vent duct.

(5) Install the speaker.

(6) Install the dash side panel (end cap).

(7) Install the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(8) Reconnect the battery negative cable.

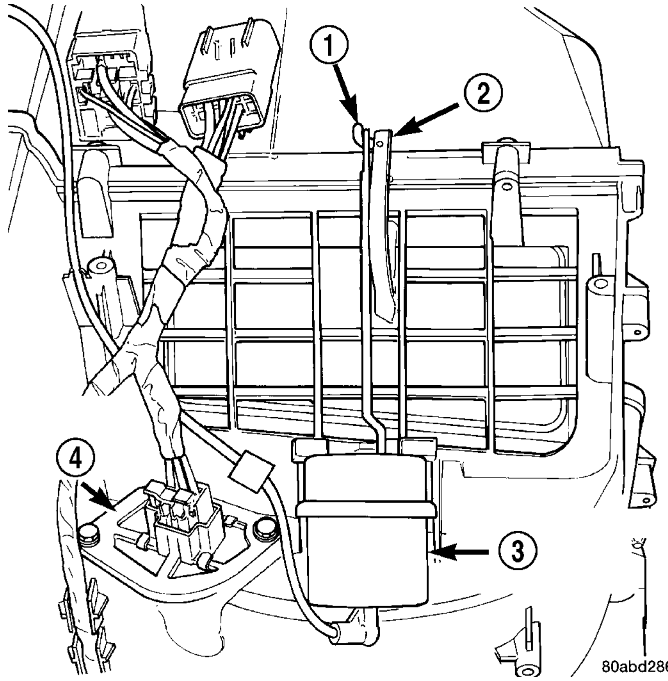

Fig. 24 Recirculation Door Actuator - Typical

1 - HOOKED PIN
2 - RECIRCULATION DOOR LEVER
3 - RECIRCULATION DOOR ACTUATOR
4 - BLOWER MOTOR RESISTOR BLOCK

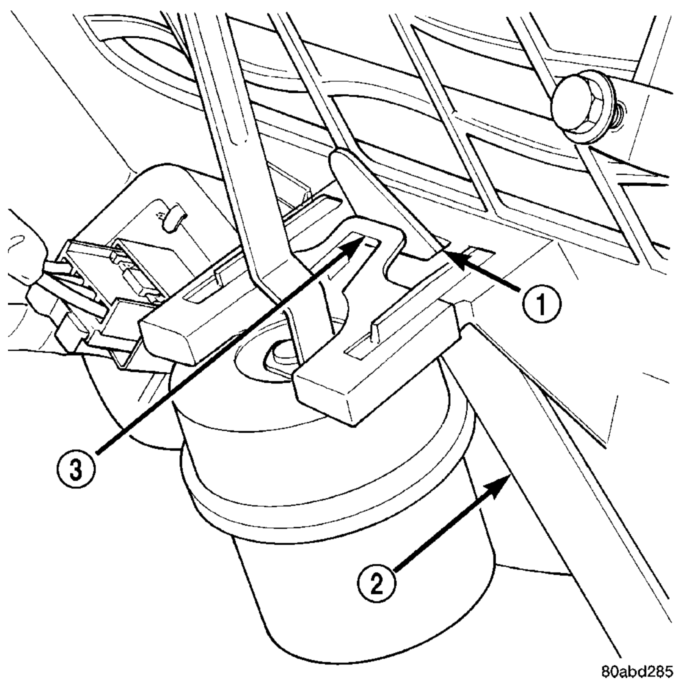

Fig. 25 Vacuum Actuator Remove/Install - Typical

1 - ACTUATOR MOUNT LATCH HOLE
2 - TRIM STICK
3 - ACTUATOR LATCH

VACUUM CHECK VALVE

DESCRIPTION

Two vacuum check valves are installed in the accessory vacuum supply system. One is on the accessory vacuum supply line in the engine compartment, near the vacuum tap on the engine intake manifold. A second vacuum check valve is located at the HVAC system takeout. The vacuum check valves are designed to allow vacuum to flow in only one direction through the vacuum supply circuits.

OPERATION

The use of the two vacuum check valves help to maintain the system vacuum needed to retain the selected A/C-heater mode settings. The check valves prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

The vacuum check valves cannot be repaired and, if faulty or damaged, must be replaced.

REMOVAL

NOTE: Note the orientation of the check valves in the vacuum supply line for correct reinstallation.

(1) Remove the vacuum check valve from the fitting at the engine intake manifold and the accessory vacuum supply line (Fig. 26).

(2) Remove the vacuum check valve from the HVAC vacuum supply line fitting and the accessory vacuum supply line.

INSTALLATION

(1) Using the orientation noted when removed, plug the vacuum check valve into the HVAC vacuum supply line fitting and the accessory vacuum supply line.

(2) Using the orientation noted when removed, plug the vacuum check valve into the fitting at the engine intake manifold and the accessory vacuum supply line.

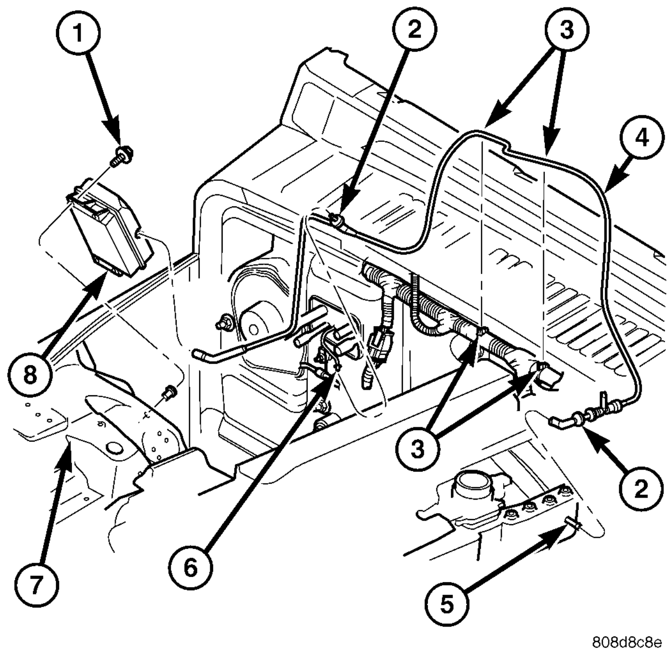

Fig. 26 Vacuum Check Valves - Typical

1 - SCREW
2 - VACUUM CHECK VALVE (2)
3 - VACUUM LINE RETAINER (2)
4 - ACCESSORY VACUUM SUPPLY LINE
5 - ENGINE VACUUM FITTING
6 - HVAC VACUUM SUPPLY LINE
7 - INNER FENDER
8 - VACUUM RESERVOIR

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is mounted to the rear of the right front inner fender wheelhouse in the engine compartment, under the battery tray. The battery and battery tray must be removed from the vehicle to access the vacuum reservoir for service.

OPERATION

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Remove the battery and battery tray from the engine compartment (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).

(2) Unplug the accessory vacuum supply line from the vacuum reservoir (Fig. 27).

(3) Remove the one screw that secures the reservoir to the inner fender panel.

(4) Remove the vacuum reservoir from the engine compartment.

INSTALLATION

(1) Position the vacuum reservoir into the engine compartment.

(2) Install the screw that secures the reservoir to the inner fender panel. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Connect the accessory vacuum supply line to the vacuum reservoir.

(4) Install the battery tray and battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION) and (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

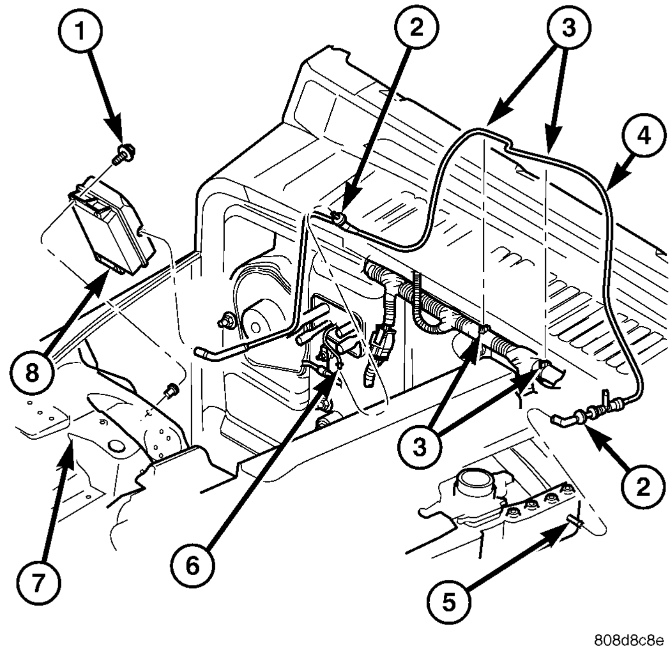

Fig. 27 Vacuum Reservoir - Typical

1 - SCREW
2 - VACUUM CHECK VALVE (2)
3 - VACUUM LINE RETAINER (2)
4 - ACCESSORY VACUUM SUPPLY LINE
5 - ENGINE VACUUM FITTING
6 - HVAC VACUUM SUPPLY LINE
7 - INNER FENDER
8 - VACUUM RESERVOIR

DISTRIBUTION

TABLE OF CONTENTS

AIR OUTLETS

DESCRIPTION

There are four panel outlets in the instrument panel, one located near each outboard end of the instrument panel facing the rear of the vehicle, and two located near the top of the instrument panel center bezel. The air outlets can be removed individually for service replacement.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The instrument panel air outlets are retained into the outlet housings by a light snap fit.

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel air outlet(s) out of the panel outlet housing(s).

INSTALLATION

(1) Position the air outlet(s) onto the outlet housing(s).

(2) Gently push the air outlet into the housing until it snaps into position.

BLEND DOOR

REMOVAL

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(1) Remove the HVAC housing from the vehicle (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(3) Lift the blend door pivot shaft out of the actuator and pivot hole in the bottom of the lower half of the HVAC housing (Fig. 1).

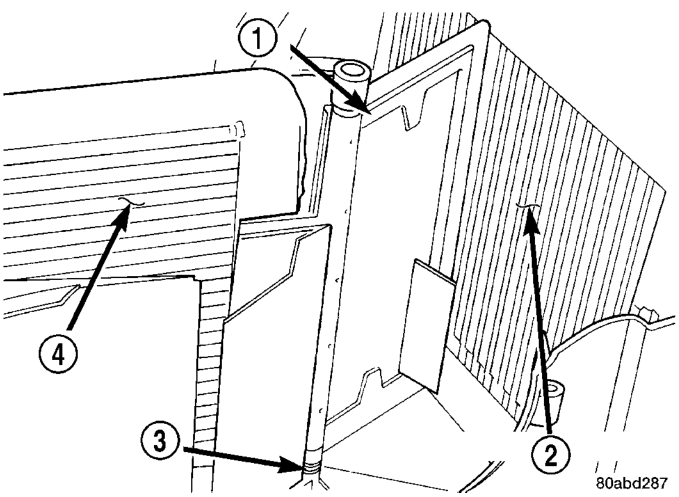

Fig. 1 Blend Door - Typical

1 - BLEND DOOR
2 - EVAPORATOR COIL
3 - PIVOT HOLE
4 - HEATER CORE

INSTALLATION

(1) Position the blend door pivot shaft into the pivot hole and actuator in the bottom of the lower half of the HVAC housing.

(2) Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY).

(3) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

BLOWER MOTOR

DESCRIPTION

The blower motor and blower wheel are located in the passenger side end of the HVAC housing, below the glove box. The blower motor controls the velocity of air flowing through the HVAC housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and wheel can be removed from inside the vehicle without removing the instrument panel or HVAC housing.

OPERATION

The blower motor will operate only when the ignition switch is in the On position, and with the A/C-heater mode control switch in any position, except Off. The blower motor receives a fused battery feed through the blower motor relay whenever the ignition switch is in the On position. The blower motor battery feed circuit is protected by a fuse in the Power Distribution Center (PDC). Blower motor speed is controlled by regulating the ground path through the blower motor switch and the blower motor resistor.

The blower motor and blower wheel are serviced only as a unit and cannot be repaired and, if faulty or damaged, must be replaced.

BLOWER MOTOR (Continued)

DIAGNOSIS AND TESTING

BLOWER MOTOR

BLOWER MOTOR INOPERATIVE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring, diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

BLOWER MOTOR ELECTRICAL DIAGNOSIS

Refer to the Blower Motor Electrical Diagnosis chart for basic checks of the blower motor circuit (Fig. 2).

BLOWER MOTOR NOISE OR VIBRATION

Refer to the Blower Motor Noise/Vibration Diagnosis chart for basic checks of the blower motor when a vibration or noise is present (Fig. 3).

BLOWER MOTOR (Continued)

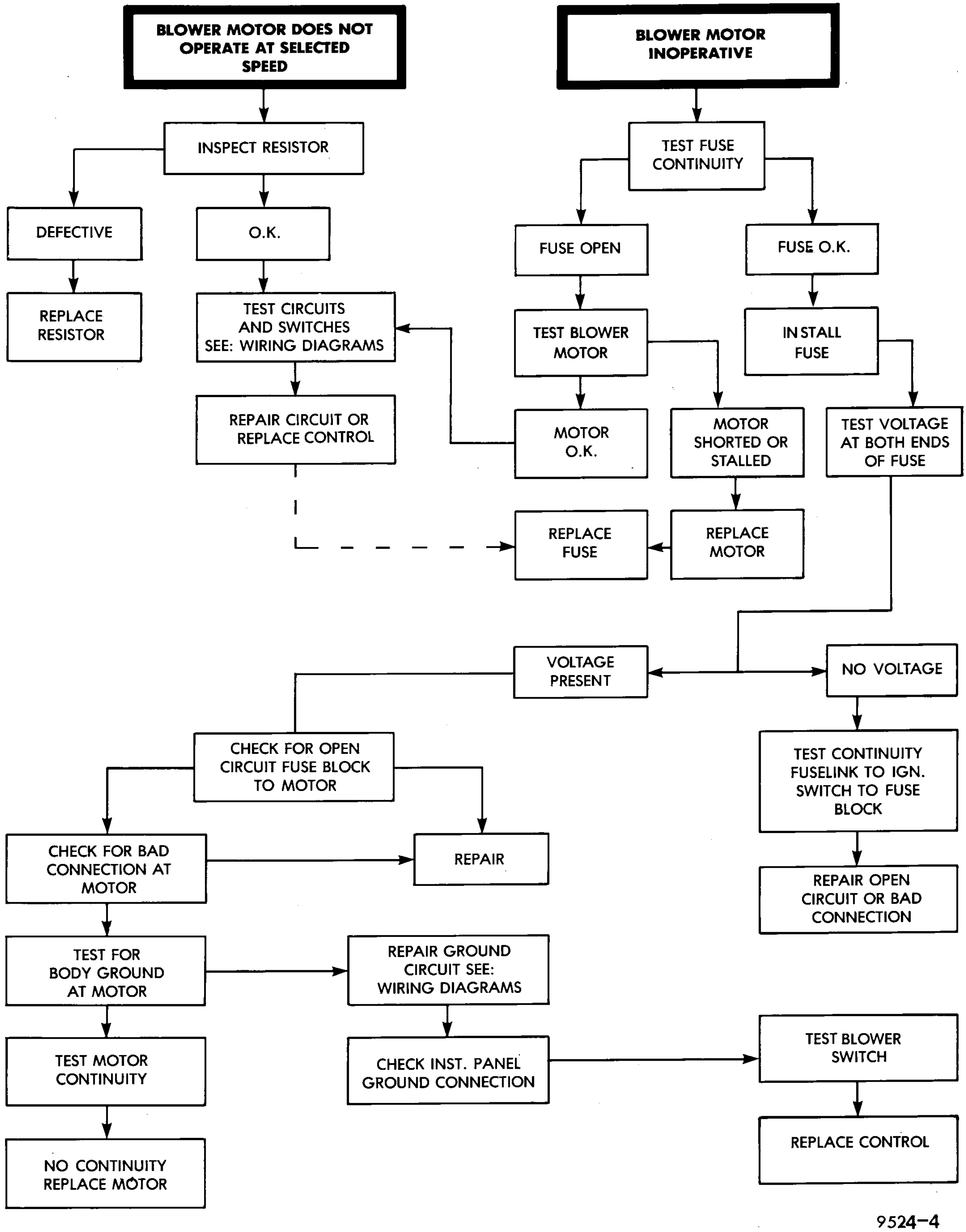

Fig. 2 Blower Motor Electrical Diagnosis

BLOWER MOTOR (Continued)

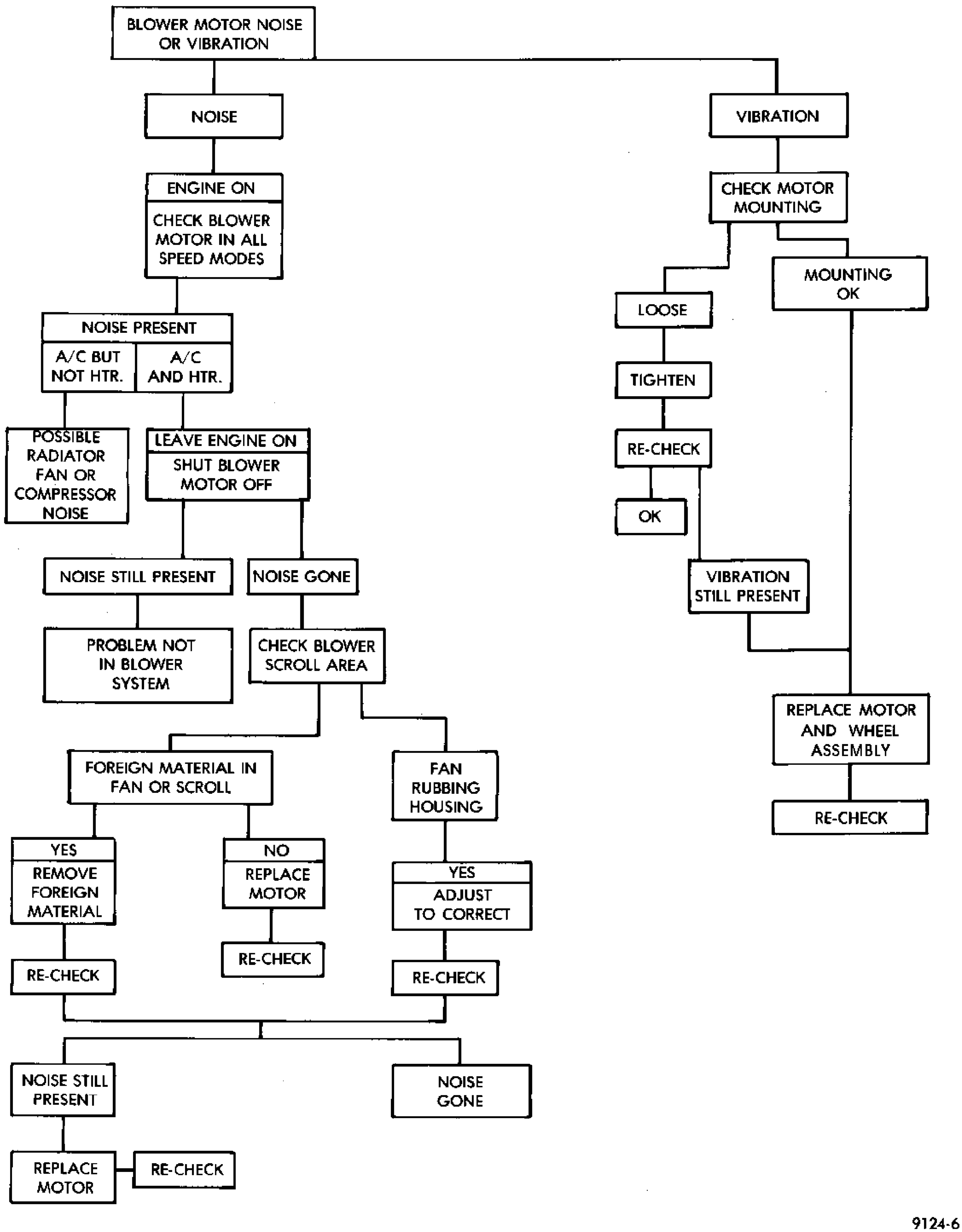

Fig. 3 Blower Motor Noise/Vibration Diagnosis

BLOWER MOTOR (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The blower motor is located on the passenger side of the vehicle under the dash. The blower motor can be removed from the vehicle without having to remove the HVAC housing.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the blower motor wire harness connector (Fig. 4).

(3) Release blower motor retainer-locking tab and rotate blower motor counterclockwise.

(4) Remove blower motor from the HVAC housing.

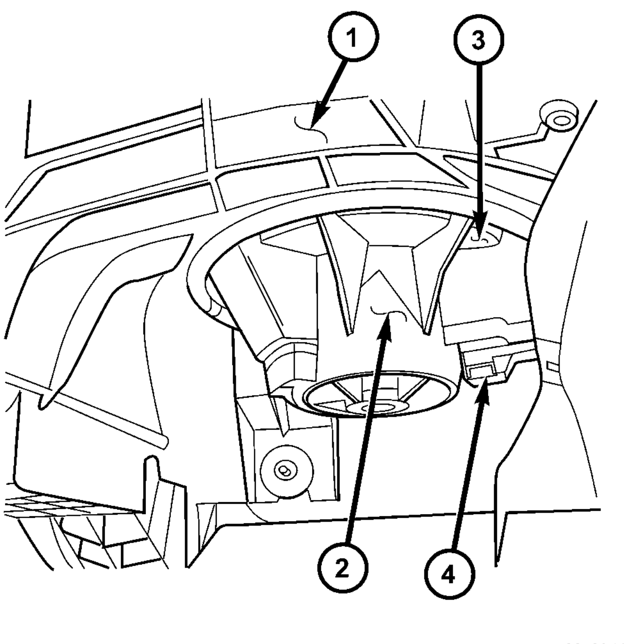

Fig. 4 HVAC Blower Motor - Typical

1 - HVAC HOUSING
2 - BLOWER MOTOR
3 - RETAINER-LOCKING TAB
4 - WIRE HARNESS CONNECTOR

INSTALLATION

NOTE: Failure to install the blower motor assembly correctly could result in an air leak or the blower motor assembly becoming completely disengaged from the HVAC housing.

(1) Align and install the blower motor into the HVAC housing.

(2) Rotate the blower motor until all of the locking tabs have secured the blower motor assembly to the HVAC housing.

(3) Connect the wire harness connector to the blower motor.

(4) Reconnect the battery negative cable.

(5) Test the blower motor for proper installation by turning the blower motor speed to its fastest position and checking around the outer edges of the blower assembly for air leaks. If any air leaks are found, remove and reinstall the blower motor.

DEFROSTER DUCT

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(2) Remove the two nuts that secure the defroster duct to the studs on the dash panel (Fig. 5).

(3) Remove the defroster duct from the studs on the dash panel.

DEFROSTER DUCT (Continued)

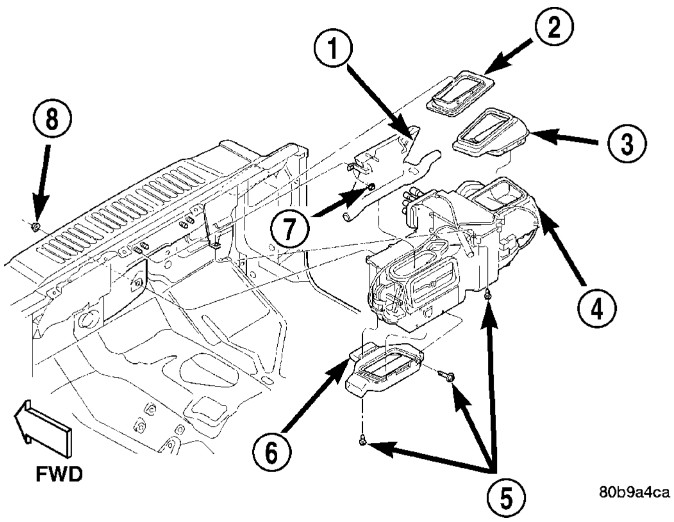

Fig. 5 Defroster Duct - LHD Shown, RHD Typical

1 - DEFROSTER DUCT
2 - COLLAR
3 - FRESH AIR DUCT
4 - HVAC HOUSING
5 - SCREW
6 - FLOOR DUCT
7 - NUT (2)
8 - NUT (5)

INSTALLATION

(1) Install the defroster duct onto the dash panel studs.

(2) Install the two push-nuts that secure the defroster duct on the studs.

(3) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

FLOOR DISTRIBUTION DUCT

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(2) Remove the three screws that secure the floor distribution duct to the bottom of the HVAC housing (Fig. 6).

(3) Remove the screw that secures the floor distribution duct to the side of the HVAC housing.

(4) Slide the floor duct out from under the HVAC housing.

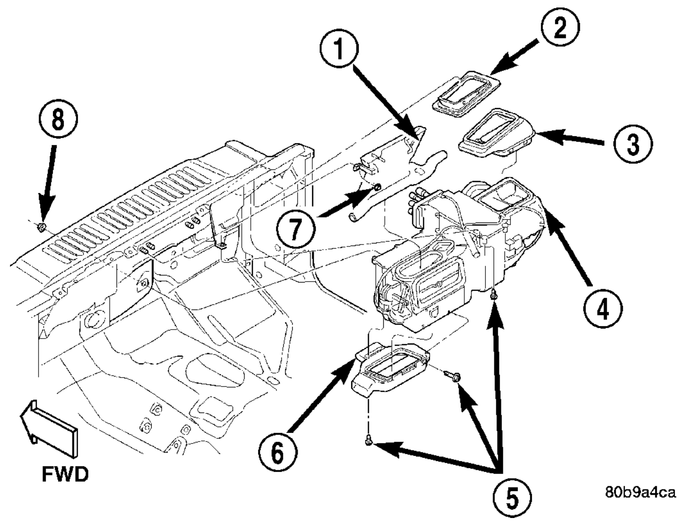

Fig. 6 Floor Distribution Duct - LHD Shown, RHD Typical

1 - DEFROSTER DUCT
2 - COLLAR
3 - FRESH AIR DUCT
4 - HVAC HOUSING
5 - SCREW
6 - FLOOR DUCT
7 - NUT (2)
8 - NUT (5)

INSTALLATION

(1) Position the floor distribution duct to the bottom of the HVAC housing.

(2) Install the screw that secures the floor distribution duct to the side of the HVAC housing. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Install the three screws that secure the floor distribution duct to the bottom of the HVAC housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

(5) Reconnect the battery negative cable.

HVAC HOUSING

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The HVAC housing must be removed from the vehicle and the two halves of the housing separated for service access of the heater core, evaporator coil, blend door, and each of the various mode doors.

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is not equipped with air conditioning, go to Step 5. If the vehicle is equipped with air conditioning, recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(3) Disconnect the liquid refrigerant line fitting from the evaporator inlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - REMOVAL). Discard the O-ring seal and install plugs in, or tape over the opened liquid refrigerant line fitting and evaporator inlet tube.

(4) Disconnect the accumulator inlet fitting from the evaporator outlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - REMOVAL). Discard the O-ring seal and install plugs in, or tape over the opened accumulator inlet fitting and evaporator outlet tube.

(5) Drain the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(6) Disconnect the heater hoses from the heater core tubes. Install plugs in, or tape over the opened heater core tubes.

(7) Unplug the HVAC system vacuum supply line connector from the tee fitting near the heater core tubes.

(8) Remove the five nuts from the HVAC housing mounting studs in the engine compartment. If necessary, loosen the battery hold-downs and reposition the battery for additional access (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

(9) Remove the cowl plenum drain tube from the HVAC housing mounting stud on the dash panel directly behind the engine cylinder head.

(10) Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(11) Remove the floor distribution duct from the bottom of the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - REMOVAL).

(12) Remove the screw that secures the HVAC housing to the dash panel bracket located on the passenger side of vehicle (Fig. 7).

(13) Pull the HVAC housing down far enough to clear the defroster and fresh air ducts, and rearward far enough for the mounting studs and the evaporator condensate drain tube to clear the dash panel.

(14) Remove the HVAC housing from the vehicle.

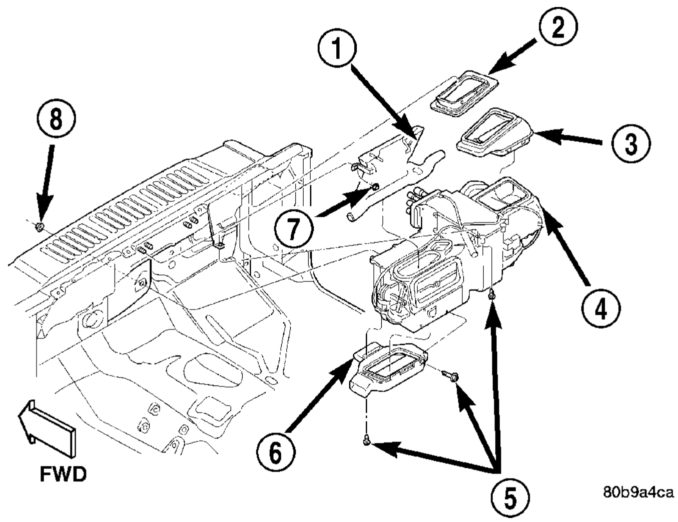

Fig. 7 HVAC Housing - LHD Shown, RHD Typical

1 - DEFROSTER DUCT
2 - COLLAR
3 - FRESH AIR DUCT
4 - HVAC HOUSING
5 - SCREW
6 - FLOOR DUCT
7 - NUT (2)
8 - NUT (5)

DISASSEMBLY

(1) Remove the HVAC housing from the vehicle and place it on a work bench (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Unplug the vacuum harness connectors from the panel/demist door actuator, defrost door actuator, floor door actuator and recirculation door actuator (if equipped) (Fig. 8).

HVAC HOUSING (Continued)

(3) Disengage the vacuum harness from any routing clips located on the lower half of the HVAC housing.

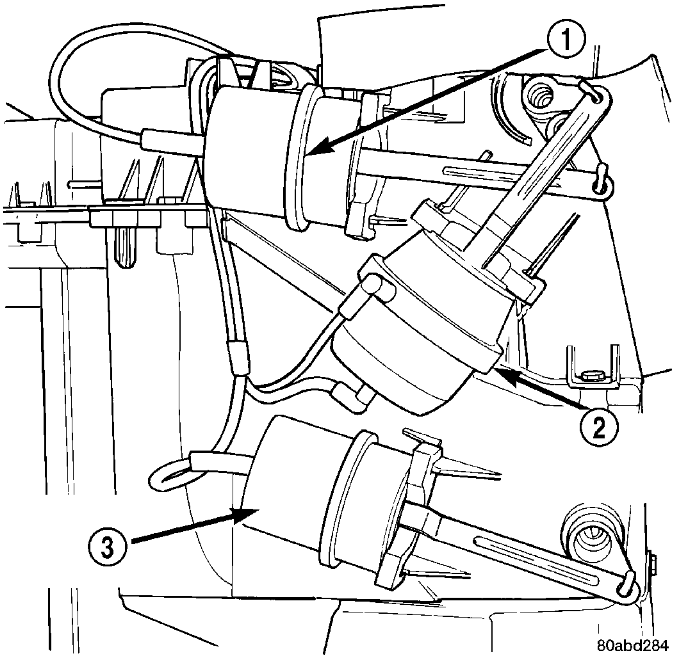

Fig. 8 Defrost, Floor, and Panel/Demist Door Vacuum Actuators - Typical

1 - PANEL/DEMIST DOOR ACTUATOR
2 - DEFROST DOOR ACTUATOR
3 - FLOOR DOOR ACTUATOR

(4) Disengage the HVAC wire harness connector and the blower motor relay wire harness connector push-in retainers from their mounting holes in the HVAC housing.

(5) Remove the blower motor from the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/BLOWER MOTOR - REMOVAL).

(6) Pull the vacuum supply line and connector through the foam seal on the heater core and evaporator coil tube mounting flange (Fig. 9).

(7) Remove the screw that secures the evaporator tube clamp and remove the clamp from the evaporator tubes.

(8) Carefully remove the foam seal from the heater core and evaporator coil tubes and mounting flange of the HVAC housing. If the seal is deformed or damaged, it must be replaced.

(9) Remove the two snap clips that help secure the upper and lower HVAC housing halves together.

(10) Remove the screws that secure the upper and lower HVAC housing halves to each other and those that hold the recirculation housing to the upper housing.

(11) Carefully separate the recirculation housing and the upper HVAC housing half from the lower housing.

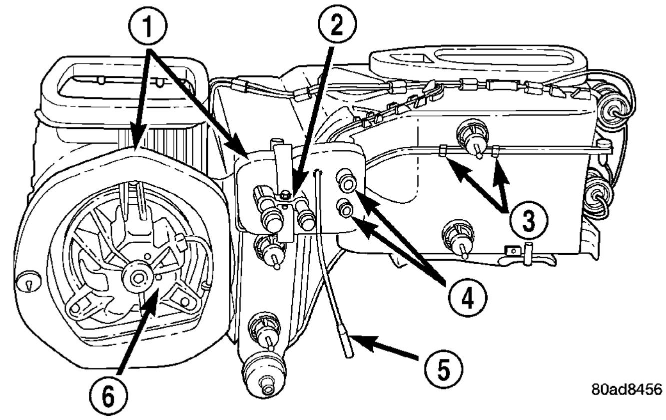

Fig. 9 HVAC Housing Disassembly - Typical

1 - FOAM SEALS
2 - EVAPORATOR TUBE CLAMP
3 - CLIPS
4 - HEATER CORE TUBES
5 - VACUUM SUPPLY LINE
6 - BLOWER MOTOR

ASSEMBLY

(1) Position the upper HVAC housing to the lower housing. During assembly, be certain of the following:

(a) That each of the mode door pivot shaft ends is properly engaged in its pivot hole.

(b) If the unit is equipped with air conditioning, that the evaporator coil tube rubber seal is properly positioned in the grooves in both the upper and lower HVAC housing halves.

(2) Install the screws that secure the upper and lower HVAC housing halves to each other and those that hold the recirculation housing to the upper housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the two snap clips that help secure the upper and lower HVAC housing halves together.

(4) Install the foam seals on the heater core and evaporator coil tubes and mounting flange of the HVAC housing.

(5) If the unit is equipped with air conditioning, reinstall the evaporator tube clamp and retaining screw. Tighten the screw to 2.2 N·m (20 in. lbs.).

(6) Insert the vacuum supply line and connector through the foam seal on the heater core and evaporator coil tube mounting flange.

(7) Install the blower motor (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/BLOWER MOTOR - INSTALLATION).

(8) Engage the HVAC wire harness connector and blower motor relay wire harness connector push-in retainers in the mounting holes of the HVAC housing.

HVAC HOUSING (Continued)

(9) Engage the vacuum harness to the routing clips located on the lower half of the HVAC housing.

(10) Plug in the vacuum harness connectors to the panel/demist door actuator, defrost door actuator, floor door actuator and recirculation door actuator (if equipped).

INSTALLATION

(1) Position the HVAC housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes, and that the openings on the top of the housing are properly aligned with the defroster and fresh air ducts.

(2) Install and tighten the screw that secures the HVAC housing to the dash panel bracket on the passenger side of the vehicle. Tighten the screw to 3.4 N·m (30 in. lbs.).

(3) Install the floor distribution duct to the bottom of the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - INSTALLATION).

(4) Install the cowl drain tube onto the HVAC housing mounting stud on the dash panel directly behind the engine cylinder head.

(5) Install and tighten the five nuts onto the HVAC housing mounting studs in the engine compartment. Tighten the nuts to 6.2 N·m (55 in. lbs.).

(6) Install the instrument panel in the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

(7) If the battery was repositioned during the removal procedure, position the battery and tighten the hold-downs (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

(8) Connect the HVAC system vacuum supply line connector to the tee fitting near the heater core tubes.

(9) Unplug or remove the tape from the heater core tubes and connect the heater hoses to the heater core tubes.

(10) Fill the engine cooling system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/HEATER CORE - INSTALLATION).

(11) If the vehicle is not equipped with air conditioning, go to Step 15. If the vehicle is equipped with air conditioning, unplug or remove the tape from the accumulator inlet tube fitting and the evaporator outlet tube. Using a new O-ring seal, connect the accumulator inlet tube fitting to the evaporator outlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - INSTALLATION).

(12) Unplug or remove the tape from the liquid line fitting and the evaporator inlet tube. Using a new O-ring seal, connect the liquid line to the evaporator inlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - INSTALLATION).

(13) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(14) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(15) Reconnect the battery negative cable.

(16) Start the engine and check for proper operation of the heating and air conditioning systems.

INSTRUMENT PANEL DEMISTER DUCTS

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel to gain access to the passenger side demister hose (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(3) Remove the knee blocker from the instrument panel to gain access to the driver side demister hose (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - REMOVAL).

(4) Reach through the glove box opening and/or the steering column opening of the instrument panel and disconnect the demister hose(s) from the demister outlet(s) and the defroster duct (Fig. 10).

INSTRUMENT PANEL DEMISTER DUCTS (Continued)

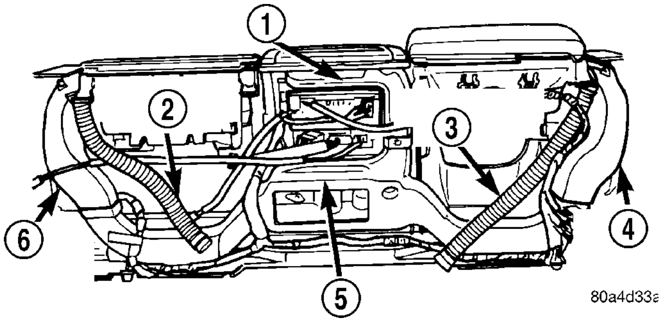

Fig. 10 Instrument Panel Ducts - LHD Shown, RHD Typical

1 - CENTER PANEL DUCT
2 - DEMISTER HOSE
3 - DEMISTER HOSE
4 - END PANEL DUCT
5 - MAIN PANEL DUCT
6 - END PANEL DUCT

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Reach through the glove box opening and/or the steering column opening of the instrument panel to connect the demister hose(s) to the demister outlet(s) and the defroster duct.

(2) If removed, install the knee blocker (Refer to 23 - BODY/INSTRUMENT PANEL/KNEE BLOCKER - INSTALLATION).

(3) If removed, install the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL DUCTS

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the instrument panel from the vehicle (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(2) Remove the demister hoses from the demister outlets (Fig. 11).

(3) Remove the two screws that secure the main panel duct to the instrument panel.

(4) Remove the one screw that secures each end panel duct and/or the center panel duct to the instrument panel.

(5) Remove the instrument panel ducts as necessary from the instrument panel

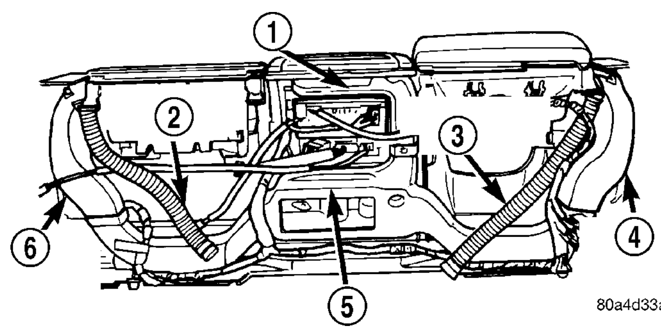

Fig. 11 Instrument Panel Ducts - LHD Shown, RHD Typical

1 - CENTER PANEL DUCT
2 - DEMISTER HOSE
3 - DEMISTER HOSE
4 - END PANEL DUCT
5 - MAIN PANEL DUCT
6 - END PANEL DUCT

INSTRUMENT PANEL DUCTS (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the instrument panel ducts into the instrument panel.

(2) Install the screw that secures each end panel duct and/or the center panel duct to the instrument panel. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Install the two screws that secure the main panel duct to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the demister hoses to the demister outlets.

(5) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

(6) Reconnect the battery negative cable.

MODE DOOR

REMOVAL

DEFROST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Remove the defrost door actuator (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR ACTUATOR - REMOVAL).

(3) Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(4) Remove the defrost door from the HVAC housing (Fig. 12).

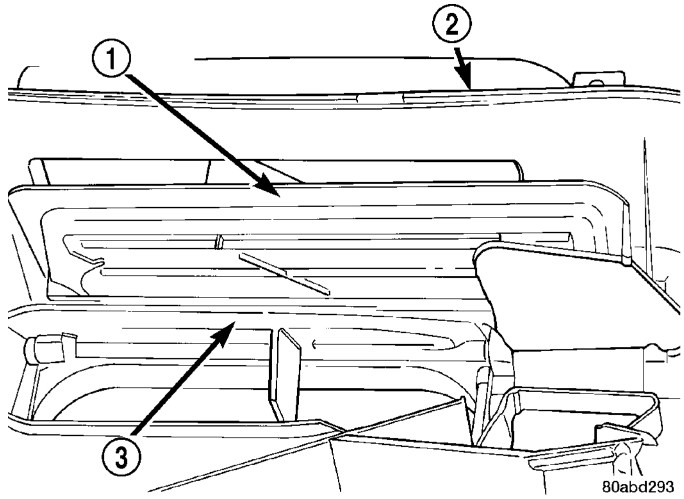

Fig. 12 Panel/Demist and Defrost Doors - Typical

1 - PANEL/DEMIST DOOR
2 - UPPER HVAC HOUSING
3 - DEFROST DOOR

FLOOR DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Remove the floor door actuator (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR ACTUATOR - REMOVAL).

(3) Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

MODE DOOR (Continued)

(4) Remove the floor door lever located on the outside of the lower half of the HVAC housing from the floor door pivot shaft.

(5) Reach inside the lower half of the HVAC housing and lift out the floor door.

PANEL/DEMIST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - REMOVAL).

(2) Remove the defrost and panel/demist door actuators (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR ACTUATOR - REMOVAL).

(3) Disassemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - DISASSEMBLY).

(4) Insert a screwdriver into the latch hole (Fig. 13) of the panel/demist door pivot shaft to release the latch of the panel door lever.

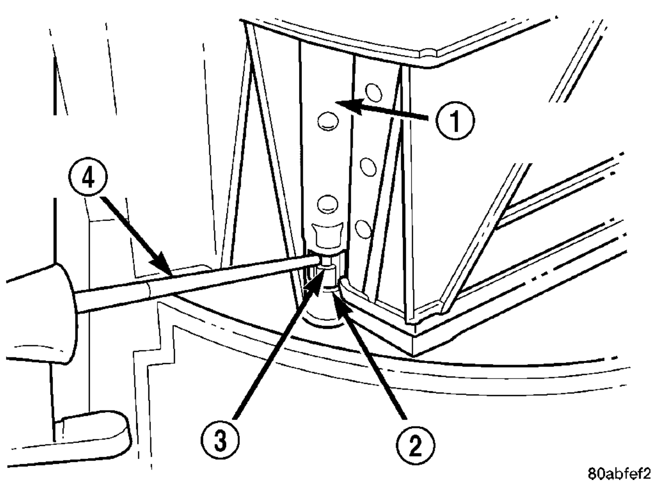

Fig. 13 Panel Door Lever - Typical

1 - DOOR PIVOT SHAFT
2 - LATCH HOLE
3 - CRANK ARM LATCH
4 - FLAT BLADE PRY TOOL

(5) Remove the panel door lever located on the outside of the lower half of the HVAC housing from the pivot shaft.

(6) Reach inside the lower half of the HVAC housing and lift out the panel/demist door (Fig. 12).

INSTALLATION

DEFROST DOOR

(1) Position the defrost door inside the lower half of the HVAC housing.

(2) Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - ASSEMBLY).

(3) Install the defrost door actuator (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ MODE DOOR ACTUATOR - INSTALLATION).

(4) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

FLOOR DOOR

(1) Position the floor door inside the lower half of the HVAC housing.

(2) Install the floor door lever onto the floor door pivot shaft.

(3) Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - ASSEMBLY).

(4) Install the floor door actuator (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/ MODE DOOR ACTUATOR - INSTALLATION).

(5) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

PANEL/DEMIST DOOR

(1) Position the panel/demist door inside the lower half of the HVAC housing.

(2) Install the panel lever onto the pivot shaft of the panel door in the lower half of the HVAC housing.

(3) Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - ASSEMBLY).

(4) Install the panel/demist and defrost door actuators (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR ACTUATOR - INSTALLATION).

(5) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

RECIRCULATION AIR DOOR

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: The recirculation air door is only servicable by replacing the complete air intake housing assembly.

PLUMBING

TABLE OF CONTENTS

PLUMBING

DESCRIPTION

The refrigerant lines and hoses are used to carry the refrigerant between the various A/C system components. A barrier hose design with a nylon tube, which is sandwiched between rubber layers, is used for the R-134a A/C system on this vehicle. This nylon tube helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum or steel, and commonly use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire A/C system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

OPERATION

High pressures are produced in the refrigerant system when the A/C compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

WARNING

ENGINE COOLING SYSTEM

WARNING: The engine cooling system is designed to develop internal pressures of 97 to 123 kilopascals (14 to 18 pounds per square inch). Do not remove or loosen the coolant pressure cap, cylinder block drain plugs, radiator drain, radiator hoses, heater hoses, or hose clamps while the engine cooling system is hot and under pressure. Allow the vehicle to cool for a minimum of 15 minutes before opening the cooling system for service. Failure to observe this warning can result in serious burns from the heated engine coolant.

A/C SYSTEM

WARNING: The A/C system contains refrigerant under high pressure. Repairs should only be performed by qualified service personnel. Severe personal injury or death may result from improper service procedures.

Avoid breathing the refrigerant and refrigerant oil vapor or mist. Exposure may irritate the eyes, nose, and/or throat. Wear eye protection when servicing the air conditioning refrigerant system. Serious eye injury can result from direct contact with the refrigerant. If eye contact occurs, seek medical attention immediately.

Do not expose the refrigerant to open flame. Poisonous gas is created when refrigerant is burned. An electronic leak detector is recommended.

If accidental system discharge occurs, ventilate the work area before resuming service. Large amounts of refrigerant released in a closed work area will displace the oxygen and cause suffocation and death.

The evaporation rate of R-134a refrigerant at average temperature and altitude is extremely high. As a result, anything that comes in contact with the refrigerant will freeze. Always protect the skin or delicate objects from direct contact with the refrigerant.

The R-134a service equipment or the vehicle refrigerant system should not be pressure tested or leak tested with compressed air. Some mixtures of air and R-134a have been shown to be combustible at elevated pressures. These mixtures are potentially dangerous, and may result in fire or explosion causing property damage, personal injury or death.

PLUMBING (Continued)

CAUTION

CAUTION: Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.
Never add R-12 to a refrigerant system designed to use R-134a and do not use R-12 equipment or parts on the R-134a system. They are not compatible and damage to the refrigerant system will result.
Do not overcharge the refrigerant system. Overcharging will cause excessive compressor head pressure and can cause noise and system failure.
Recover the refrigerant before removing any secondary retaining clips, if equipped. Recover the refrigerant before opening any fitting or connection.
Before disconnecting a refrigerant line or hose, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system. Open the fittings with caution, even after the system has been discharged.
Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system. Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.
The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities.
Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.
All tools, including the refrigerant dispensing manifold, manifold gauge set and test hoses should be kept clean and dry. Keep the work area clean. Contamination of the refrigerant system must be avoided to ensure proper A/C system operation.

CAUTION: The use of A/C system sealers may result in damage to A/C refrigerant recovery/evacuation/recharging equipment and/or A/C systems.
Many federal, state/provincial and local regulations prohibit the recharge of A/C systems with known leaks. DaimlerChrysler recommends the detection of A/C system leaks through the use of approved leak detectors and fluorescent leak detection dyes.
Vehicles found with A/C system sealers should be treated as contaminated and replacement of the entire A/C refrigerant system is recommended. A/C systems found to be contaminated with A/C system sealers, A/C stop-leak products or seal conditioners voids the warranty for the A/C system.

DIAGNOSIS AND TESTING

REFRIGERANT SYSTEM LEAKS

WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.
AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-134a. This is accomplished by performing a system Charge Level-Check or Fill. If while performing this test A/C liquid line pressure is less than 345 kPa (50 psi) proceed to System Empty procedure. If liquid line pressure is greater than 345 kPa (50 psi) proceed to System Low procedure. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. A review of the fittings, lines and components for oily residue is an indication of the leak location. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

SYSTEM EMPTY

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (approximately 28 in Hg.). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed to Step 2.
(2) Prepare a 0.284 Kg. (10 oz.) refrigerant charge to be injected into the refrigerant system.
(3) Connect and dispense 0.284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.
(4) Proceed to Step 2 of System Low procedure.

SYSTEM LOW

(1) Determine if there is any R-134a refrigerant in the system.

PLUMBING (Continued)

(2) Position the vehicle in a wind free work area. This will aid in detecting small leaks.

(3) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run for five minutes with the A/C system set to the following:

- Transmission in Park or Neutral with parking brake set
- Engine idling
- Mode control set to the outside air position
- Blower control set to the high speed position
- A/C set to the ON position
- All windows open

CAUTION: A leak detector only designed for R-12 refrigerant will not detect leaks in a R-134a refrigerant system.

(4) Shut the vehicle Off and wait 2-7 minutes. Then use an electronic leak detector that is designed to detect R-134a refrigerant and search for leaks. Fittings, lines or components that appear to be oily usually indicate a refrigerant leak. To inspect the A/C evaporator for leaks, insert the leak detector probe into the drain tube opening or an air outlet. A dye for R-134a is available to aid in leak detection. Use only DaimlerChrysler approved refrigerant dye.

STANDARD PROCEDURE

REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED BEFORE CONNECTING TO, OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used (Fig. 1). Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

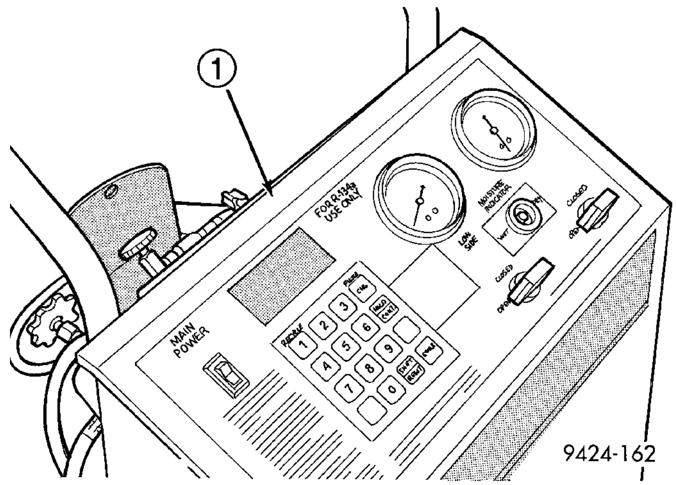

Fig. 1 Refrigerant Recovery/Recycling Station - Typical

1 - R-134a REFRIGERANT STATION

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 2). The service hoses on the gauge set being used should have manual (turn wheel), or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

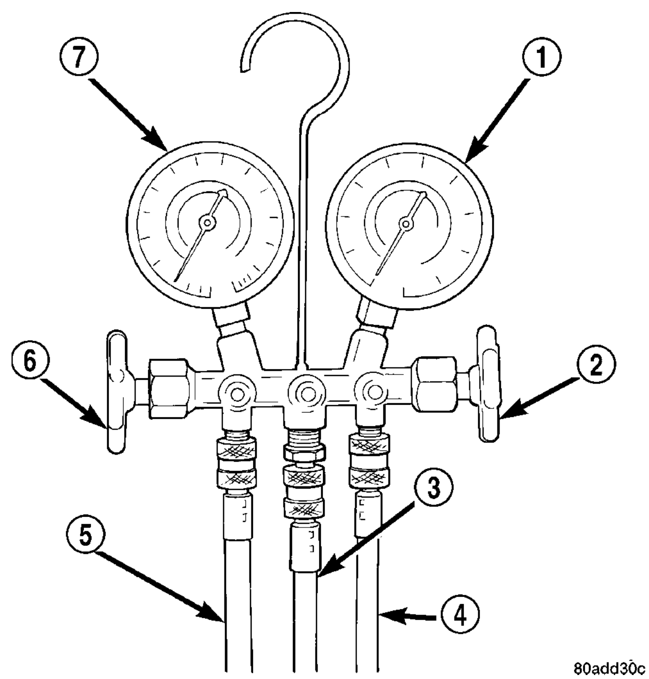

Fig. 2 Manifold Gauge Set - Typical

1 - HIGH PRESSURE GAUGE
2 - VALVE
3 - VACUUM/REFRIGERANT HOSE (YELLOW W/BLACK STRIPE)
4 - HIGH PRESSURE HOSE (RED W/BLACK STRIPE)
5 - LOW PRESSURE HOSE (BLUE W/BLACK STRIPE)
6 - VALVE
7 - LOW PRESSURE GAUGE

PLUMBING (Continued)

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

LOW PRESSURE GAUGE HOSE The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the liquid line near the evaporator inlet tube at the rear of the engine compartment.

HIGH PRESSURE GAUGE HOSE The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the manifold directly over the discharge port of the compressor.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE The center manifold hose (Yellow, or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

REFRIGERANT CHARGE LEVEL TEST

WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.
R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

NOTE: Refer to the underhood HVAC specification tag for the proper charge level.

The procedure below should be used to check the refrigerant charge level in the air conditioning system.

It is recommended to use a manifold gauge set or reclaim/recycle equipment.

(1) Use a manifold gauge set and check the liquid line pressure.

(2) Attach a clamp-on thermocouple to the liquid line near the evaporator.

(3) The vehicle must be in the following modes:

- Automatic transmission in park or manual transmission in neutral.
- Engine at idle
- A/C mode control set to outside air
- A/C mode control set to panel mode
- A/C temperature control set to full cool
- Blower motor control set on highest speed
- Vehicle windows closed

(4) Operate the A/C system for at least two minutes to allow the system to stabilize.

(5) Observe liquid line pressure and temperature. Using the Charge Determination Chart (Fig. 3) determine where the system is currently operating. If the system is not in the proper range, reclaim all the refrigerant and recharge per A/C label.

REFRIGERANT SYSTEM RECOVERY

WARNING: (Refer to 24 - HEATING & AIR CONDITIONING - WARNING) AND (Refer to 24 - HEATING & AIR CONDITIONING - CAUTION) BEFORE PERFORMING THIS OPERATION.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM EVACUATE

NOTE: Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

If a compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

PLUMBING (Continued)

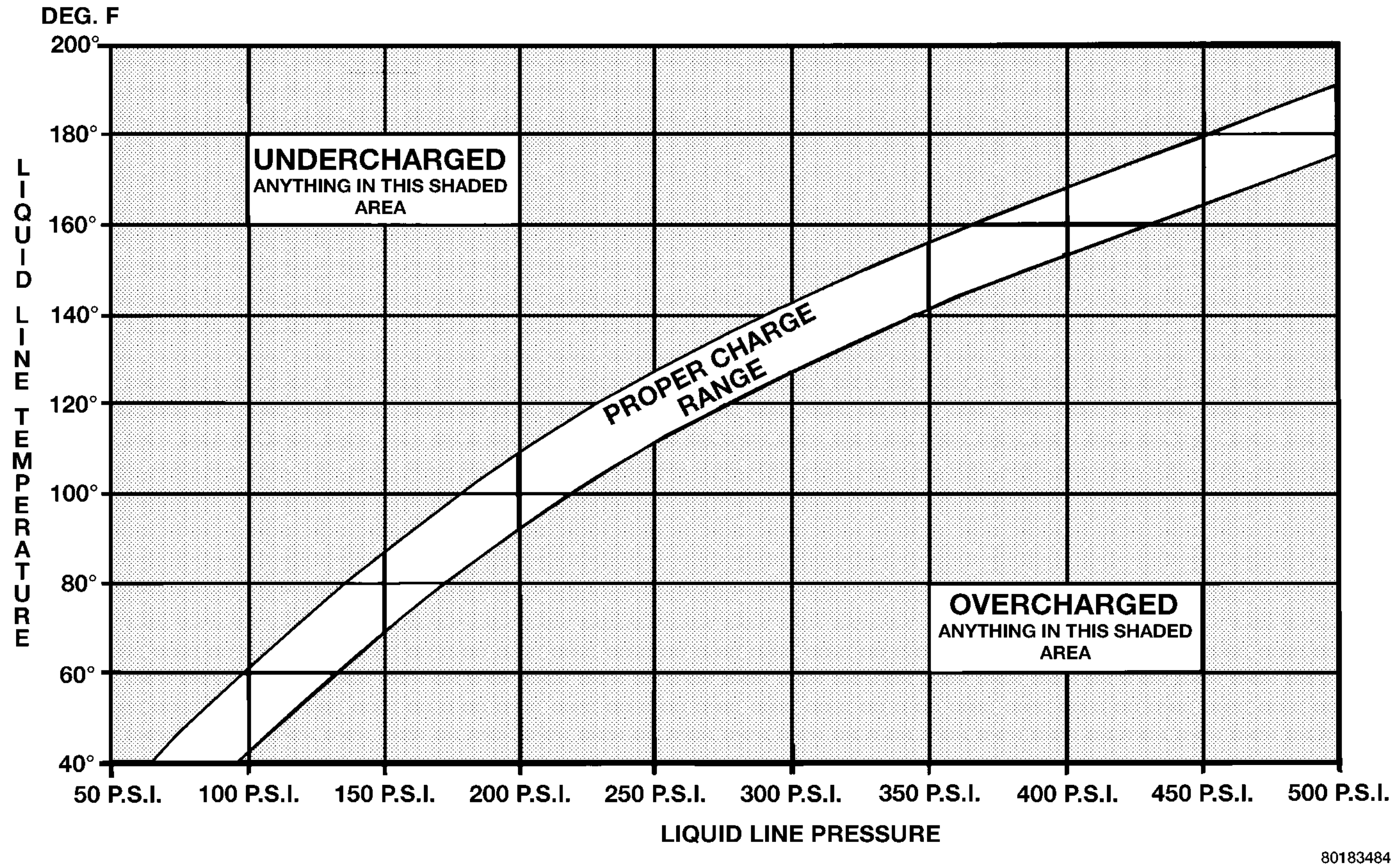

Fig. 3 Charge Determination Chart

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

(1) Recover the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Connect a suitable charging station, refrigerant recovery machine or a manifold gauge set with vacuum pump and refrigerant recovery equipment.

(3) Open the suction and discharge valves and start the vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge to eliminate all moisture in system. When the suction gauge reads -88 kPa (- 26 in. Hg) vacuum or greater for 30 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

(4) Close all valves. Turn off and disconnect the vacuum pump.

(5) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

PLUMBING (Continued)

REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW SAFETY PRECAUTIONS AND WARNINGS IN THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

CAUTION: A small amount of refrigerant oil is removed from the A/C system each time the refrigerant system is recovered and evacuated. Before charging the A/C system, you MUST replenish any oil lost during the recovery process. Refer the equipment manufacturer instructions for more information.

CAUTION: Do not overcharge refrigerant system, as excessive compressor head pressure can cause noise and system failure.

After the system has been tested for leaks and evacuated, a refrigerant (R-134a) charge can be injected into the system.

NOTE: When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

The procedure below should be used to fill the refrigerant charge in the air conditioning system. This A/C system does not have or use a sight glass to check or charge the system.

(1) If using a separate vacuum pump close all valves before disconnecting pump. Connect manifold gauge set to the A/C service ports.

NOTE: Always refer to the underhood HVAC Specification label for the refrigerant fill level of the vehicle being serviced.

(2) Measure refrigerant (refer to capacities). Refer to the instructions provided with the equipment being used.

(3) Verify engine is shut off. Open the suction and discharge valves. Open the charge valve to allow the refrigerant to flow into the system. When the transfer of refrigerant has stopped, close the suction and discharge valve.

(4) If all of the charge did not transfer from the dispensing device, put vehicle controls into the following mode:

- Automatic transmission in park or manual transmission in neutral
- Engine at idle
- A/C mode control set to outside air
- A/C mode control set to panel mode
- A/C temperature control set to full cool
- Blower motor control set on highest speed
- Vehicle windows closed

If the A/C compressor does not engage, test the compressor clutch control circuit and correct any failure (Refer to 8 - ELECTRICAL/WIRING DIAGRAM INFORMATION - DIAGNOSIS AND TESTING).

(5) Open the suction valve to allow the remaining refrigerant to transfer to the system.

WARNING: TAKE CARE NOT TO OPEN THE DISCHARGE (HIGH-PRESSURE) VALVE AT THIS TIME.

(6) Close all valves and test the A/C system performance.

(7) Disconnect the charging station or manifold gauge set. Install the service port caps.

A/C COMPRESSOR

DESCRIPTION

A/C COMPRESSOR

The A/C system uses a Denso 10PA17 seven cylinder, reciprocating wobble plate-type A/C compressor on all models. This A/C compressor has a fixed displacement of 150 cubic centimeters (9.375 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the A/C compressor.

HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor manifold. This mechanical valve is designed to vent refrigerant from the A/C system to protect against damage to the A/C compressor and other A/C system components, caused by a restriction in air flow through the A/C condenser or, an overcharge of refrigerant.

A/C COMPRESSOR (Continued)

OPERATION

A/C COMPRESSOR

The A/C compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The A/C compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The A/C compressor draws in low-pressure refrigerant vapor from the A/C evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor. The A/C compressor pumps the high-pressure refrigerant vapor to the A/C condenser through the compressor discharge port.

The A/C compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley and clutch coil are available for service.

HIGH PRESSURE RELIEF VALVE

The high pressure relief valve vents the A/C system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The high pressure relief valve closes when a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the A/C system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the A/C system. If the valve vents refrigerant, it does not mean that the valve is faulty.

The high pressure relief valve is factory-calibrated. The high pressure relief valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The high pressure relief valve is only serviced as a part of the A/C compressor.

DIAGNOSIS AND TESTING

A/C COMPRESSOR NOISE

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - DIAGNOSIS AND TESTING) before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap(Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - INSTALLATION).

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(5) If the noise is from opening and closing of the high pressure relief valve, reclaim, evacuate and recharge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE). If the high pressure relief valve still does not seat properly, replace the compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).

(6) If the noise is from liquid slugging on the suction line, replace the accumulator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/ACCUMULATOR - REMOVAL) and check the refrigerant oil level and the refrigerant system charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE).

(7) If the liquid slugging condition continues following accumulator replacement, replace the compressor and repeat Step 1.

A/C COMPRESSOR (Continued)

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) or (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL) 4.0L.

(4) Disconnect the compressor clutch coil wire harness connector.

(5) Depending on the engine usage, remove the bolts or nuts that secure the suction and discharge line fittings to the compressor. Install plugs in, or tape over all of the opened refrigerant line fittings and compressor ports (Fig. 4).

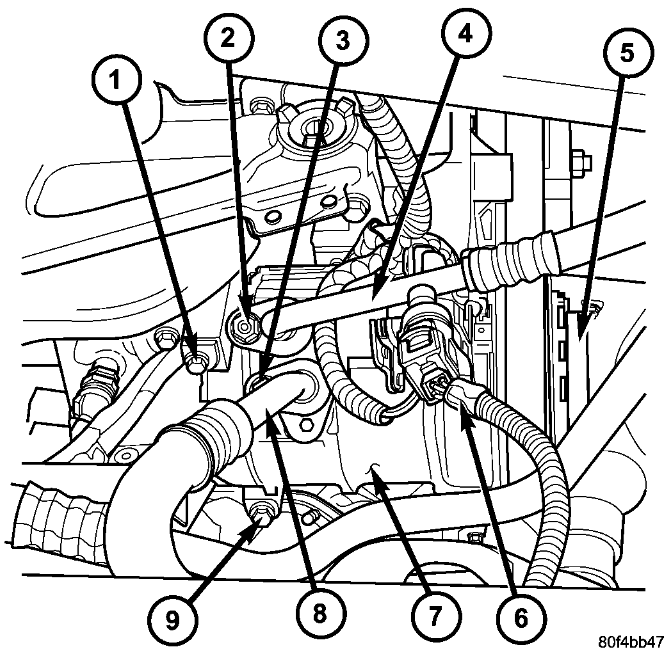

Fig. 4 Compressor and Lines – 2.4L Shown, 4.0L Typical

1 - UPPER COMPRESSOR MOUNTING BOLTS (2)
2 - DISCHARGE LINE NUT
3 - SUCTION LINE NUT
4 - DISCHARGE LINE
5 - A/C COMPRESSOR CLUTCH
6 - A/C HIGH PRESSURE SWITCH
7 - A/C COMPRESSOR
8 - SUCTION LINE
9 - LOWER COMPRESSOR MOUNTING BOLTS (2)

(6) Remove the bolts and nuts that secure the compressor and brackets (Fig. 5) or (Fig. 6).

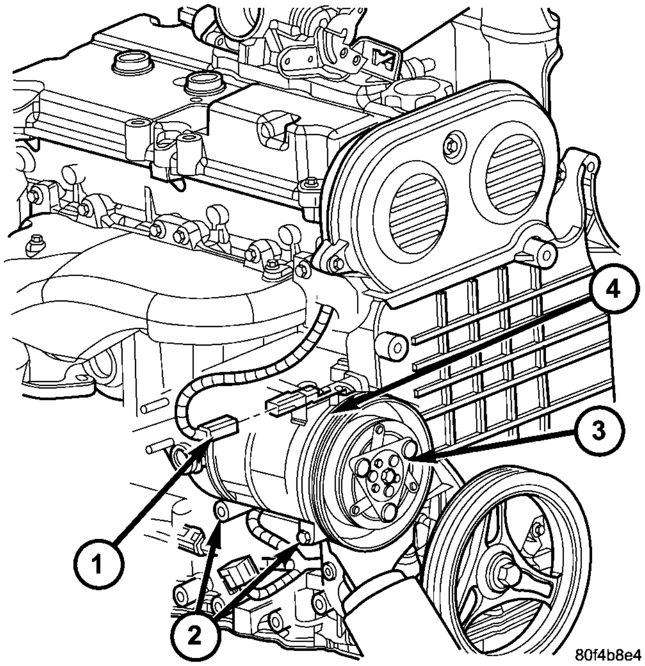

Fig. 5 A/C Compressor - 2.4L Engine

1 - A/C CLUTCH WIRE HARNESS CONNECTOR
2 - LOWER COMPRESSOR MOUNTING BOLTS (2)
3 - A/C COMPRESSOR AND CLUTCH ASSEMBLY
4 - UPPER COMPRESSOR MOUNTING BOLTS (2)

(7) Remove the A/C compressor from the engine compartment.

INSTALLATION

NOTE: If a replacement compressor is being installed, be certain to check the refrigerant oil level. See Refrigerant Oil Level in this group for the procedures. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(1) Position the A/C compressor into the engine compartment.

(2) Install the bolts that secure the compressor.

- Tighten the 4.0L bolts fastening the compressor to the cylinder block to 45-65 N·m (35-50 ft. lbs.).
- Tighten the 4.0L bolts fastening the rear brace to the compressor and cylinder block to 40-55 N·m (30-40 ft. lbs.).
- Tighten the 2.4L bolts fastening the compressor to the cylinder block to 28 N·m (21 ft. lbs.).

(3) Remove the tape or plugs from the opened refrigerant line fittings and compressor ports.

A/C COMPRESSOR (Continued)

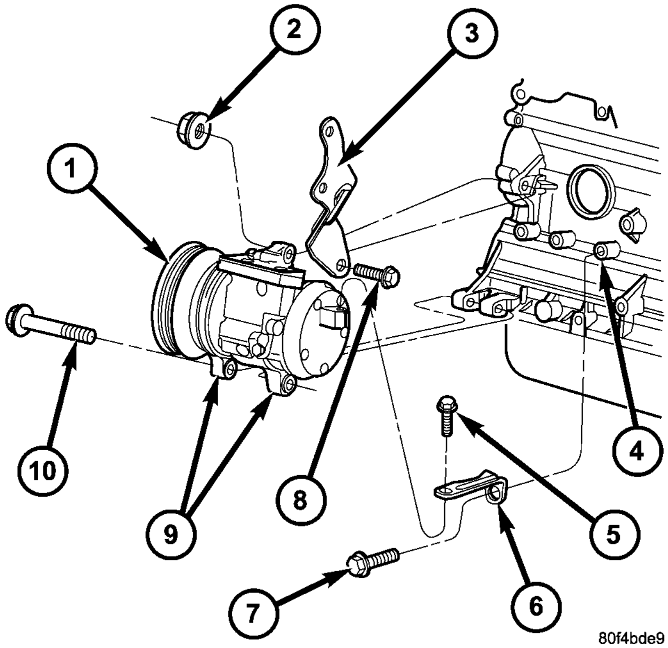

Fig. 6 A/C Compressor and Brackets - 4.0L Engine

1 - A/C COMPRESSOR
2 - A/C COMPRESSOR MOUNTING NUT
3 - A/C COMPRESSOR UPPER MOUNTING BRACKET
4 - ENGINE BLOCK LOWER MOUNTING POINT
5 - A/C COMPRESSOR LOWER BRACKET MOUNTING BOLT
6 - A/C COMPRESSOR LOWER MOUNTING BRACKET
7 - LOWER BRACKET TO ENGINE BLOCK BOLT
8 - A/C COMPRESSOR UPPER BRACKET MOUNTING BOLT
9 - A/C COMPRESSOR LOWER MOUNTING POINT
10 - A/C COMPRESSOR TO BLOCK BOLT

(4) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the discharge and liquid line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(5) Install the suction line and discharge line fittings onto the compressor.

(6) Install the bolts or nuts (depending on engine application) that secure the suction and discharge line fittings to the compressor. Tighten the bolts or nuts to 25.4 N·m (20 ft. lbs.).

(7) Connect the wire harness connector to the compressor clutch coil.

(8) Install the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) or (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION) 4.0L.

(9) Reconnect the battery negative cable.

(10) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(11) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

A/C CONDENSER

DESCRIPTION

The A/C condenser is located in the air flow in front of the radiator. The A/C condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the A/C compressor to give up its heat to the air passing over the condenser fins.

OPERATION

When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: Review the warnings and cautions in the front of this section before performing the following operation (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

CAUTION: Before removing the A/C condenser, note the location of each of the radiator/condenser air seals. These air seals are used to direct air through the A/C condenser and radiator. The air seals must be reinstalled in their proper locations in order for the A/C and engine cooling systems to perform as designed.

(1) Disconnect and isolate the negative battery cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM RECOVERY).

(3) Partially drain the engine cooling system(Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM DRAINING).

(4) Remove the cooling recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL.

A/C CONDENSER (Continued)

(5) Disconnect the upper radiator hose from the radiator and position the hose out of the way (Refer to 7 - COOLING - OPERATION - HOSE CLAMPS).

(6) Remove the radiator cooling fan and fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).

(7) Raise and support the vehicle.

(8) Position the lower condenser/radiator air seal out of the way and remove the two bolts that secure the lower condenser mounting bracket to the bottom of the grille panel.

(9) Lower the vehicle.

(10) If equipped, remove the upper condenser/radiator air seal (Fig. 7).

(11) Remove the nuts that secure the discharge and liquid lines to the condenser tapping block.

(12) Disconnect the discharge and liquid lines from the condenser tapping block and remove and discard the O-ring seals.

(13) Install plugs in, or tape over the opened refrigerant line fittings and the condenser ports.

(14) Remove the two bolts that secure the upper condenser mounting brackets to the top of the grille panel.

(15) Remove the three bolts on each side of the radiator that secure the radiator mounting brackets to the grille panel.

(16) Tilt the radiator back towards the engine. Use care to prevent damaging the radiator fins.

(17) Carefully remove the A/C condenser from the engine compartment.

INSTALLATION

NOTE: If the A/C condenser is being replaced, add 22 milliliters (0.75 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(1) Carefully position the A/C condenser into the engine compartment.

(2) Install the two bolts that secure the upper condenser mounting brackets to the top of the grille panel. Tighten the bolts to 2.2 N·m (20 in. lbs.).

(3) Align the radiator mounting brackets to the grille panel and install the six bolts that secure the radiator to the grille panel. Tighten the bolts to 8 N·m (72 in. lbs.).

(4) Raise and support the vehicle.

(5) Position the lower condenser/radiator air seal out of the way and install the two bolts that secure the lower condenser mounting bracket to the bottom of the grille panel. Tighten the bolts to 2.2 N·m (20 in. lbs.).

(6) Lower the vehicle.

(7) Remove the tape or plugs from the discharge and liquid line fittings and the condenser ports.

(8) Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the discharge and liquid line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(9) Install the discharge and liquid lines onto the condenser tapping block.

(10) Install the nuts that secures the discharge and liquid line fittings to the condenser tapping block. Tighten the nuts to 12 N·m (105 in. lbs.).

(11) If equipped, install the upper condenser/radiator air seal.

(12) Install the radiator cooling fan and fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).

(13) Connect the upper radiator hose to the radiator and install the hose clamp (Refer to 7 - COOLING - OPERATION - HOSE CLAMPS).

(14) Install the coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).

(15) Reconnect the battery negative cable.

(16) Fill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE - COOLING SYSTEM REFILLING)

(17) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(18) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

A/C CONDENSER (Continued)

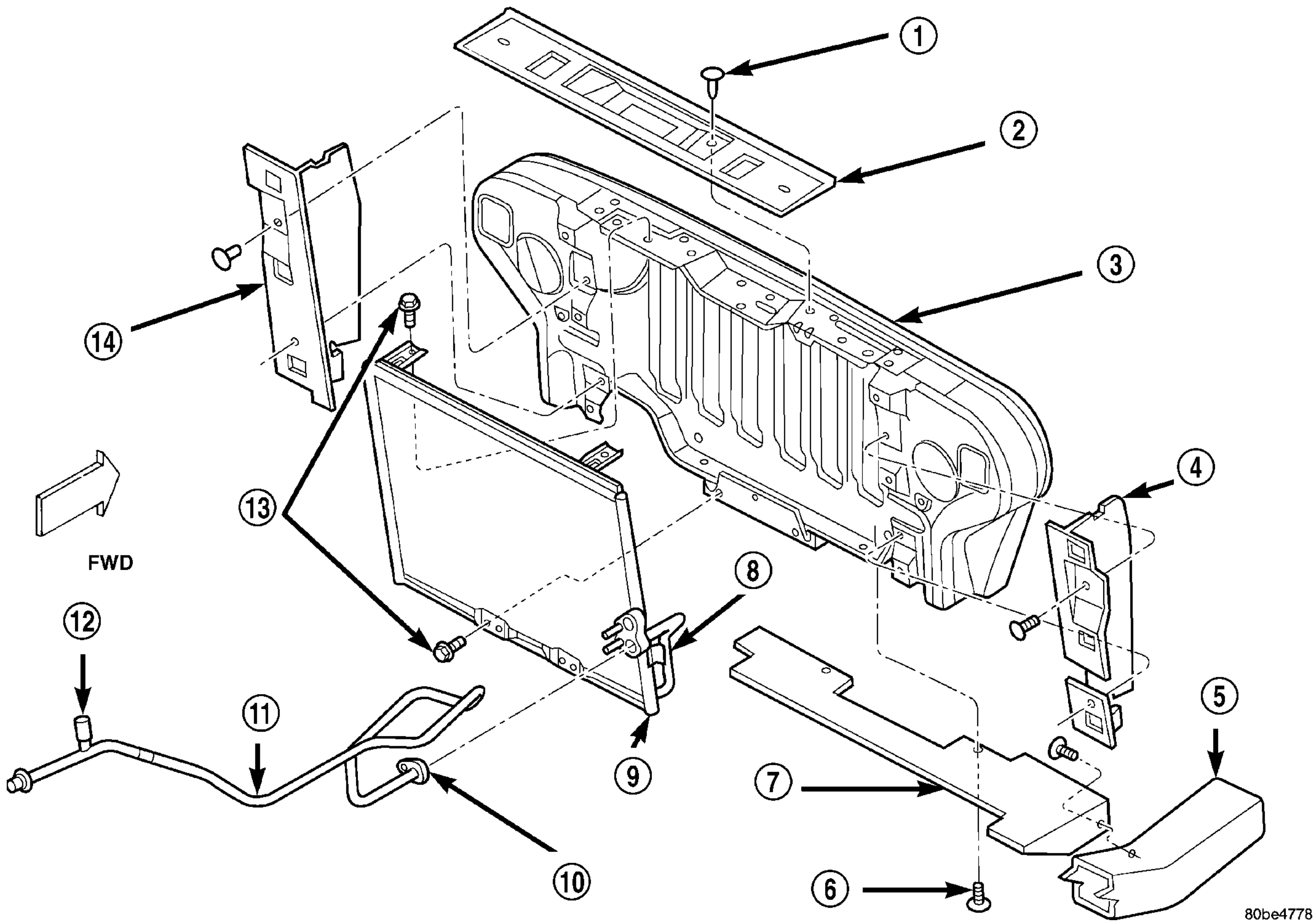

Fig. 7 A/C Condenser

1 - PUSH-PIN RETAINER
2 - UPPER AIR SEAL
3 - GRILLE PANEL
4 - AIR SEAL
5 - FRAME RAIL
6 - PUSH-PIN RETAINER
7 - LOWER AIR SEAL
8 - CONDENSER TAPPING BLOCK
9 - A/C CONDENSER
10 - REFRIGERANT LINE FITTING
11 - LIQUID LINE
12 - SERVICE PORT
13 - BOLTS
14 - AIR SEAL

A/C DISCHARGE LINE

DESCRIPTION

The A/C discharge line is the refrigerant line that goes from the A/C compressor to the A/C condenser. The discharge line has no serviceable parts except the rubber O-rings. The discharge line cannot be repaired and, if found to be leaking or damaged, it must be replaced.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Disconnect and isolate the negative battery cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).

(3) On vehicles equipped with the 4.0L engine, remove the bolt that secures the refrigerant line support bracket to the top of the engine and remove the discharge line from the bracket (Fig. 8).

(4) Remove the bolt that secures the discharge line fitting to the top of the compressor.

(5) Disconnect the discharge line fitting from the compressor discharge port.

A/C DISCHARGE LINE (Continued)

(6) Remove the seal from the discharge line fitting and discard.

(7) Install plug in, or tape over the opened discharge line fitting and the compressor discharge port.

(8) Remove the nut that secures the discharge line fitting to the condenser.

(9) Disconnect the discharge line fitting from the condenser inlet port and remove the discharge line from the vehicle.

(10) Remove the O-ring seal from the discharge line fitting and discard.

(11) Install plug in, or tape over the opened discharge line fitting and the condenser inlet port.

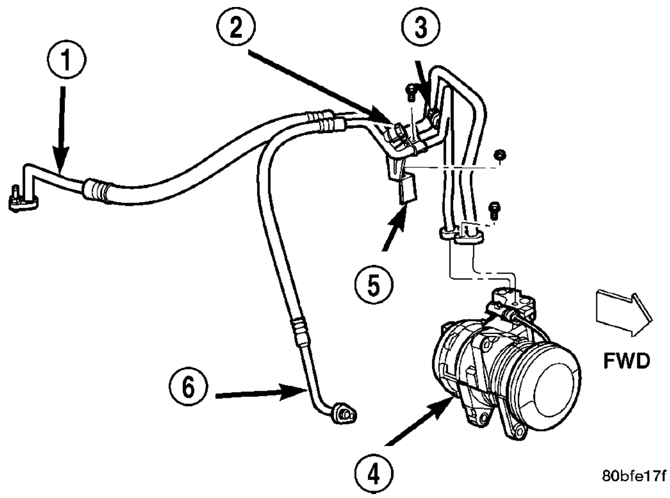

Fig. 8 Suction and Discharge Lines - 4.0L Shown, 2.4L Typical

1 - SUCTION LINE
2 - SERVICE PORT
3 - A/C HIGH PRESSURE SWITCH
4 - A/C COMPRESSOR
5 - MOUNTING BRACKET
6 - DISCHARGE LINE

INSTALLATION

NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.

(1) Position the discharge line into the engine compartment.

(2) Remove the tape or plugs from the condenser inlet port and the discharge line fitting.

(3) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting.

(4) Connect the discharge line fitting to the condenser inlet port.

(5) Install the nut that secures the discharge line fitting to the condenser. Tighten the nut to 12 N·m (105 in. lbs.).

(6) Remove the tape or plugs from the compressor discharge port and the discharge line fitting.

(7) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting.

(8) Connect the discharge line fitting to the compressor discharge port on the top of the compressor.

(9) Install the bolt that secures the discharge line fitting to the compressor. Tighten the bolt to 25.4 N·m (20 ft. lbs.).

(10) Install the discharge line into the refrigerant line support bracket and install the support bracket bolt. Tighten the bolt to 28 N·m (21 ft. lbs.).

(11) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

(12) Recharge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

(13) Reconnect the negative battery cable.

A/C EVAPORATOR

DESCRIPTION

The evaporator coil is located in the HVAC housing, behind the instrument panel. The evaporator is positioned in the housing so that all air that enters the housing must pass over the fins of the evaporator coils before it is distributed through the system ducts and outlets. However, air passing over the evaporator fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator tubes.

OPERATION

Refrigerant enters the evaporator from the fixed orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas when it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

A/C EVAPORATOR (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Disassemble the HVAC housing to access the evaporator (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(3) Lift the evaporator out of the lower half of the housing.

INSTALLATION

NOTE: If the evaporator is being replaced, add 45 milliliters (1.5 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(1) Install the evaporator coil into the bottom half of the HVAC housing.

(2) Assemble the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY).

(3) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

A/C ORIFICE TUBE

DESCRIPTION

The fixed orifice tube is factory installed in the liquid line between the outlet of the condenser and the inlet of the evaporator. The orifice tube is located in the end of the liquid line that is closest to the condenser outlet tube.

The inlet end of the fixed orifice tube has a nylon mesh filter screen, which filters the refrigerant and helps to reduce the potential for blockage of the metering orifice by refrigerant system contaminants (Fig. 9). The outlet end of the tube has a nylon mesh diffuser screen. The O-rings on the plastic body of the fixed orifice tube seal the tube to the inside of the liquid line and prevent the refrigerant from bypassing the fixed metering orifice.

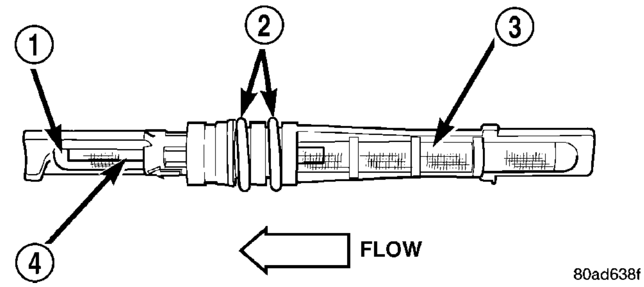

Fig. 9 Fixed Orifice Tube - Typical

1 - DIFFUSER SCREEN
2 - O-RING SEALS
3 - INLET FILTER SCREEN
4 - ORIFICE

OPERATION

The fixed A/C orifice tube is used to meter the flow of liquid refrigerant into the A/C evaporator. The high-pressure liquid refrigerant from the A/C condenser expands into a low-pressure liquid as it passes through the metering orifice and diffuser screen of the A/C orifice tube.

The A/C orifice tube is not serviceable. It cannot be repaired, and if faulty or plugged, it must be replaced as part of the liquid line (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - INSTALLATION).

DIAGNOSIS AND TESTING

A/C ORIFICE TUBE

The fixed A/C orifice tube can be checked for proper operation using the following procedure. However, the fixed orifice tube is only serviced as a part of the liquid line unit. If the results of this test indicate that the A/C orifice tube is obstructed or missing, the entire liquid line must be replaced.

WARNING: THE LIQUID LINE BETWEEN THE CONDENSER OUTLET AND THE A/C ORIFICE TUBE CAN BECOME HOT ENOUGH TO BURN THE SKIN. USE EXTREME CAUTION WHEN PERFORMING THE FOLLOWING TEST.

(1) Confirm that the refrigerant system is properly charged (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE).

A/C ORIFICE TUBE (Continued)

(2) Start the engine. Turn on the air conditioning system and confirm that the compressor clutch is engaged.

(3) Allow the air conditioning system to operate for five minutes.

(4) Lightly and cautiously touch the liquid line near the condenser outlet at the front of the engine compartment. The liquid line should be hot to the touch.

(5) Touch the liquid line near the evaporator inlet at the rear of the engine compartment. The liquid line should be cold to the touch.

(6) If there is a distinct temperature differential between the two ends of the liquid line, the A/C orifice tube is in good condition. If there is little or no detectable temperature differential between the two ends of the liquid line, the A/C orifice tube is obstructed or missing and the liquid line must be replaced.

ACCUMULATOR

DESCRIPTION

The accumulator (Fig. 10) is mounted in the engine compartment between the evaporator outlet and the compressor suction port. An integral mounting bracket is used to secure the accumulator to the right side rail with a bolt. A threaded fitting on the top of the accumulator canister provides the port through which the A/C low pressure switch monitors the refrigerant system pressures.

The accumulator cannot be repaired and, if faulty or damaged, it must be replaced. The refrigerant lines, rubber O-rings and the A/C low pressure switch are available for service replacement.

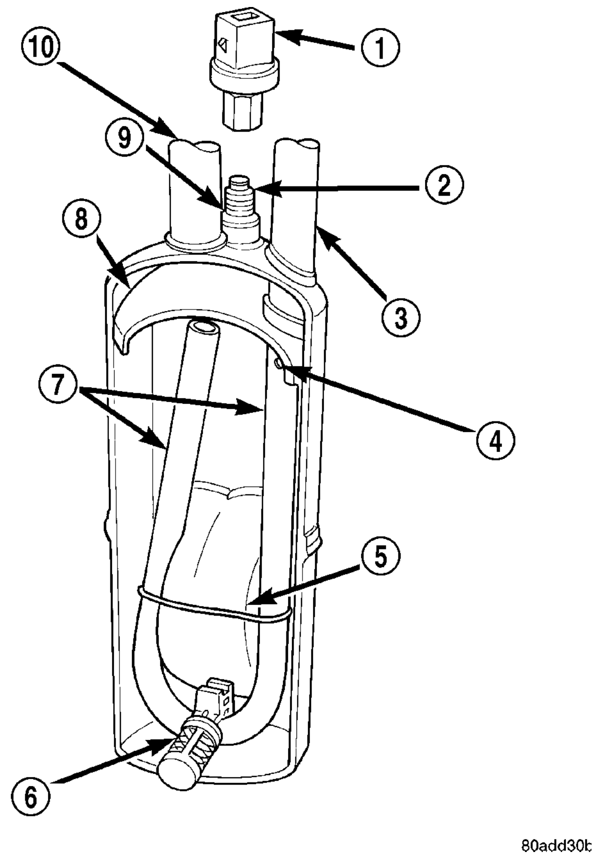

Fig. 10 Accumulator - Typical

1 - A/C LOW PRESSURE SWITCH
2 - PRESSURE SWITCH FITTING
3 - OUTLET TO COMPRESSOR
4 - ANTI-SIPHON HOLE
5 - DESICCANT BAG
6 - OIL RETURN ORIFICE FILTER
7 - VAPOR RETURN TUBE
8 - ACCUMULATOR DOME
9 - O-RING SEAL
10 - INLET FROM EVAPORATOR

OPERATION

Refrigerant enters the accumulator canister as a low pressure vapor through the inlet tube. Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING - CAUTION) AND (Refer to 24 - HEATING & AIR CONDITIONING - WARNING).

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(3) Disconnect the wire harness connector from the A/C low pressure switch.

(4) Remove the plastic retaining clip that secures the suction line to the liquid line near the accumulator.

(5) Remove the two nuts that secure the refrigerant lines to the accumulator (Fig. 11).

(6) Disconnect the refrigerant lines from the accumulator.

(7) Remove the O-ring seals from the opened refrigerant line fittings and discard.

(8) Install plugs in, or tape over the opened refrigerant line fittings and accumulator ports.

(9) Loosen the bolt that secures the accumulator retaining band to the support bracket located on the dash panel.

ACCUMULATOR (Continued)

(10) Pull the accumulator and retaining band forward until the bolt in the band is clear of the slotted hole in the support bracket.

(11) Remove the accumulator from the engine compartment and remove the retaining band from the accumulator.

(12) If necessary, remove the A/C low pressure switch from the accumulator.

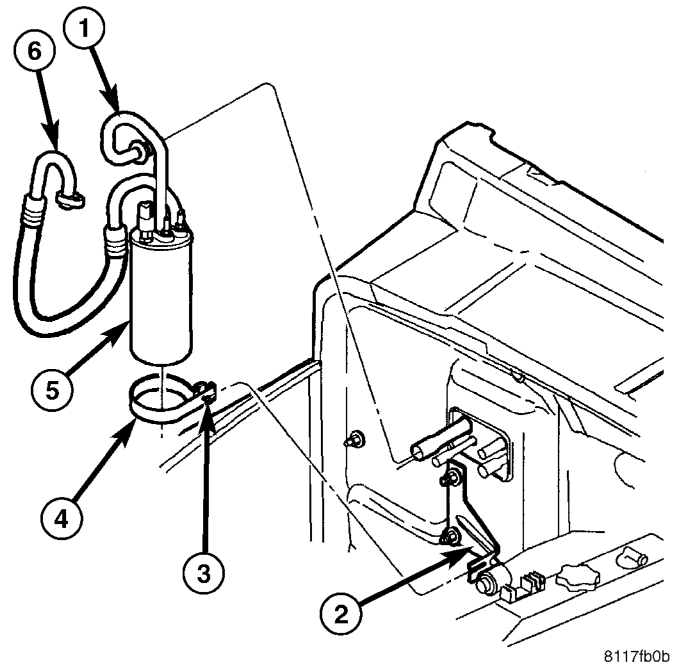

Fig. 11 A/C Accumulator - Typical

1 - SUCTION LINE (EVAPORATOR SIDE)
2 - SUPPORT BRACKET
3 - BOLT
4 - RETAINING BAND
5 - ACCUMULATOR
6 - SUCTION LINE (COMPRESSOR SIDE)

INSTALLATION

NOTE: If the accumulator is being replaced, add 90 milliliters (3 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(1) If removed, install the A/C low pressure switch onto the accumulator using a new O-ring seal. Tighten the switch securely.

(2) Install the retaining band onto the accumulator and position the accumulator into the slotted hole of the support bracket in the engine compartment.

(3) Tighten the bolt that secures the accumulator retaining band to the support bracket. Tighten the bolt to 4.5 N·m (40 in. lbs.).

(4) Remove the tape or plugs from the opened refrigerant line fittings and the accumulator ports.

(5) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the refrigerant line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(6) Reconnect the refrigerant lines to the accumulator.

(7) Install two nuts that secure the refrigerant line fittings to the accumulator. Tighten the nuts to 2.2 N·m (20 in. lbs.).

(8) Install the plastic retaining clip that secures the suction line to the liquid line near the accumulator.

(9) Connect the wire harness connector to the A/C low pressure switch.

(10) Reconnect the battery negative cable.

(11) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(12) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

HEATER CORE

DESCRIPTION

The heater core is located in the HVAC housing, behind the instrument panel. It is a heat exchanger made of rows of tubes and fins.

OPERATION

Engine coolant is circulated through the heater hoses and heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes. Air directed through the heater core picks up the heat from the heater core fins. The blend door allows control of the heater output air temperature by regulating the amount of air that is flowing through the heater core within the HVAC housing. The blower motor speed controls the volume of air flowing through the HVAC housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced.

HEATER CORE (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - REMOVAL).

(2) Disassemble the HVAC housing to access the heater core (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(3) Lift the heater core out of the lower half of the housing.

INSTALLATION

(1) Install the heater core into the bottom half of the HVAC housing.

(2) Assemble the HVAC housing(Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ HVAC HOUSING - ASSEMBLY).

(3) Install the HVAC housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

LIQUID LINE

DESCRIPTION

The liquid line is the refrigerant line that carries refrigerant from the A/C condenser to the evaporator. The liquid line is made from lightweight aluminum or steel, and uses braze-less fittings.

The liquid line contains the fixed orifice tube and is only serviced as an assembly, except for the rubber O-ring seals used on the end fittings. The liquid line cannot be adjusted or repaired and, if found to be leaking or damaged, it must be replaced.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING - WARNING) AND (Refer to 24 - HEATING & AIR CONDITIONING - CAUTION).

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(3) Remove the secondary retaining clip from the spring-lock coupler that secures the liquid line to the evaporator inlet tube (Fig. 12).

(4) Using the proper A/C line disconnect tool, disconnect the liquid line fitting from the evaporator inlet tube (outboard fitting) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - REMOVAL). Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the O-ring seal from the liquid line fitting and discard.

(6) Install plugs in, or tape over the opened liquid line fitting and the evaporator inlet port.

(7) Remove the liquid line from the plastic retaining clips located on the right inner fender.

(8) Remove the nut that secures the liquid line fitting to the condenser outlet port (lower fitting).

(9) Remove the O-ring seal from the liquid line fitting and discard.

(10) Install plugs in, or tape over the opened liquid line fitting and the condenser outlet port.

(11) Remove the liquid line from the engine compartment.

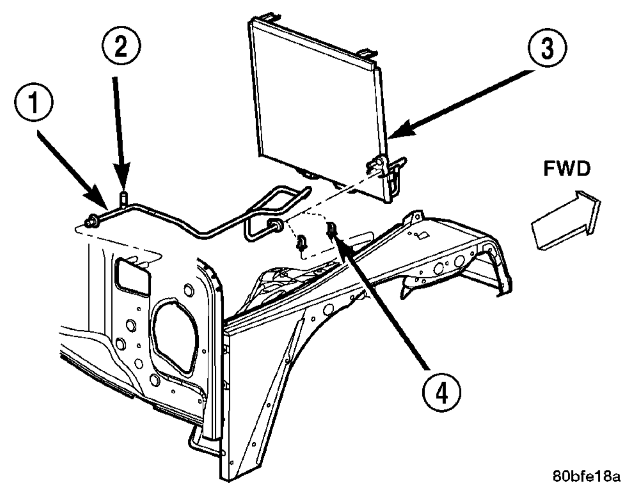

Fig. 12 Liquid Line - 4.0L Shown, 2.4L Typical

1 - LIQUID LINE
2 - SERVICE PORT
3 - A/C CONDENSER
4 - PLASTIC RETAINING CLIP (2)

LIQUID LINE (Continued)

INSTALLATION

NOTE: Replacement of the refrigerant line O-ring seals is required anytime a refrigerant line is opened. Failure to replace the rubber O-ring seals could result in a refrigerant system leak.

(1) Position the liquid line into the engine compartment.

(2) Remove the tape or plugs from the liquid line fitting and the condenser outlet port.

(3) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the liquid line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(4) Connect the liquid line to the condenser outlet port.

(5) Install the nut that secures the liquid line fitting to the stud on the condenser outlet port. Tighten the nut to 9 N·m (80 in. lbs.).

(6) Install the liquid line into the plastic retaining clips located on the right inner fender

(7) Remove the tape or plugs from the liquid line fitting and the evaporator inlet port.

(8) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the liquid line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(9) Connect the liquid line to the evaporator inlet port (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - INSTALLATION).

(10) Install the secondary retaining clip onto the spring-lock coupler that secures the liquid line to the evaporator inlet tube.

(11) Reconnect the battery negative cable.

(12) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(13) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

REFRIGERANT

DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

REFRIGERANT LINE COUPLER

DESCRIPTION

Spring-lock type refrigerant line couplers are used to connect many of the refrigerant lines and other components to the refrigerant system. These couplers require a special tool for disengaging the two coupler halves.

OPERATION

The spring-lock coupler is held together by a garter spring inside a circular cage on the male half of the fitting (Fig. 13). When the two coupler halves are connected, the flared end of the female fitting slips behind the garter spring inside the cage on the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage.

Two O-rings on the male half of the fitting are used to seal the connection. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material.

Secondary clips are installed over the two connected coupler halves at the factory for added blowoff protection. In addition, some models have a plastic ring that is used at the factory as a visual indicator to confirm that these couplers are connected. After the coupler is connected, the plastic indicator ring is no longer needed; however, it will remain on the refrigerant line near the coupler cage.

REFRIGERANT LINE COUPLER (Continued)

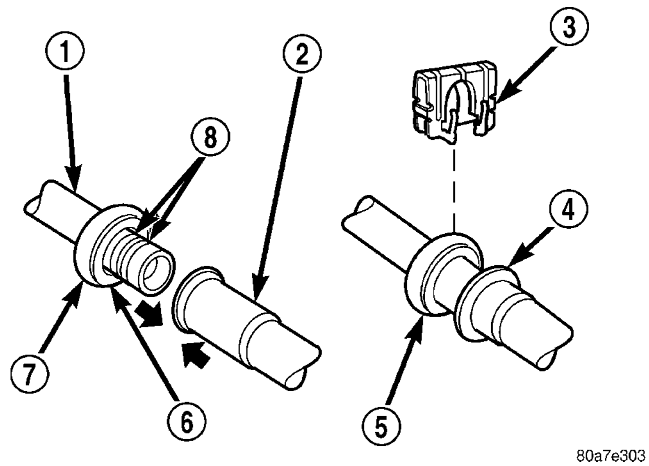

Fig. 13 Spring-Lock Coupler - Typical

1 - MALE HALF SPRING-LOCK COUPLER
2 - FEMALE HALF SPRING-LOCK COUPLER
3 - SECONDARY CLIP
4 - CONNECTION INDICATOR RING
5 - COUPLER CAGE
6 - GARTER SPRING
7 - COUPLER CAGE
8 - O-RING SEALS

REMOVAL

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Remove the secondary retaining clip from the spring-lock coupler.

(3) Fit the proper size A/C line disconnect tool (Special Tool Kit 7193) over the spring-lock coupler cage (Fig. 14).

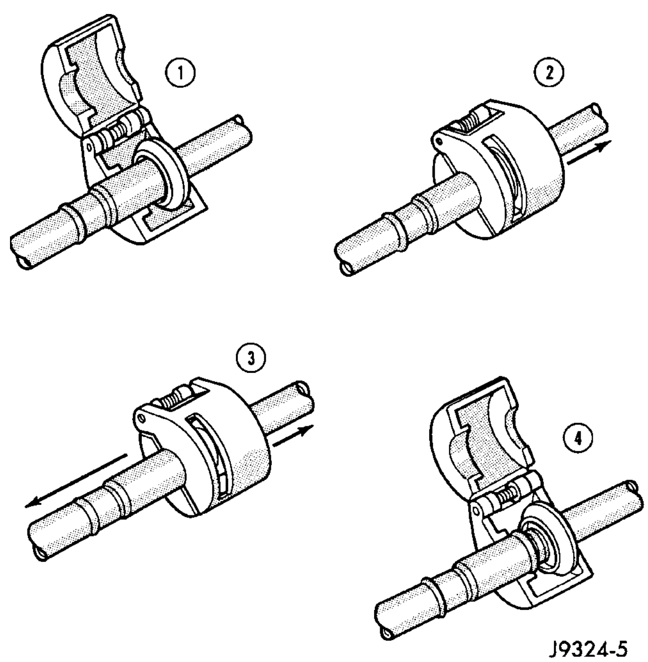

Fig. 14 Refrigerant Line Spring-Lock Coupler Disconnect

(4) Close the two halves of the A/C line disconnect tool around the spring-lock coupler.

(5) Push the A/C line disconnect tool into the open side of the coupler cage to expand the garter spring. Once the garter spring is expanded and while still pushing the disconnect tool into the open side of the coupler cage, pull on the refrigerant line attached to the female half of the coupler fitting until the flange on the female fitting is separated from the garter spring and cage on the male fitting within the disconnect tool.

NOTE: The garter spring may not release if the A/C line disconnect tool is cocked while pushing it into the coupler cage opening.

(6) Open and remove the A/C line disconnect tool from the disconnected spring-lock coupler.

(7) Complete the separation of the two halves of the coupler fitting.

INSTALLATION

(1) Check to ensure that the garter spring is located within the cage of the male coupler fitting, and that the garter spring is not damaged.

(a) If the garter spring is missing, install a new spring by pushing it into the coupler cage opening.

(b) If the garter spring is damaged, remove it from the coupler cage with a small wire hook (DO NOT use a screwdriver) and install a new garter spring.

(2) Clean any dirt or foreign material from both halves of the coupler fitting.

(3) Install new O-rings on the male half of the coupler fitting.

CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any other O-rings may allow the connection to leak intermittently during vehicle operation.

(4) Lubricate the male fitting and O-rings, and the inside of the female fitting with clean R-134a refrigerant oil. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(5) Fit the female half of the coupler fitting over the male half of the fitting.

(6) Push together firmly on the two halves of the coupler fitting until the garter spring in the cage on the male half of the fitting snaps over the flanged end on the female half of the fitting.

(7) Ensure that the spring-lock coupler is fully engaged by trying to separate the two coupler halves. This is done by pulling the refrigerant lines on either side of the coupler away from each other.

(8) Reinstall the secondary retaining clip over the spring-lock coupler cage.

REFRIGERANT OIL

DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The 10PA17 compressor used in this vehicle is designed to use an ND-8 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

STANDARD PROCEDURE

REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the air conditioning system and consequently result in higher discharge air temperatures.

NOTE: The oil used in the compressor is ND-8 PAG R-134a refrigerant oil. Only refrigerant oil of the same type should be used to service the system. Do not use any other oil. The oil container should be kept tightly capped until it is ready for use. Tightly cap afterwards to prevent contamination from dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with. Special effort must be used to keep all R-134a system components moisture-free. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

REFRIGERANT OIL CAPACITIES

Component	ml	oz
Total System Fill	180	6.1
Accumulator	90	3.0
Condenser	22	0.75
Evaporator	45	1.5
Compressor	Drain and measure the oil from the old compressor - see text.	

SERVICE PORT VALVE CORE

DESCRIPTION

The A/C service port valve cores are serviceable items. The high side valve is located on the located on the manifold directly over the discharge port of the A/C compressor. The low side valve is located on the liquid line near the evaporator inlet tube at the rear of the engine compartment.

REMOVAL

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

SERVICE PORT VALVE CORE (Continued)

(1) Remove the protective cap from the low and/or high side service port as necessary.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(3) Using a standard Schrader-type valve core tool, remove the valve core from the service port as required.

(4) Install a plug in or tape over the opened service port.

INSTALLATION

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT - WARNING - A/C PLUMBING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT - CAUTION - A/C PLUMBING).

(1) Lubricate the A/C service port valve core with clean refrigerant oil prior to installation. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Remove the tape or plug from the A/C service port.

(3) Using a standard Schrader-type valve core tool, install and tighten the replacement valve core into the A/C service ports as required.

CAUTION: A valve core that is not fully seated in the A/C service port can result in damage to the valve during refrigerant system evacuation and charge. Such damage may result in a loss of system refrigerant while uncoupling the charge adapters.

(4) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT/REFRIGERANT - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(5) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - FRONT/REFRIGERANT - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

(6) Reinstall the protective cap onto the A/C service ports as required.

SUCTION LINE

DESCRIPTION

The suction line is the refrigerant line that goes from the evaporator outlet tube to the compressor inlet port. The suction line is serviced in two sections. The front section connects between the accumulator and the A/C compressor. The rear section connects between the evaporator and the accumulator.

The suction lines are services only as assemblies, except for the rubber O-ring seals. The suction lines cannot be adjusted or repaired and, if found to be leaking or damaged, must be replaced.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING - WARNING) AND (Refer to 24 - HEATING & AIR CONDITIONING - CAUTION).

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(3) Remove the suction line from the plastic retaining clip located near the accumulator.

(4) Remove the secondary retaining clip from the spring-lock coupler that secures the suction line to the evaporator outlet tube.

(5) Using the proper A/C line disconnect tool, disconnect the suction line fitting from the evaporator outlet tube (Fig. 15) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - REMOVAL).

(6) Remove the O-ring seal from the suction line fitting and discard.

(7) Install plugs in, or tape over the opened suction line fitting and the evaporator outlet port.

(8) Depending on the engine usage, remove the bolts or nuts that secure the suction line fitting to the compressor.

SUCTION LINE (Continued)

(9) Remove the O-ring seal from the suction line fitting and discard.

(10) Install plugs in, or tape over the opened suction line fitting and the compressor inlet port.

(11) Remove the two nuts that secure the suction lines to the accumulator.

(12) Disconnect the suction lines from the accumulator.

(13) Remove the O-ring seals from the opened suction line fittings and discard.

(14) Install plugs in, or tape over the opened suction line fittings and accumulator ports.

(15) Remove the suction lines from the vehicle.

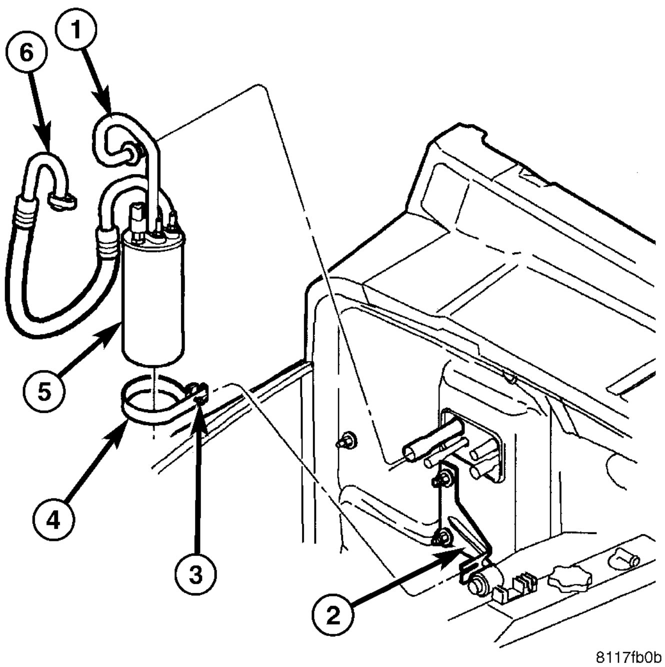

Fig. 15 Suction Lines - 4.0L Shown, 2.4L Typical

1 - SUCTION LINE (EVAPORATOR SIDE)
2 - SUPPORT BRACKET
3 - BOLT
4 - RETAINING BAND
5 - ACCUMULATOR
6 - SUCTION LINE (COMPRESSOR SIDE)

INSTALLATION

(1) Remove the tape or plugs from the opened suction line fittings and the accumulator ports.

(2) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the suction line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(3) Reconnect the suction lines to the accumulator.

(4) Install two nuts that secure the suction line fittings to the accumulator. Tighten the nuts to 2.2 N·m (20 in. lbs.).

(5) Remove the tape or plugs from the opened suction line fitting and compressor inlet port.

(6) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the suction line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(7) Install the suction line onto the compressor.

(8) Install the bolt or nut (depending on engine application) that secure the suction line fitting to the compressor. Tighten the bolt or nut to 25.4 N·m (20 ft. lbs.).

(9) Remove the tape or plugs from the suction line fitting and the accumulator outlet tube.

(10) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the suction line fitting. Use only the specified O-ring as it is made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

(11) Connect the suction line spring-lock coupler to the evaporator outlet tube (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT LINE COUPLER - INSTALLATION).

(12) Install the secondary retaining clip onto the spring-lock coupler that secures the suction line to the evaporator outlet tube.

(13) Install the suction line into the plastic retaining clip located near the accumulator.

(14) Reconnect the battery negative cable.

(15) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(16) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

EMISSIONS CONTROL

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EMISSIONS CONTROL

DESCRIPTION

DESCRIPTION - EMISSION CONTROL SYSTEM

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). The MIL is displayed as an engine icon on the instrument panel. Refer to Malfunction Indicator Lamp (MIL) in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example** , assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 1).

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL.

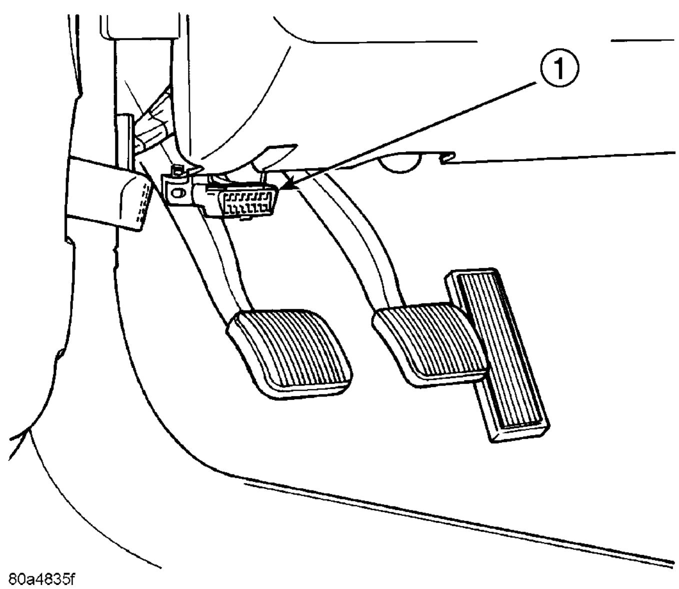

Fig. 1 DATA LINK (DIAGNOSTIC) CONNECTOR LOCATION

1 - 16–WAY DATA LINK CONNECTOR

EMISSIONS CONTROL (Continued)

DESCRIPTION - STATE DISPLAY TEST MODE

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. Connect the DRB scan tool to the data link connector and access the state display screen. Then access either State Display Inputs and Outputs or State Display Sensors.

DESCRIPTION - CIRCUIT ACTUATION TEST MODE

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly. Connect the DRB scan tool to the data link connector and access the Actuators screen.

DESCRIPTION - DIAGNOSTIC TROUBLE CODES

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

BULB CHECK

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

OBTAINING DTC'S USING DRB SCAN TOOL

(1) Obtain the applicable Powertrain Diagnostic Manual.

(2) Obtain the DRB Scan Tool.

(3) Connect the DRB Scan Tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel; near the steering column.

(4) Turn the ignition switch on and access the "Read Fault" screen.

(5) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(6) To erase DTC's, use the "Erase Trouble Code" data screen on the DRB scan tool. **Do not erase any DTC's until problems have been investigated and repairs have been performed.**

DESCRIPTION - TASK MANAGER

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is referred to as the 'Task Manager'.

DESCRIPTION - MONITORED SYSTEMS

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator Lamp (MIL) will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the MIL or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

The following is an operation and description of each system monitor:

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio,

EMISSIONS CONTROL (Continued)

the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” water. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040” orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP’s solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due

EMISSIONS CONTROL (Continued)

to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL will be illuminated.

DESCRIPTION - TRIP DEFINITION

The term “Trip” has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3

EMISSIONS CONTROL (Continued)

good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a "Trip" is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the "Similar Condition Window" for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor, is considered to be a Good Trip. These will include the following:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

DESCRIPTION - COMPONENT MONITORS

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (MIL) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

All open/short circuit checks or any component that has an associated limp in will set a fault after 1 trip with the malfunction present. Components without an associated limp in will take two trips to illuminate the MIL.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

DESCRIPTION - NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

EMISSIONS CONTROL (Continued)

THROTTLE BODY AIRFLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

DESCRIPTION - HIGH AND LOW LIMITS

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

DESCRIPTION - LOAD VALUE

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
All Engines	2% to 8% of Maximum Load	9% to 17% of Maximum Load

OPERATION - TASK MANAGER

The Task Manager determines which tests happen when and which functions occur when. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence
- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

Test Sequence

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are know as 'two trip monitors.' Other tests that turn the MIL lamp on after a single failure are known as 'one trip monitors.' A trip is defined as 'start the vehicle and operate it to meet the criteria necessary to run the given monitor.'

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

- Pending

Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors **pending** resolution of the original fault. The Task Manager does not run the test until the problem is remedied.

For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.

- Conflict

There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this **conflict** is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.

For example, if the Fuel System Monitor is in progress, the Task Manager does not run the EGR Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.

- Suspend

Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will **sus-**

EMISSIONS CONTROL (Continued)

pend the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precis diagnosis.

For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the EGR monitor, the Task Manager may still run the EGR Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the EGR system is actually failing or if an Oxygen Sensor is failing.

MIL Illumination

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a third trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third key cycle) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MIL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

Diagnostic Trouble Codes (DTCs)

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

Priorities

- Priority 0 —Non-emissions related trouble codes
- Priority 1 — One trip failure of a two trip fault for non-fuel system and non-misfire.
- Priority 2 — One trip failure of a two trip fault for fuel system (rich/lean) or misfire.
- Priority 3 — Two trip failure for a non-fuel system and non-misfire or matured one trip comprehensive component fault.
- Priority 4 — Two trip failure or matured fault for fuel system (rich/lean) and misfire or one trip catalyst damaging misfire.

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

DTC Self Erasure

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within ±375 RPM and load is within ±10% of when the fault occurred.

NOTE: It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.

DTCs can be erased anytime with a DRB III. Erasing the DTC with the DRB III erases all OBD II information. The DRB III automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

Trip Indicator

The **Trip** is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

Good Trip

The Good Trip counters are as follows:

- Specific Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on DRB III)
    - Comprehensive Components
    - Major Monitor
- Warm-Up Cycles

Specific Good Trip

The term Good Trip has different meanings depending on the circumstances:

- If the MIL is OFF, a trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

EMISSIONS CONTROL (Continued)

• If the MIL is ON and a DTC was set by the Fuel Monitor or Misfire Monitor (both continuous monitors), the vehicle must be operated in the Similar Condition Window for a specified amount of time.

• If the MIL is ON and a DTC was set by a Task Manager commanded once-per-trip monitor (such as the Oxygen Sensor Monitor, Catalyst Monitor, Purge Flow Monitor, Leak Detection Pump Monitor, EGR Monitor or Oxygen Sensor Heater Monitor), a good trip is when the monitor is passed on the next start-up.

• If the MIL is ON and any other emissions DTC was set (not an OBD II monitor), a good trip occurs when the Oxygen Sensor Monitor and Catalyst Monitor have been completed, or two minutes of engine run time if the Oxygen Sensor Monitor and Catalyst Monitor have been stopped from running.

Fuel System Good Trip

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

• Engine in closed loop
• Operating in Similar Conditions Window
• Short Term multiplied by Long Term less than threshold
• Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

Misfire Good Trip

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

• Operating in Similar Condition Window
• 1000 engine revolutions with no misfire

Warm-Up Cycles

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up Cycle Counter that can be viewed on the DRB III. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

• Engine coolant temperature must start below and rise above 160° F
• Engine coolant temperature must rise by 40° F
• No further faults occur

Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

CAUTION: Erasing DTCs, either with the DRB III or by disconnecting the battery, also clears all Freeze Frame data.

Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

FUEL SYSTEM

• **Fuel System Similar Conditions Window** — An indicator that 'Absolute MAP When Fuel Sys Fail' and 'RPM When Fuel Sys Failed' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.

• **Absolute MAP When Fuel Sys Fail** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.

• **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.

• **RPM When Fuel Sys Fail** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.

• **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.

• **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.

• **Upstream O2S Volts** — A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.

• **SCW Time in Window (Similar Conditions Window Time in Window)** — A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.

• **Fuel System Good Trip Counter** — A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor

EMISSIONS CONTROL (Continued)

must stay below that threshold for a calibrated amount of time.

- **Test Done This Trip** — Indicates that the monitor has already been run and completed during the current trip.

MISFIRE

- **Same Misfire Warm-Up State** — Indicates if the misfire occurred when the engine was warmed up (above 160° F).
- **In Similar Misfire Window** — An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Misfire Occurred** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter** — Counts 0–100 720 degree cycles.
- **SCW Cat 200 Rev Counter** — Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter** — Counts 0–4 when in similar conditions.
- **Misfire Good Trip Counter** — Counts up to three to turn OFF the MIL.
- **Misfire Data**— Data collected during test.
- **Test Done This Trip**— Indicates YES when the test is done.

EVAPORATIVE EMISSIONS

TABLE OF CONTENTS

EVAPORATIVE EMISSIONS

DESCRIPTION - EVAPORATION CONTROL SYSTEM

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a duty-cycle purge system. The PCM controls vapor flow by operating the duty-cycle EVAP purge solenoid. Refer to Duty-Cycle EVAP Canister Purge Solenoid.

An ORVR system is used. This system is part of the EVAP Control System. Refer to On-Board Refueling Vapor Recovery (ORVR) for information.

When equipped with certain emissions packages, a Leak Detection Pump (LDP) will be used as part of the evaporative system for OBD II requirements. Also refer to Leak Detection Pump.

NOTE: The evaporative system uses specially manufactured lines/hoses. If replacement becomes necessary, only use fuel resistant hose.

EVAPORATIVE EMISSIONS (Continued)

SPECIFICATIONS

TORQUE - EMISSIONS

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
EVAP Canister Mounting Nuts	9	-	80
Leak Detection Pump Filter Mounting Bolt	7	-	65
LDP Pump Mounting Bolts	1	-	11
EVAP Canister/LDP Mounting Bracket-to-Body Nuts	-	-	250
EVAP Canister/LDP Mounting Bracket-to-Body Bolts	-	-	212

CCV SYSTEM

DESCRIPTION - CCV SYSTEM

The 4.0L 6-cylinder engine is equipped with a Closed Crankcase Ventilation (CCV) system and a fixed orifice valve (Fig. 1). The 2.4L 4-cylinder uses a PCV valve. Refer to PCV Valve for 2.4L information.

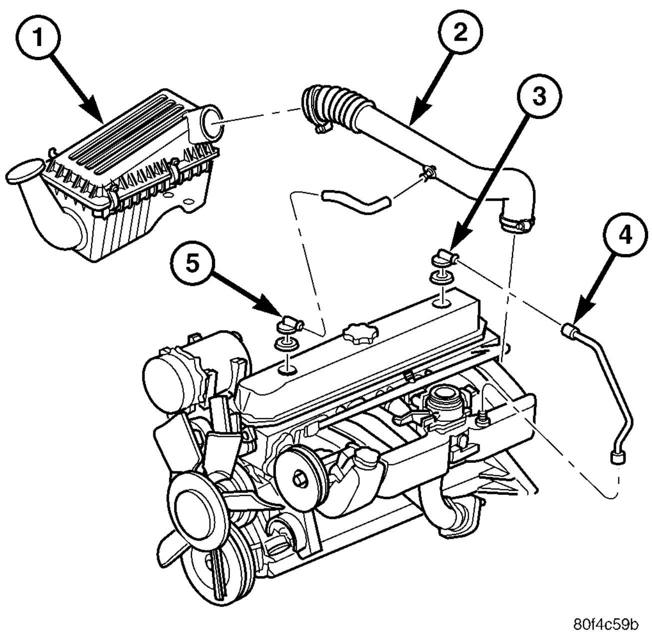

Fig. 1 CRANKCASE VENTILATION (CCV) FITTING - 4.0L

1 - AIR CLEANER ASSEMBLY
2 - AIR INTAKE TUBE
3 - FIXED ORIFICE FITTING
4 - VACUUM LINE
5 - AIR INLET FITTING

OPERATION - CCV SYSTEM

The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled valve.

On 4.0L 6-cylinder engines, a molded vacuum tube connects manifold vacuum to the top of the cylinder head (valve) cover. The vacuum fitting contains a fixed orifice of a calibrated size. It meters the amount of crankcase vapors drawn out of the engine.

When the engine is operating, fresh air enters the engine and mixes with crankcase vapors. Manifold vacuum draws the vapor/air mixture through the fixed orifice and into the intake manifold. The vapors are then consumed during combustion.

DIAGNOSIS AND TESTING - CCV SYSTEM

TESTING/CLEANING

The Crankcase Ventilation (CCV) system performs the same function as a conventional PCV system, but does not use a vacuum controlled valve. A vacuum fitting containing a fixed orifice of a calibrated size is used. It meters the amount of crankcase vapors drawn out of the engine.

(1) Check each CCV system tube (line) for leaks, cracks, kinks or bends. Replace as necessary

(2) Disconnect each CCV tube.

(3) Remove fixed orifice fitting from valve cover.

(4) Blow compressed air through each tube, and the fixed orifice fitting. Check for blockage or restrictions. If cleaning is necessary, spray a soapy-type all-purpose cleaner into each component and blow out. After restriction is cleared, rinse out component with clear water. Blow water from component and install to vehicle. **To prevent damage to plastic components, never spray carburetor-type cleaner into any of the plastic tubes or the fixed orifice fitting. Never attempt to clean the fixed orifice fitting with a metal object as calibration could be affected. If fixed fitting cannot be cleared, replace it.**

PCV VALVE

DESCRIPTION

2.4L

The 2.4L 4-cylinder engine is equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of:

- a PCV valve attached to the left/front side of the valve cover (Fig. 2). It is secured with 1 bolt. An o-ring is used to seal valve to valve cover (Fig. 3). Another type of threaded PCV valve may be used (Fig. 4).
- the air cleaner housing
- tubes and hoses to connect the system components.

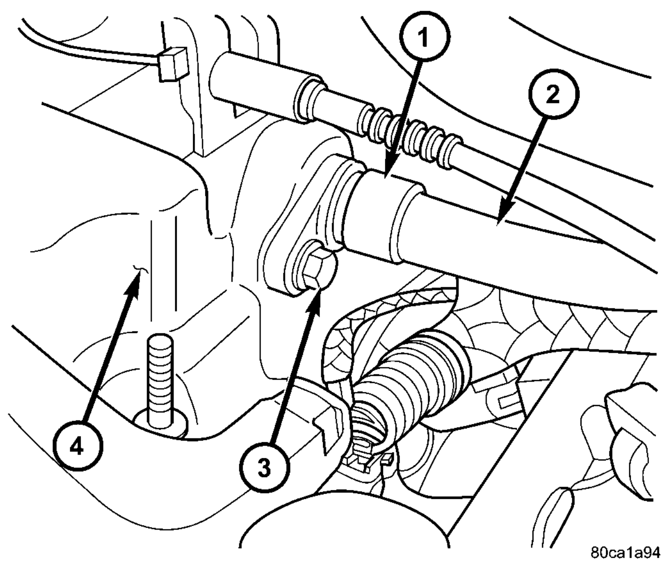

Fig. 2 PCV VALVE LOCATION - 2.4L

1 - PCV VALVE
2 - HOSE
3 - MOUNTING BOLT
4 - VALVE COVER (LEFT SIDE)

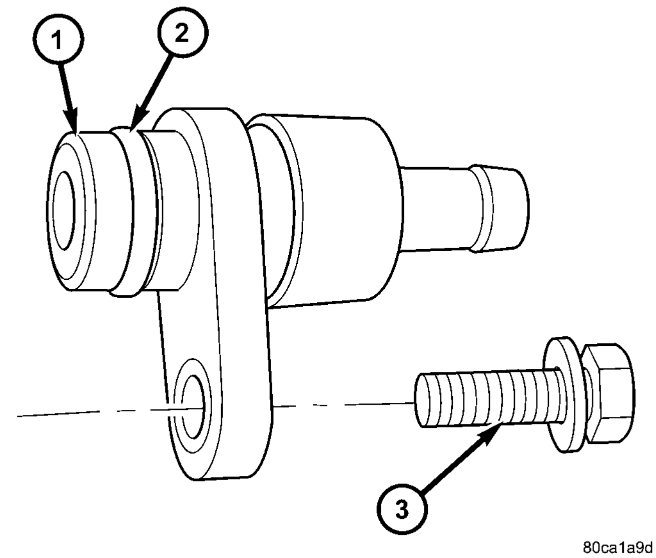

Fig. 3 PCV VALVE AND O-RING - 2.4L

1 - PCV VALVE
2 - O-RING
3 - MOUNTING BOLT

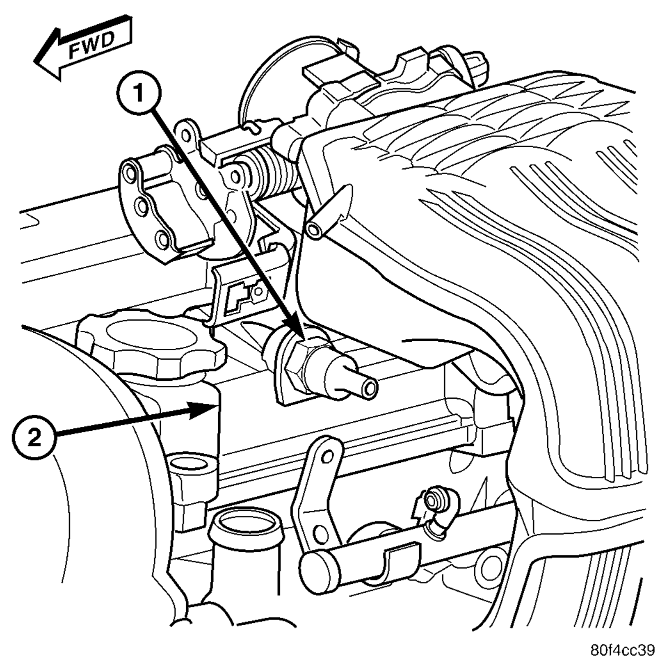

Fig. 4 PCV VALVE - 2.4L - THREADED

1 - PCV VALVE (THREADED)
2 - VALVE COVER (LEFT SIDE)

PCV VALVE (Continued)

OPERATION

2.4L

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose and crankcase breather(s) (if used). The metered air, along with crankcase vapors, are drawn through the PCV valve and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow-by gases to the intake system, reducing engine sludge formation.

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

TYPICAL PCV valves are shown in (Fig. 5), (Fig. 6) and (Fig. 7).

When the engine is not operating, or during an engine pop-back, the spring forces the plunger back against the seat (Fig. 5). This will prevent vapors from flowing through the valve.

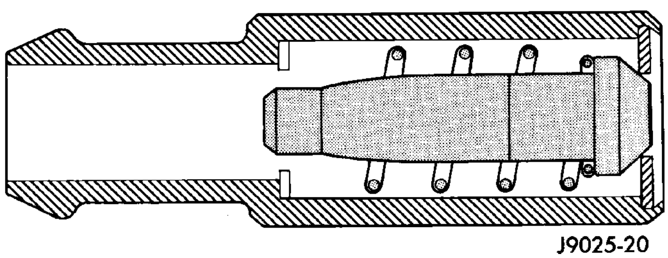

Fig. 5 ENGINE OFF OR ENGINE BACKFIRE - NO VAPOR FLOW

During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve (Fig. 6). In this position there is minimal vapor flow through the valve.

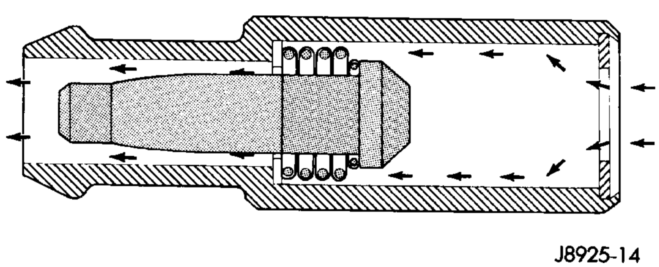

Fig. 6 HIGH INTAKE MANIFOLD VACUUM - MINIMAL VAPOR FLOW

During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve (Fig. 7).

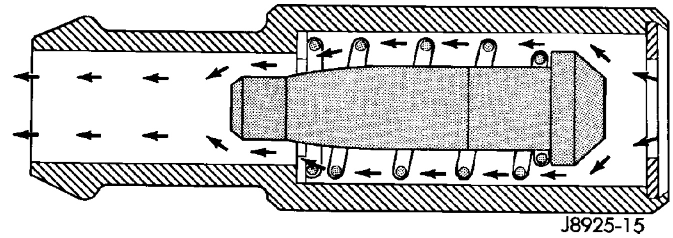

Fig. 7 MODERATE INTAKE MANIFOLD VACUUM - MAXIMUM VAPOR FLOW

REMOVAL

2.4L

The PCV valve is attached to the left/front side of the valve cover (Fig. 2). It is secured with 1 bolt. An o-ring is used to seal valve to valve cover (Fig. 3). Another type of threaded PCV valve may be used (Fig. 4).

(1) Remove hose from valve. Check condition of hose.

(2) Bolted PCV Valve:

(a) Remove 1 bolt.

(b) Remove PCV valve from valve cover.

(c) Check condition of valve o-ring.

(3) Threaded PCV Valve:

(a) Unscrew valve from valve cover.

EVAP/PURGE SOLENOID

DESCRIPTION

The duty cycle EVAP canister purge solenoid (DCP) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The Powertrain Control Module (PCM) operates the solenoid.

OPERATION

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM cycles (energizes and de-energizes) the solenoid 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time that the solenoid is energized. The PCM adjusts solenoid pulse width based on engine operating condition.

EVAP/PURGE SOLENOID (Continued)

REMOVAL

The duty cycle EVAP canister purge solenoid is located in the engine compartment near the front of the brake master cylinder (Fig. 8). It is attached to a slip-on type bracket.

The EVAP System Test Port is located near the EVAP/Purge Solenoid (Fig. 8).

(1) Disconnect electrical wiring connector at solenoid.

(2) Disconnect vacuum lines/hoses at solenoid.

(3) Lift solenoid and rubber solenoid support from mounting bracket.

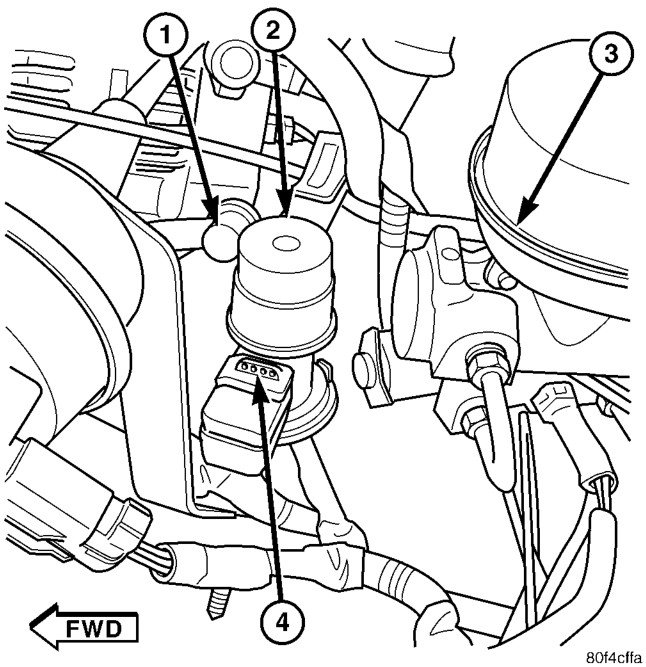

Fig. 8 EVAP/PURGE SOLENOID

1 - EVAP SYSTEM TEST PORT
2 - EVAP/PURGE SOLENOID
3 - FRONT OF BRAKE MASTER CYLINDER
4 - SOLENOID MOUNTING BRACKET

INSTALLATION

(1) Install purge solenoid and rubber support to its mounting bracket.

(2) Connect vacuum harness and wiring connector.

FUEL FILLER CAP

DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. Certain models are equipped with a 1/4 turn cap.

OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with a California emissions package and a Leak Detection Pump (LDP), the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.

REMOVAL

If replacement of the 1/4 turn fuel tank filler tube cap is necessary, it must be replaced with an identical cap to be sure of correct system operation.

CAUTION: Remove the fuel tank filler tube cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or before draining the fuel tank.

LEAK DETECTION PUMP

DESCRIPTION

The Leak Detection Pump (LDP) is attached to a bracket located to the rear of the right / rear tire under the plastic wheelhouse liner.

Vehicles equipped with JTEC engine control modules use a leak detection pump. Vehicles equipped with NGC engine control modules use an NVLD pump. Refer to Natural Vacuum - Leak Detection (NVLD) for additional information.

The evaporative emission system is designed to prevent the escape of fuel vapors from the fuel system (Fig. 9). Leaks in the system, even small ones, can allow fuel vapors to escape into the atmosphere. Government regulations require onboard testing to make sure that the evaporative (EVAP) system is functioning properly. The leak detection system tests for EVAP system leaks and blockage. It also performs self-diagnostics. During self-diagnostics, the Powertrain Control Module (PCM) first checks the Leak Detection Pump (LDP) for electrical and mechanical faults. If the first checks pass, the PCM then uses the LDP to seal the vent valve and pump air into the system to pressurize it. If a leak is present, the PCM will continue pumping the LDP to replace the air that leaks out. The PCM determines the size of the leak based on how fast/long it must pump the LDP as it tries to maintain pressure in the system.

LEAK DETECTION PUMP (Continued)

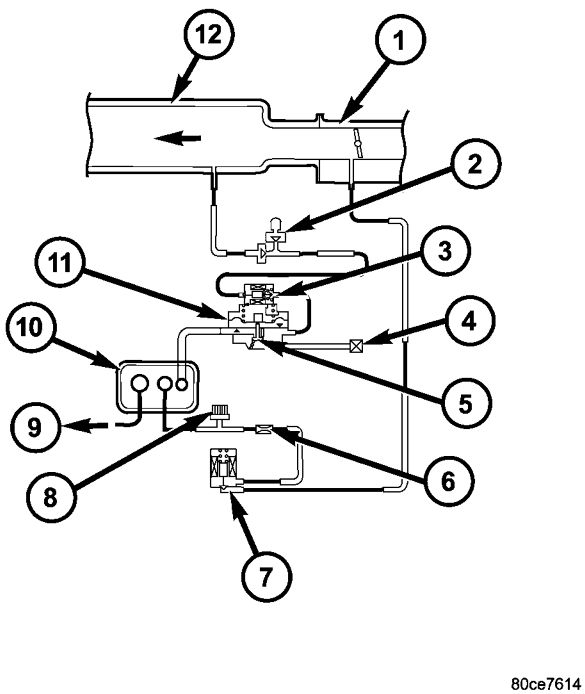

Fig. 9 SYSTEM COMPONENTS

1 - Throttle Body
2 - Service Vacuum Supply Tee (SVST)
3 - LDP Solenoid
4 - EVAP System Air Filter
5 - LDP Vent Valve
6 - EVAP Purge Orifice
7 - EVAP Purge Solenoid
8 - Service Port
9 - To Fuel Tank
10 - EVAP Canister
11 - LDP
12 - Intake Air Plenum

EVAP LEAK DETECTION SYSTEM COMPONENTS

Service Port: Used with special tools like the Miller Evaporative Emissions Leak Detector (EELD) to test for leaks in the system.

EVAP Purge Solenoid: The PCM uses the EVAP purge solenoid to control purging of excess fuel vapors stored in the EVAP canister. It remains closed during leak testing to prevent loss of pressure.

EVAP Canister: The EVAP canister stores fuel vapors from the fuel tank for purging.

EVAP Purge Orifice: Limits purge volume.

EVAP System Air Filter: Provides air to the LDP for pressurizing the system. It filters out dirt while allowing a vent to atmosphere for the EVAP system.

OPERATION

The main purpose of the LDP is to pressurize the fuel system for leak checking. It closes the EVAP system vent to atmospheric pressure so the system can be pressurized for leak testing. The diaphragm is powered by engine vacuum. It pumps air into the EVAP system to develop a pressure of about 7.5″ H2O (1/4) psi. A reed switch in the LDP allows the PCM to monitor the position of the LDP diaphragm. The PCM uses the reed switch input to monitor how fast the LDP is pumping air into the EVAP system. This allows detection of leaks and blockage. The LDP assembly consists of several parts (Fig. 10). The solenoid is controlled by the PCM, and it connects the upper pump cavity to either engine vacuum or atmospheric pressure. A vent valve closes the EVAP system to atmosphere, sealing the system during leak testing. The pump section of the LDP consists of a diaphragm that moves up and down to bring air in through the air filter and inlet check valve, and pump it out through an outlet check valve into the EVAP system. The diaphragm is pulled up by engine vacuum, and pushed down by spring pressure, as the LDP solenoid turns on and off. The LDP also has a magnetic reed switch to signal diaphragm position to the PCM. When the diaphragm is down, the switch is closed, which sends a 12 V (system voltage) signal to the PCM. When the diaphragm is up, the switch is open, and there is no voltage sent to the PCM. This allows the PCM to monitor LDP pumping action as it turns the LDP solenoid on and off.

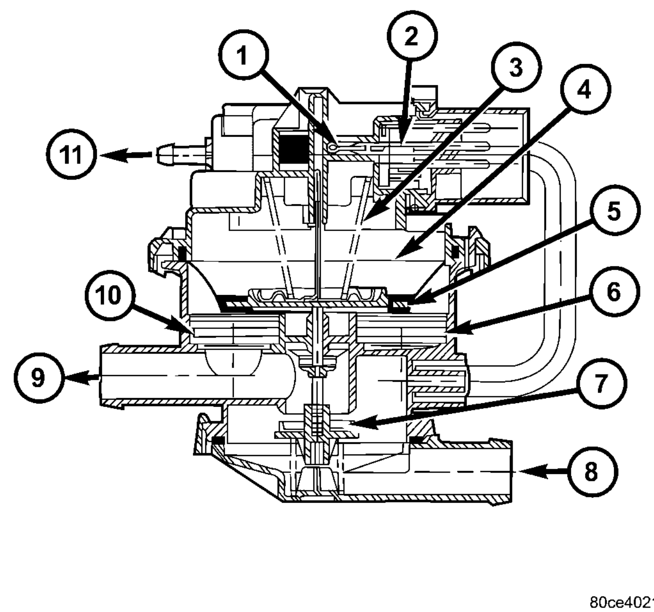

Fig. 10 EVAP LEAK DETECTION SYSTEM COMPONENTS

1 - Reed Switch
2 - Solenoid
3 - Spring
4 - Pump Cavity
5 - Diaphragm
6 - Inlet Check Valve
7 - Vent Valve
8 - From Air Filter
9 - To Canister
10 - Outlet Check Valve
11 - Engine Vacuum

LEAK DETECTION PUMP (Continued)

LDP AT REST (NOT POWERED)

When the LDP is at rest (no electrical/vacuum) the diaphragm is allowed to drop down if the internal (EVAP system) pressure is not greater than the return spring. The LDP solenoid blocks the engine vacuum port and opens the atmospheric pressure port connected through the EVAP system air filter. The vent valve is held open by the diaphragm. This allows the canister to see atmospheric pressure (Fig. 11).

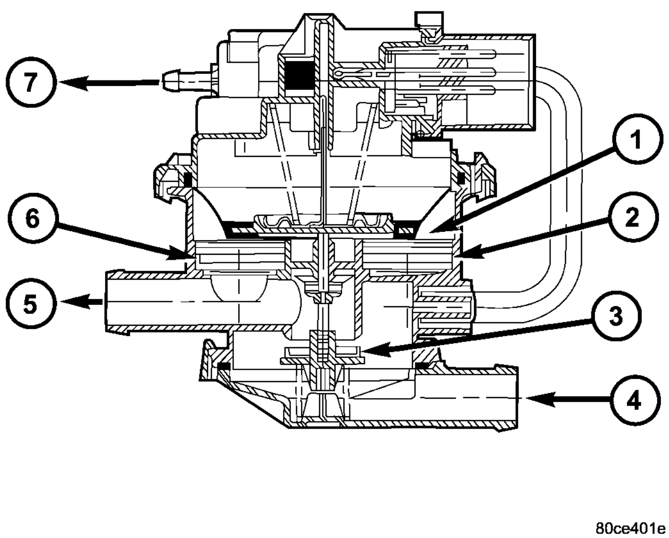

Fig. 11 LDP AT REST

1 - Diaphragm
2 - Inlet Check Valve (Closed)
3 - Vent Valve (Open)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Closed)
7 - Engine Vacuum (Closed)

DIAPHRAGM UPWARD MOVEMENT

When the PCM energizes the LDP solenoid, the solenoid blocks the atmospheric port leading through the EVAP air filter and at the same time opens the engine vacuum port to the pump cavity above the diaphragm. The diaphragm moves upward when vacuum above the diaphragm exceeds spring force. This upward movement closes the vent valve. It also causes low pressure below the diaphragm, unseating the inlet check valve and allowing air in from the EVAP air filter. When the diaphragm completes its upward movement, the LDP reed switch turns from closed to open (Fig. 12).

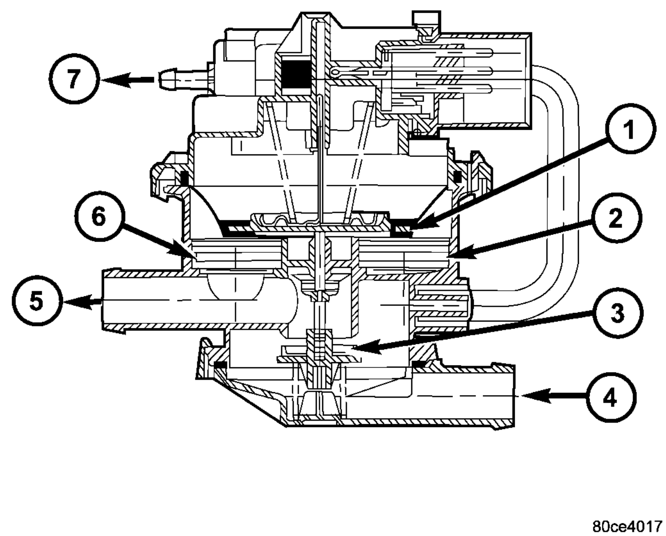

Fig. 12 DIAPHRAGM UPWARD MOVEMENT

1 - Diaphragm
2 - Inlet Check Valve (Open)
3 - Vent Valve (Closed)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Closed)
7 - Engine Vacuum (Open)

LEAK DETECTION PUMP (Continued)

DIAPHRAGM DOWNWARD MOVEMENT

Based on reed switch input, the PCM de-energizes the LDP solenoid, causing it to block the vacuum port, and open the atmospheric port. This connects the upper pump cavity to atmosphere through the EVAP air filter. The spring is now able to push the diaphragm down. The downward movement of the diaphragm closes the inlet check valve and opens the outlet check valve pumping air into the evaporative system. The LDP reed switch turns from open to closed, allowing the PCM to monitor LDP pumping (diaphragm up/down) activity (Fig. 13). During the pumping mode, the diaphragm will not move down far enough to open the vent valve. The pumping cycle is repeated as the solenoid is turned on and off. When the evaporative system begins to pressurize, the pressure on the bottom of the diaphragm will begin to oppose the spring pressure, slowing the pumping action. The PCM watches the time from when the solenoid is de-energized, until the diaphragm drops down far enough for the reed switch to change from opened to closed. If the reed switch changes too quickly, a leak may be indicated. The longer it takes the reed switch to change state, the tighter the evaporative system is sealed. If the system pressurizes too quickly, a restriction somewhere in the EVAP system may be indicated.

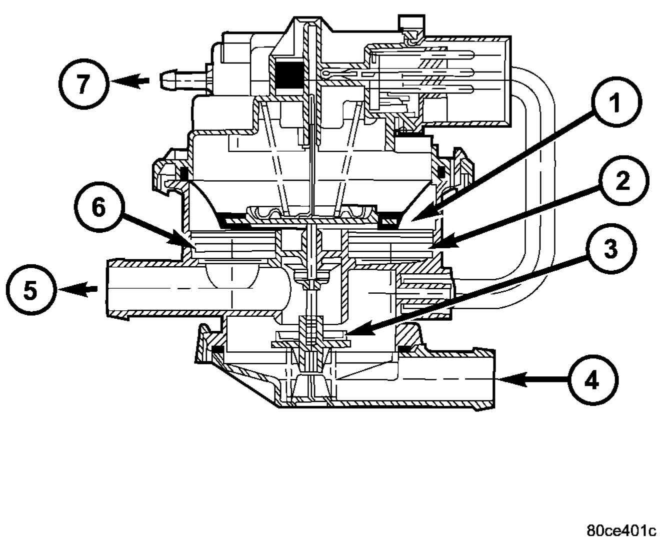

Fig. 13 DIAPHRAGM DOWNWARD MOVEMENT

1 - Diaphragm
2 - Inlet Check Valve (Closed)
3 - Vent Valve (Closed)
4 - From Air Filter
5 - To Canister
6 - Outlet Check Valve (Open)
7 - Engine Vacuum (Closed)

PUMPING ACTION

Action : During portions of this test, the PCM uses the reed switch to monitor diaphragm movement. The solenoid is only turned on by the PCM after the reed switch changes from open to closed, indicating that the diaphragm has moved down. At other times during the test, the PCM will rapidly cycle the LDP solenoid on and off to quickly pressurize the system. During rapid cycling, the diaphragm will not move enough to change the reed switch state. In the state of rapid cycling, the PCM will use a fixed time interval to cycle the solenoid. If the system does not pass the EVAP Leak Detection Test, the following DTCs may be set:

- P0442 - EVAP LEAK MONITOR 0.040″ LEAK DETECTED
- P0455 - EVAP LEAK MONITOR LARGE LEAK DETECTED
- P0456 - EVAP LEAK MONITOR 0.020″ LEAK DETECTED
- P1486 - EVAP LEAK MON PINCHED HOSE FOUND
- P1494 - LEAK DETECTION PUMP SW OR MECH FAULT
- P1495 - LEAK DETECTION PUMP SOLENOID CIRCUIT

REMOVAL

The Leak Detection Pump (LDP), LDP Filter, and EVAP canister are attached to a common support bracket. This support assembly is located to the rear of the right / rear tire under the plastic wheelhouse liner (Fig. 14). The LDP filter is also located near the EVAP canister (Fig. 15). The LDP and LDP filter are replaced (serviced) as one unit.

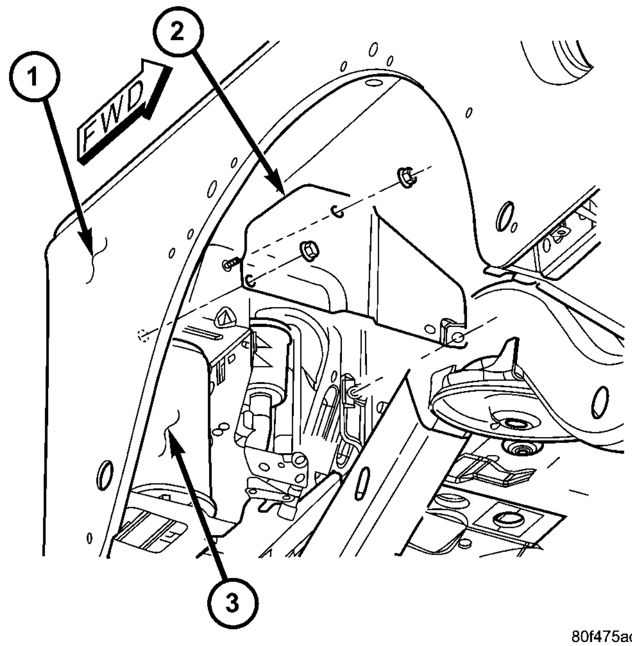

Fig. 14 EVAP CANISTER / LDP LOCATION

1 - RIGHT / REAR FENDER (WHEELHOUSE)
2 - VERTICAL SUPPORT BRACKET
3 - EVAP CANISTER

LEAK DETECTION PUMP (Continued)

(1) Remove right/rear tire/wheel.

(2) Remove wheelhouse liner at right/rear wheel.

(3) Remove vertical support bracket (Fig. 14) to gain access to 2 ORVR vapor lines.

(4) Two vapor lines connect the fuel tank to the EVAP canister and Leak Detection Pump (LDP). This connection is made near the right/rear corner of the fuel tank. Carefully disconnect these 2 vapor lines (Fig. 15) near top of flow management valve. Be very careful not to bend or kink the vapor lines. If lines leak, a Diagnostic Trouble Code (DTC) will be set.

(5) Remove common support bracket assembly (Fig. 16) containing LDP pump, LDP filter and EVAP canister from vehicle. While lowering this assembly, disconnect LDP electrical connector (Fig. 16) at LDP pump. **Do not allow the assembly to hang from the wire harness.**

(6) Carefully separate hose at bottom of LDP filter.

(7) Carefully remove vapor/vacuum lines at LDP.

(8) If necessary, remove LDP filter mounting bolt and remove filter.

(9) Remove EVAP canister from common support bracket by removing 4 nuts (Fig. 16).

(10) Remove 3 LDP mounting bolts (Fig. 17) and remove LDP from support bracket.

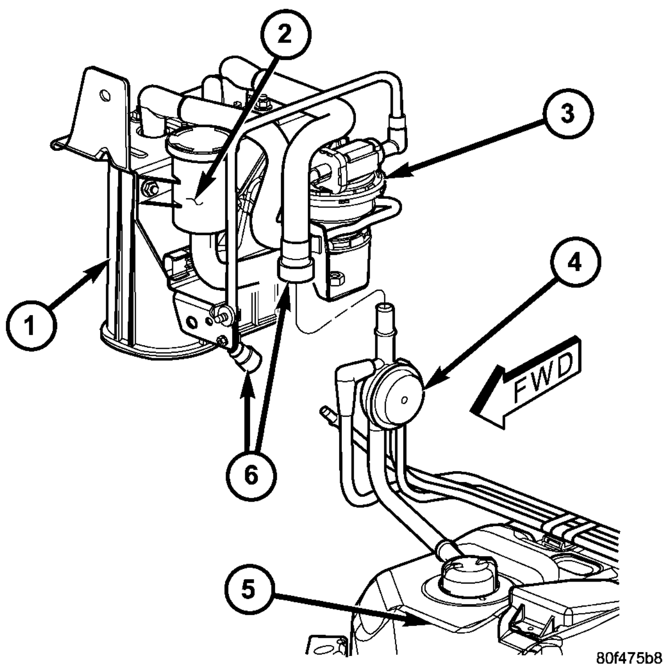

Fig. 15 DISCONNECTING ORVR VAPOR LINES

1 - EVAP CANISTER
2 - LDP FILTER
3 - LDP
4 - FLOW MANAGEMENT VALVE
5 - FUEL TANK
6 - VAPOR LINES (2)

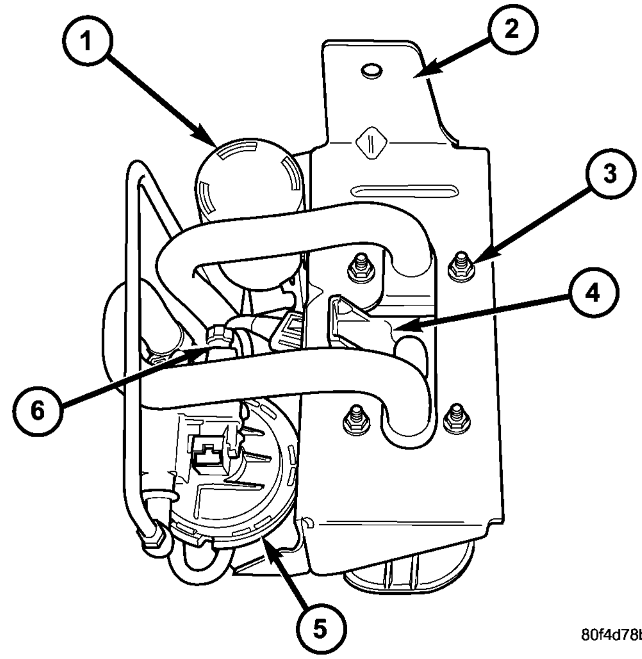

Fig. 16 COMMON SUPPORT BRACKET ASSEMBLY

1 - LDP FILTER
2 - COMMON SUPPORT BRACKET
3 - EVAP CANISTER NUTS (4)
4 - EVAP CANISTER
5 - LDP
6 - LDP ELEC. CONNECT.

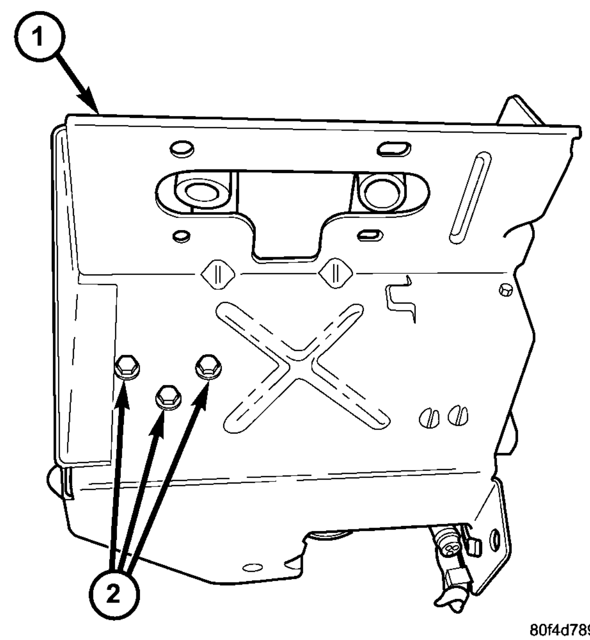

Fig. 17 LDP MOUNTING BOLTS

1 - COMMON SUPPORT BRACKET
2 - LDP MOUNTING BOLTS (3)

LEAK DETECTION PUMP (Continued)

INSTALLATION

The Leak Detection Pump (LDP), LDP Filter, and EVAP canister are attached to a common support bracket. This support assembly is located to the rear of the right / rear tire under the plastic wheelhouse liner (Fig. 14). The LDP filter is also located near the EVAP canister (Fig. 15). The LDP and LDP filter are replaced (serviced) as one unit.

(1) Install LDP and 3 mounting bolts to common support bracket. Tighten bolts to 1 N·m (11 in. lbs.) torque.

(2) If necessary, install LDP filter to common support bracket. Tighten bolt to 7 N·m (65 in. lbs.) torque.

(3) Install EVAP canister to common support bracket and install 4 mounting nuts (Fig. 16).

(4) Carefully install vapor/vacuum lines to LDP, LDP filter and EVAP canister. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the LDP, LDP filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) will be set.**

(5) Raise assembly into position while connecting electrical connector to LDP. Do not allow this assembly to hang from the wire harness. While assembly is still being supported, connect 2 vapor lines to fuel tank. This connection is made near the right/rear corner of the fuel tank. Carefully connect these 2 vapor lines (Fig. 15) near top of flow management valve. **Be very careful not to bend or kink the vapor lines. If lines leak, a Diagnostic Trouble Code (DTC) will be set.**

(6) Position common support bracket assembly to body. Install and tighten bolts.

(7) Install vertical support bracket (Fig. 14).

(8) Install wheelhouse liner at right/rear wheel.

(9) Install right/rear tire/wheel.

ORVR

DESCRIPTION

The ORVR (On-Board Refueling Vapor Recovery) system consists of a unique fuel tank, flow management valve, fluid control valve, one-way check valve and EVAP (vapor) canister (Fig. 18), or (Fig. 19).

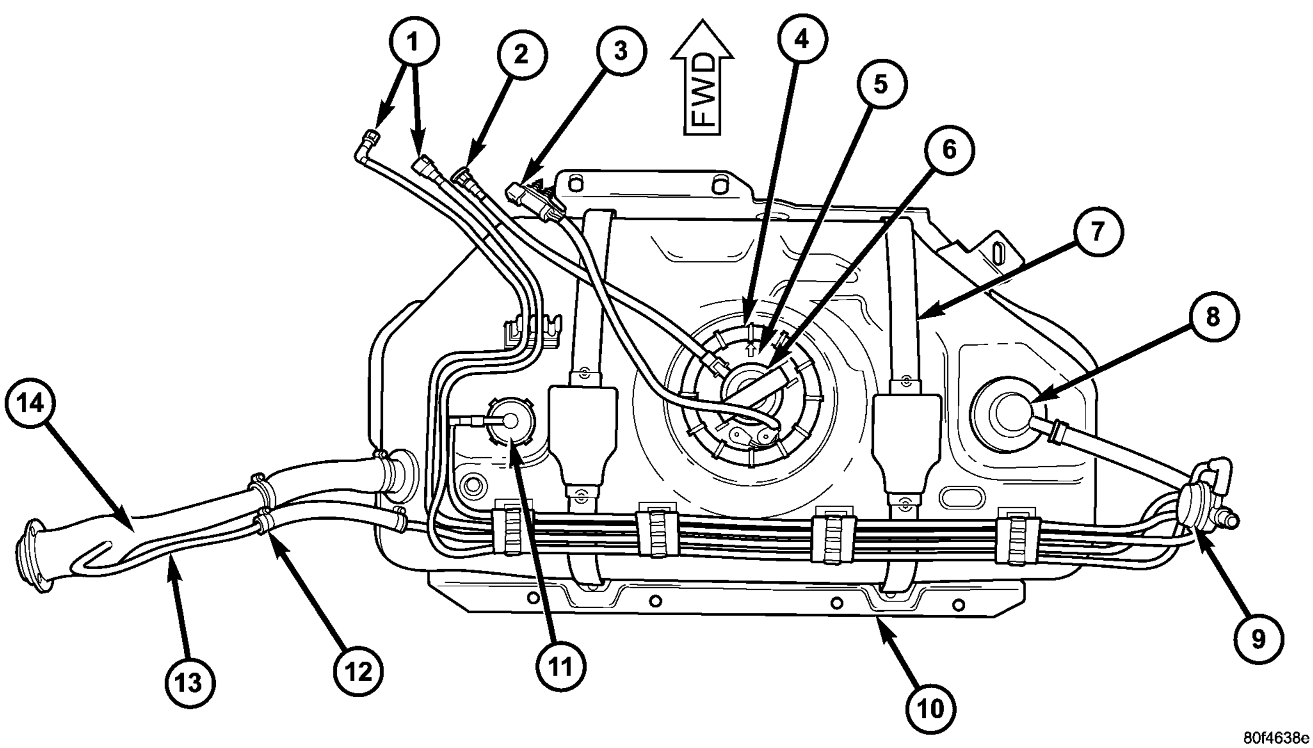

Fig. 18 FUEL TANK/FUEL PUMP MODULE (TOP VIEW)

1 - VAPOR LINES (2)
2 - FUEL SUPPLY LINE
3 - ELECTRICAL CONNECTOR
4 - MODULE LOCKNUT
5 - FUEL PUMP MODULE ASSEMBLY
6 - FUEL FILTER/FUEL PRESSURE REGULATOR
7 - FUEL TANK STRAPS (2)
8 - CHECK VALVE
9 - FUEL MANAGEMENT VALVE
10 - SKID PLATE
11 - CHECK VALVE
12 - CLAMPS (2)
13 - VENT LINE
14 - FUEL FILL TUBE

ORVR (Continued)

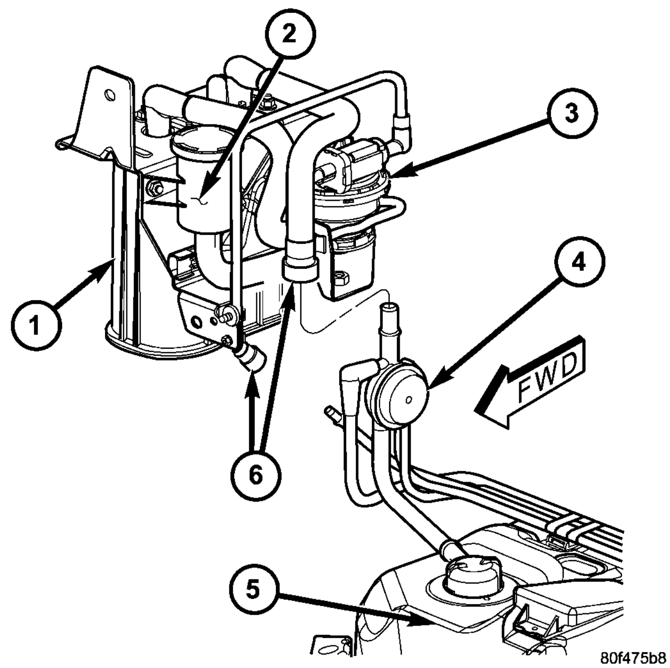

Fig. 19 ORVR VAPOR LINES

1 - EVAP CANISTER
2 - LDP FILTER
3 - LDP
4 - FLOW MANAGEMENT VALVE
5 - FUEL TANK
6 - VAPOR LINES (2)

OPERATION

The ORVR (On-Board Refueling Vapor Recovery) system is used to remove excess fuel tank vapors. This is done while the vehicle is being refueled.

Fuel flowing into the fuel filler tube (approx. 1” I.D.) creates an aspiration effect drawing air into the fuel fill tube. During refueling, the fuel tank is vented to the EVAP canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the EVAP canister, the vehicle’s computer controlled purge system draws vapor out of the canister for the engine to burn. The vapor flow is metered by the purge solenoid so that there is no, or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fuel fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve and on to the vapor canister. Vapor is absorbed in the EVAP canister until vapor flow in the lines stops. This stoppage occurs following fuel shut-off, or by having the fuel level in the tank rise high enough to close the control valve. This control valve contains a float that rises to seal the large diameter vent path to the EVAP canister. At this point in the refueling process, fuel tank pressure increases, the check valve closes (preventing liquid fuel from spiting back at the operator), and fuel then rises up the fuel filler tube to shut off the dispensing nozzle.

VACUUM LINES

DESCRIPTION

A vacuum schematic for emission related items can be found on the VECI label. Refer to Vehicle Emission Control Information (VECI) Label for label location.

VAPOR CANISTER

DESCRIPTION

The EVAP (vapor) canister, Leak Detection Pump (LDP) and LDP Filter are attached to a common support bracket. This support assembly is located to the rear of the right / rear tire under the plastic wheelhouse liner (Fig. 14).

OPERATION

A maintenance free, EVAP canister is used on all vehicles. The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

The EVAP canister is also to be considered as part of the ORVR system.

REMOVAL

The Leak Detection Pump (LDP), LDP Filter, and EVAP canister are attached to a common support bracket. This support assembly is located to the rear of the right / rear tire under the plastic wheelhouse liner (Fig. 14).

For EVAP canister removal procedures, refer to Leak Detection Pump Removal/Installation.

INSTALLATION

The Leak Detection Pump (LDP), LDP Filter, and EVAP canister are attached to a common support bracket. This support assembly is located to the rear of the right / rear tire under the plastic wheelhouse liner (Fig. 14).

For EVAP canister installation procedures, refer to Leak Detection Pump Removal/Installation.

Description	Group-Page

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NOTES

1.0 INTRODUCTION

The procedures contained in this manual include specifications, instructions, and graphics needed to diagnose the PCM Powertrain System. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

Please follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the appropriate modules; i.e., if the DRBIII® displays a "No Response" condition, you must diagnose this first before proceeding.
2. Read DTCs (diagnostic trouble codes) with the DRBIII®.
3. If no DTCs are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All system schematic diagrams are in Section 10.0. All charts and graphs are in Section 11.0.

An * placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added; current systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DTC. It is recommended that you review the entire manual to become familiar with all new and enhanced diagnostic procedures.

After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic procedure manual covers the 2004 Wrangler (TJ) with 2.4L and 4.0L Engines.

1.2 SIX-STEP TROUBLE SHOOTING PROCEDURE

Diagnosis of the Powertrain Control Module (PCM) is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The Powertrain Control Module (PCM) monitors and controls:

- fuel system
- ignition system
- charging system
- speed control system
- automatic transmission ("42RLE" transmissions only)

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The on-board OBDII/EUROIII diagnostics incorporated with the PCM controller are intended to assist the field technician in repairing vehicle problems by the quickest means.

3.2 FUNCTION OPERATION

3.2.1 FUEL CONTROL (GAS)

The PCM controls the air/fuel ratio of the engine by varying fuel injector on time. Mass air flow is calculated by the speed density method using engine speed and manifold absolute pressure (IAT is a modifier in Speed Density).

Different fuel calculation strategies are used depending on the operational state of the engine. During crank mode, a prime shot fuel pulse is delivered followed by fuel pulses determined by a crank time strategy. Cold engine operation is determined via an open loop strategy until the O2 sensors have reached operating temperature. At this point, the strategy enters a closed loop mode where fuel requirements are based upon the state of the O2 sensors, engine speed, MAP, throttle position, air temperature, battery voltage, and coolant temperature.

3.2.2 ON-BOARD DIAGNOSTICS

The PCM has been programmed to monitor any circuit or system that has an effect on vehicle emissions, or is used by the PCM to determine the proper functionality of these systems. This monitoring is called “on-board diagnosis.”

Certain criteria or, “arming conditions”, must be met for a trouble code to be entered into the PCM memory. The criteria may be a range of: engine rpm, engine temperature, and/or input voltage to the PCM. If a problem is detected with a monitored circuit, and all of the criteria or arming conditions are met, a trouble code will be stored in the PCM.

It is possible that a trouble code for a monitored circuit may not be entered into the PCM memory even though a malfunction has occurred. This may happen because one of the trouble code criteria (arming conditions) has not been met.

The PCM compares input signal voltages from each input device with specifications (the established high and low limits of the range) that are preprogrammed for that device. If the input voltage is not within specifications and other trouble code criteria (arming conditions) are met, a trouble code will be stored in the PCM memory.

The On Board Diagnostics have evolved to the second Generation of Diagnostics referred to as OBDII/EUROIII. These OBDII/EUROIII Diagnostics control the functions necessary to meet the requirements of California OBDII/EUROIII and Federal OBD regulations. These requirements specify the inclusion of a Malfunction Indicator Light (MIL) located on the instrument panel for all 1994 and subsequent model-year passenger cars, light duty trucks, and medium-duty vehicles. The purpose of the MIL is to inform the vehicle operator in the event of the malfunction of any emission systems and components which can affect emissions and which provide input to, or receive output from, the PCM.

The following table summarizes the various OBDII EuroIII monitors operation.

OBDII / EUROIII Monitor Operation

Comprehensive Components Monitor	**Major Monitors Non Fuel Control & Non Misfire**	**Major Monitors Fuel Control & Misfire**
Run constantly	Run Once Per Trip	Run constantly
Includes All Engine Hardware •Sensors, Switches, Solenoids, etc.	Monitors Entire Emission System	Monitors Entire System
Most are One Trip Faults – Usually Turns On The MIL and Sets DTC After One Failure	Most are Two Trip Faults – Turns On The MIL and Sets DTC After Two Consecutive Failures	Two Trip Faults – Turns On The MIL and Sets DTC After Two Consecutive Failures
Priority 3	**Priority 1 or 3**	**Priority 2 or 4**
All Checked For Continuity Open Short To Ground Short To Voltage Inputs Checked For Rationality Outputs Checked For Functionality	Done Stop Testing = Yes Oxygen Sensor Heater Oxygen Sensor Response Catalytic Converter Efficiency Except EWMA ● up to 6 tests per trip and a one trip fault (SBEC) and a two-trip fault on JTEC EGR System Evaporative Emission System (Purge and Leak) Non-LDP or LDP	**Fuel Control Monitor** Monitors Fuel Control System For: Fuel System Lean Fuel System Rich Requires 3 Consecutive *Fuel System Good Trips* to Extinguish The MIL **Misfire Monitor** Monitors For Engine Misfire at: 4 X 1000 RPM Counter (4000 Revs) (Type B) **200 X 3 (600) RPM Counter (Type A)
Requires 3 Consecutive *Global Good Trips* to Extinguish the MIL*	Requires 3 Consecutive *Global Good Trips* to Extinguish the MIL*	Requires 3 Consecutive *Global Good Trips* To Extinguish the MIL **Type A misfire is a one trip failure on pre-1999, 2 Trip failure on 1999 and later. The MIL will illuminate at the first or second failure, based on MY.

***40 Warm Up Cycles** are required to erase DTCs *after* the MIL has been extinguished.

OBDII/EUROIII MONITOR RUN PROCESS, JTEC

The following procedure has been established to assist Chrysler Dealer Technicians in the field with enabling and running OBD II/EURO III Monitors. The order listed in the following procedure is intended to allow the technician to effectively complete each monitor and to set the CARB Readiness Status in the least time possible.

NOTE:
A. Once the monitor run process has begun, do not turn off the ignition. By turning the ignition key off, monitor enabling conditions will be lost.
B. By performing a Battery Disconnect, or Selecting Erase DTCs, the CARB Readiness and all additional OBD information will be cleared.

Monitor Preliminary Checks:

1. Plug a DRB III® into the vehicle's DLC.
2. Turn the ignition, KEY ON - ENGINE OFF. Watch for MIL lamp illumination during the bulb check. MIL lamp must have illuminated, if not, repair MIL lamp.
3. On the DRB III® Select #1 DRB III Standalone.
4. Select #1 1998-2002 Diagnostics
5. Select #1 Engine.
6. Select #2 DTCs and Related Functions
7. Select #1 Read DTCs

* Verify that No Emissions Related DTCs are Present.

* If an Emissions DTC is Present, the OBD II/EUROIII Monitors may not run and the CARB Readiness will not update.

*The Emissions related DTC, will need to be repaired, then cleared. By clearing DTCs, the OBD Monitors will need to be run and completed to set the CARB Readiness Status.

8. Return to Engine Select Function Menu and Select #9, OBD II/EUROIII Monitors.
9. Select #3 CARB Readiness Status.

Do all the CARB Readiness Status Locations read YES?

*YES, then all monitors have been completed and this vehicle is ready to be I/M or Emission Tested.

*NO, then the following procedure needs to be followed to run/complete all available monitors.

NOTE:
A. Only the monitors, which are not YES in the CARB Readiness Status, need to be completed.
B. Specific criteria need to be met for each monitor. Each monitor has a Pre-Test screen to assist in running the monitor. For additional information, refer to the Chrysler Corporation Technical Training Workbook titled On Board Diagnostics, part number 81-699-97094.

The most efficient order to run the monitors has been outlined below, including suggestions to aid the process. The first two monitors have very similar enable criteria; it is possible that the Evaporative Leak Detection Monitor will run during the O2 Sensor Heater Monitor.

1. **O2 Sensor Heater Monitor**
   This monitor requires a cold start, usually an overnight soak or parked for at least 8 hours without the engine running. The engine coolant temperature must be within 10 degrees of ambient/battery temperature, and the sensed Ambient (outside) Temperature must be between approximately 0° F and 100° F. For the monitor run conditions, select the O2S HEATER MON PRE-TEST in the DRB III®, OBD II/EUROIII Monitors Menu
2. **Evaporative Leak Detection Monitor (If the vehicle is equipped with an LDP system)**
   This monitor requires a cold start, usually an overnight soak or parked for at least 8 hours without the engine running. The engine coolant temperature must be within 10 degrees of ambient/battery temperature, and the sensed Ambient (outside) Temperature must be between approximately 40° F and 90° F. For the monitor run conditions select the EVAP LDP MON PRE-TEST in the DRB III®, OBD II/EUROIII Monitors Menu.
3. **Catalyst Monitor**
   The vehicle will need to be driven at highway speed for a few minutes. If the vehicle is equipped with a manual transmission, using 4th gear may assist in meeting the monitor running criteria. For the monitor run conditions, select the EWMA CAT MON PRE-TEST in the DRB III®, OBD II/EUROIII Monitors Menu.

4. **O2 Sensor Monitor**
The vehicle will need to be driven for a period of time and brought to a stop for a short period of time with the Automatic Transmission left in Drive. The O2S Monitor will not run in Park or Neutral on an Automatic Transmission equipped vehicle. For the monitor run conditions, select the O2S MON PRE-TEST in the DRB III®, OBD II/EUROIII Monitors Menu.

5. **Purge Monitor**
All the Purge Free (PF) cells must update on the ADAPTIVE MEMORY screen before the Purge Flow Monitor will run. For the monitor run conditions, select the PURGE FLOW MON PRE-TEST in the DRB III®, OBD II/EUROIII Monitors Menu. The Purge Flow Monitor will not run in Park or Neutral on an Automatic Transmission equipped vehicle. The Purge Flow Monitor will attempt to run every **other** throttle closure. If all of the parameters are met and it still does not run, with your foot firmly on the Service Brake, slightly (1/4) open the Throttle and quickly close the Throttle. This will allow the Purge Free update to happen, and then the Purge Flow Monitor will Run.

3.2.3 OTHER CONTROLS

CHARGING SYSTEM

The charging system is turned on when the engine is started and ASD relay energized. When the ASD relay is on, ASD output voltage is supplied to the ASD sense circuit at the PCM. This voltage is connected in some cases, through the PCM and supplied to one of the generator field terminals (Generator Source +). All others, the Generator field is connected directly to the ASD output voltage. The amount of current produced by the generator is controlled by the Electronic Voltage Regulator (EVR) circuitry, in the PCM. Battery temperature is determined either by IAT, Ambient or Battery temperature sensor. This temperature along with sensed line voltage is used by the PCM to vary battery charging. This is accomplished by cycling the path to ground to the other generator field terminal (Generator field driver).

SPEED CONTROL

The PCM controls vehicle speed by operation of the speed control servo vacuum and vent solenoids. Energizing the vacuum solenoid applies vacuum to the servo to increase throttle position. Operation of the vent solenoid slowly releases the vacuum allowing throttle position to decrease. A special dump solenoid allows immediate release of throttle position caused by braking, cruise control turn off, shifting into neutral, excessive RPM (tires spinning) or ignition key off.

FUEL VAPOR RECOVERY SYSTEM (DUTY CYCLE PURGE CONTROL) GAS ENGINE

Duty Cycle Purge is a system that feeds fuel gases from the purge canister and gasoline tank into the throttle body for mixing with incoming air. Metering of the gases is performed by duty cycling the purge solenoid by the PCM.

The system is disabled during wide-open throttle conditions and while the engine is below a specified coolant temperature. When engine temperature becomes greater than a calibrated parameter, duty cycle purge is delayed for a calibrated time. Once purge delay is over, purge will be ramped in to soften the effect of dumping additional fuel into the engine.

The PCM provides a modulated 5 Hz signal (at closed throttle) or 10 Hz signal (at open throttle) to control this system. Modulation of the signal is based upon a calculated air flow (based upon known fuel flow through the injector at a given pulse width and RPM) and is adjusted to compensate for changes in flow due to varying engine vacuum.

LEAK DETECTION PUMP

LEAK DETECTION PUMP OPERATION

The evaporative emission system is designed to prevent the escape of fuel vapors from the fuel system. Leaks in the system, even small ones, can allow fuel vapors to escape into the atmosphere. Government regulations require onboard testing to make sure that the evaporative (EVAP) system is functioning properly. The leak detection system test for EVAP system leaks and blockage. It also performs self-diagnostics. During self-diagnostics, the Powertrain Control Module (PCM) first checks the Leak Detection Pump (LDP) for electrical and mechanical faults. If the first checks pass, the PCM then uses the LDP to seal the vent valve and pump air into the system to pressurize it. If a leak is present, the PCM will continue pumping the LDP to replace the air that leaks out. The PCM determines the size of the leak based on how fast/long it must pump the LDP as it tries to maintain pressure in the system.

EVAP LEAK DETECTION SYSTEM COMPONENTS (FIGURE 1)

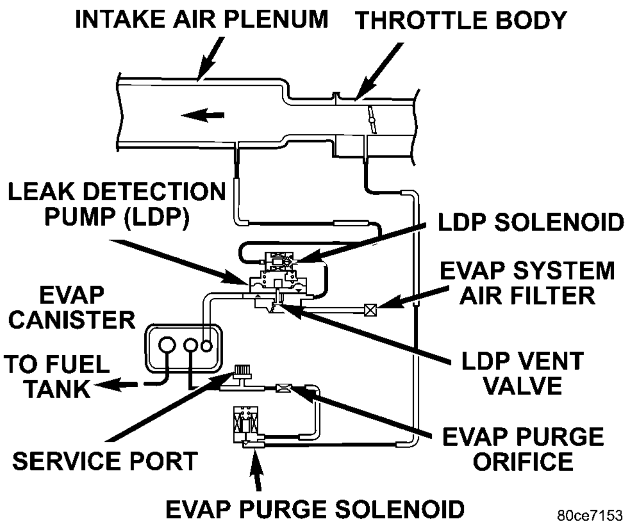
Service Port: Used with special tools like the Miller Evaporative Emissions Leak Detector (EELD) to test for leaks in the system.

EVAP Purge Solenoid: The PCM uses the EVAP purge solenoid to control purging of excess fuel vapors stored in the EVAP canister. It remains closed during leak testing to prevent loss of pressure.

EVAP Canister: The EVAP canister stores fuel vapors from the fuel tank for purging.

EVAP Purge Orifice: Limits purge volume.

EVAP System Air Filter: Provides air to the LDP for pressurizing the system. It filters out dirt while allowing a vent to atmosphere for the EVAP system.

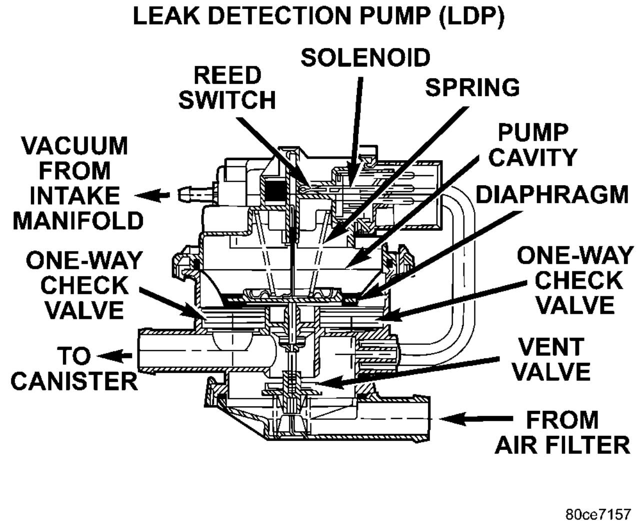


LEAK DETECTION PUMP (LDP) COMPONENTS

The main purpose of the LDP is to pressurize the fuel system for leak checking. It closes the EVAP system vent to atmospheric pressure so the system can be pressurized for leak testing. The diaphragm is powered by engine vacuum. It pumps air into the EVAP system to develop a pressure of about 7.5″ HO (1/4) psi. A reed switch in the LDP allows the PCM to monitor the position of the LDP diaphragm. The PCM uses the reed switch input to monitor how fast the LDP is pumping air into the EVAP system. This allows detection of leaks and blockage.

The LDP assembly consists of several parts (Figure 2). The solenoid is controlled by the PCM, and it connects the upper pump cavity to either engine vacuum or atmospheric pressure. A vent valve closes the EVAP system to atmosphere, sealing the system during leak testing. The pump section of the LDP consists of a diaphragm that moves up and down to bring air in through the air filter and inlet check valve, and pump it out through an outlet check valve into the EVAP system.

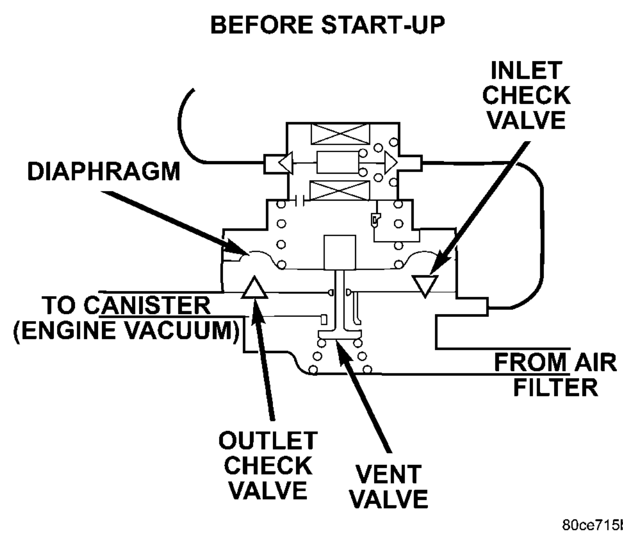
The diaphragm is pulled up by engine vacuum, and pushed down by spring pressure, as the LDP solenoid turns on and off. The LDP also has a magnetic reed switch to signal diaphragm position to the PCM. When the diaphragm is down, the switch is closed, which sends a 12 V (system voltage) signal to the PCM. When the diaphragm is up, the switch is open, and there is no voltage sent to



the PCM. This allows the PCM to monitor LDP pumping action as it turns the LDP solenoid on and off.

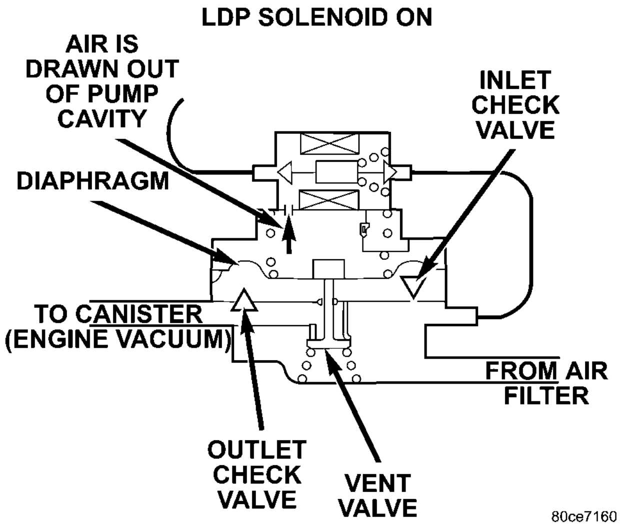
LDP AT REST (NOT POWERED)

When the LDP is at rest (no electrical/vacuum) the diaphragm is allowed to drop down if the internal (EVAP system) pressure is not greater than the return spring. The LDP solenoid blocks the engine vacuum port and opens the atmospheric pressure port connected through the EVAP system air filter. The vent valve is held open by the diaphragm. This allows the canister to see atmospheric pressure (Figure 3).



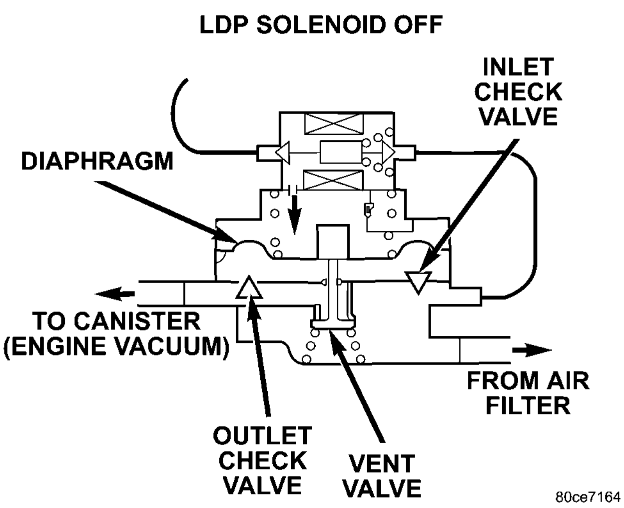
DIAPHRAGM UPWARD MOVEMENT

When the PCM energizes the LDP solenoid, the solenoid blocks the atmospheric port leading through the EVAP air filter and at the same time opens the engine vacuum port to the pump cavity above the diaphragm. The diaphragm moves upward when vacuum above the diaphragm exceeds spring force. This upward movement closes the vent valve. It also causes low pressure below the diaphragm, unseating the inlet check valve and allowing air in from the EVAP air filter. When the diaphragm completes its upward movement, the LDP reed switch turns from closed to open (Figure 4).



DIAPHRAGM DOWNWARD MOVEMENT

Based on reed switch input, the PCM de-energizes the LDP solenoid, causing it to block the vacuum port, and open the atmospheric port. This connects the upper pump cavity to atmosphere through the EVAP air filter. The spring is now able to push the diaphragm down. The downward movement of the diaphragm closes the inlet check valve and opens the outlet check valve pumping air into the evaporative system. The LDP reed switch turns from open to closed, allowing the PCM to monitor LDP pumping (diaphragm up/down) activity (Figure 5. During the pumping mode, the diaphragm will not move down far enough to open the vent valve.



The pumping cycle is repeated as the solenoid is turned on and off. When the evaporative system begins to pressurize, the pressure on the bottom of the diaphragm will begin to oppose the spring pressure, slowing the pumping action. The PCM watches the time from when the solenoid is de-energized, until the diaphragm drops down far enough for the reed switch to change from opened to closed. If the reed switch changes too quickly, a leak may be indicated. The longer it takes the reed switch to change state, the tighter the evaporative system is sealed. If the system pressurizes too quickly, a restriction somwehere in the EVAP system may be indicated.

PUMPING ACTION

During portions of this test, the PCM uses the reed switch to monitor diaphragm movement. The solenoid is only turned on by the PCM after the reed switch changes from open to closed, indicating that the diaphragm has moved down. At other times during the test, the PCM will rapidly cycle the LDP solenoid on and off to quickly pressurize the system. During rapid cycling, the diaphragm will not move enough to change the reed switch state. In the state of rapid cycling, the PCM will use a fixed time interval to cycle the solenoid.

If the system does not pass the EVAP Leak Detection Test, the following DTCs may be set:

- P0442 – EVAP LEAK MONITOR 0.040″ LEAK DETECTED
- P0455 – EVAP LEAK MONITOR LARGE LEAK DETECTED
- P0456 – EVAP LEAK MONITOR 0.020″ LEAK DETECTED
- P1486 – EVAP LEAK MON PINCHED HOSE FOUND
- P1494 – LEAK DETECTION PUMP SW OR MECH FAULT
- P1495 – LEAK DETECTION PUMP SOLENOID CIRCUIT

ENABLING CONDITIONS TO RUN EVAP LEAK DETECTION TEST

1. Cold start: with ambient temperature (obtained from modeling the inlet air temperature sensor on passenger vehicles and the battery temperature sensor on Jeep & truck vehicles) between 4°C (40°F) and 32°C (90°F) for 0.040 leak. Between 4°C (40°F) and 29°C (85°F) for 0.020 leak.
2. Engine coolant temperature within: -12° to -8°C (10° to 18°F) of battery/ambient.
3. Battery voltage between 10 and 15 volts.

NOTE: If battery voltage drops below 10 volts for more than 5 seconds during engine cranking, the EVAP leak detection test will not run.

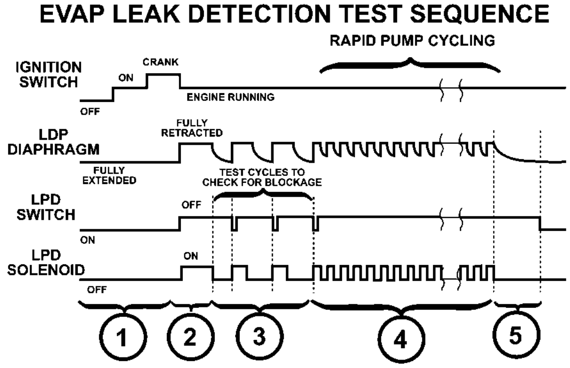
4. Low fuel warning light off (fuel level must be between 15% and 85%).
5. MAP sensor reading 22 in Hg or above (This is the manifold absolute pressure, not vacuum).
6. No engine stall during test.

NOTE: The following values are approximate and vehicle specific. Use the values seen in pre test/monitor test screen on the DRBIII®. See TSB 25-002-98 for more detail.

A DTC will not set if a one-trip fault is set or if the MIL is illuminated for any of the following:

- Purge Solenoid
- All engine Controller Self Test Faults
- All Cam and/or Crank Sensor Faults
- MAP Sensor Faults
- Ambient/Battery Temperature Sensor Electrical Faults
- All Coolant Sensor Faults
- All TPS Faults
- LDP Pressure Switch Faults
- EGR Solenoid Electrical Faults
- All Injector Faults
- Baro Out Of Range
- Vehicle Speed Faults
- LDP Solenoid Circuit

EVAP LEAK DETECTION TEST SEQUENCE



SECTION 1-P1495 LEAK DETECTION PUMP SOLENOID CIRCUIT CAN SET (KEY "ON")
SECTION 2-P1494 LEAK DETECTION PUMP SW OR MECH FAULT CAN SET
SECTION 3-P1486 EVAP LEAK MON PINCHED HOSE FOUND CAN SET
SECTION 4-NO DTC CAN SET DURING THIS TIME
SECTION 5-P0456 EVAP LEAK MONITOR 0.020 LEAK DETECTED/P0442-EVAP LEAK MONITOR 0.040 LEAK DETECTED/P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED CAN SET-TIMES WILL VARY

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FIGURE 6 SECTION 1

When the ignition key is turned to "ON", the LDP diaphragm should be in the down position and the LDP reed switch should be closed. If the EVAP system has residual pressure, the LDP diaphragm may be up. This could result in the LDP reed switch being open when the key is turned to "ON" and a P1494 fault could be set because the PCM is expecting the reed switch to be closed.

After the key is turned "ON", the PCM immediately tests the LDP solenoid circuit for electrical faults. If a fault is detected, DTC P1495 will set, the MIL will illuminate, and the remaining EVAP Leak Detection Test is cancelled.

NOTE: If battery temperature is not within range, or if the engine coolant temperature is not within a specified range of the battery temperature, the PCM will not run tests for DTC P1494, P1486, P0442, P0455 and P04441. These temperature calibrations may be different between models.

FIGURE 6 SECTION 2

If DTCP1495 is not set, the PCM will check for DTC P1494. If the LDP reed switch was closed when the key was turned to "ON", the PCM energizes the LDP solenoid for up to 8 seconds and monitors the LDP switch. As the LDP diaphragm is pulled up by engine vacuum, the LDP reed switch should change from closed to open. If it does not, the PCM sets a temporary fault (P1494) in memory, and waits until the next time the Enabling Conditions are met to run the test again. If this is again detected, P1494 is stored and the MIL is illuminated. If the problem is not detected during the next enabling cycle, the temporary fault will be cleared.

However, if the PCM detects the reed switch open when the key is turned to "ON", the PCM must determine if this condition is due to residual pressure in the EVAP system, or an actual fault. The PCM stores information in memory on EVAP system purging from previous engine run or drive cycles.

If little or no purging took place, residual pressure could be holding the LDP diaphragm up, causing the LDP switch to be open. Since this is not a malfunction, the PCM cancels the EVAP Leak Detection Test without setting the temporary fault.

If there was sufficient purging during the previous sycle to eliminate EVAP system pressure, the PCM judges that this is a malfunction and sets a temporary fault in memory. The next time that the Enabling Conditions are met, the test will run again. If the fault is again detected, the MIL will illuminate and DTC 1494 will be stored. If the fault is not detected, the temporary fault will be cleared.

FIGURE 6 SECTION 3

If no fault has been detected so far, the PCM begins testing for possible blockage in the EVAP system between the LDP and the fuel tank. This is done by monitoring the time required for the LDP to pump air into the EVAP system during two to three pump cycles. If no blockage is present, the LDP diaphragm is able to quickly pump air out of the LDP each time the PCM turns off the LDP solenoid. If a blockage is present, the PCM detects that the LDP takes longer to complete each pump cycle. If the pump cycles take longer than expected (approximately 6 to 10 seconds) the PCM will suspect a blockage. On the next drive when Enabling Conditions are met, the test will run again. If blockage is again detected, P1486 is stored, and the MIL is illuminated.

FIGURE 6 SECTION 4

After the LDP blockage tests are completed, the PCM then tests for EVAP system leakage. First, the PCM commands the LDP to rapidly pump for 20 to 50 seconds (depending on fuel level) to build pressure in the EVAP system. This evaluates the system to see if it can be sufficiently pressurized. This evaluation (rapid pump cycling) may occur several times prior to leak checking. The LDP reed switch does not close and open during rapid pumping because the diaphragm does not travel through its full range during this part of the test.

FIGURE 6 SECTION 5

Next, the PCM performs one or more tests cycles by monitoring the time required for the LDP reed switch to close (diaphragm to drop) after the LDP solenoid is turned off.

If the switch does not close, or closes after a long delay, it means that the system does not have any significant leakage and the EVAP Leak Detection Test is complete.

However, if the LDP reed switch closes quickly, there may be a leak or the fuel level may be low enough that the LDP must pump more to finish pressurizing the EVAP system. In this case, the PCM will rapidly pump the LDP again to build pressure in the EVAP system, and follow that by monitoring the time needed for several LDP test cycles. This process of rapid pumping followed by several LDP test cycles may repeat several times before the PCM judges that a leak is present.

When leaks are present, the LDP test cycle time will be inversely proportional to the size of the leak. The larger the leak, the shorter the test cycle time. The smaller the leak, the longer the test cycle time. DTC's may be set when a leak as small as 0.5 mm (0.020″) diameter is present.

If the system detects a leak, a temporary fault will be stored in PCM memory. The time it takes to detect a .020, .040, or larger leak is based on calibrations that vary from model to model. The important point to remember is if a leak is again detected on the next EVAP Leak Detection Test, the MIL will illuminate and a DTC will be stored based on the size of leak detected. If no leak is detected during the next test, the temporary fault will be cleared.

DIAGNOSTIC TIPS

During diagnosis, you can compare the LDP solenoid activity with the monitor sequence in Figure 6. If the PCM detects a problem that could set a DTC, the testing is halted and LDP solenoid activity will stop. As each section of the test begins, it indicates that the previous section passed successfully. By watching to see which tests complete, you can see if any conditions are present that the PCM considers abnormal.

For example, if the LDP solenoid is energized for the test cycles to test for blockage (P1486), it means that the LDP has already passed its test for P1494. Then, if the PCM detects a possible blockage, it will set a temporary fault without turning on the MIL and continue the leak portion of the test. However, the PCM will assume that the system is already pressurized and skip the rapid pump cycles.

Always diagnose leaks, if possible, before disconnecting connections. Disconnecting connections may mask a leak condition.

Keep in mind that if the purge solenoid seat is leaking, it could go undetected since the leak would end up in the intake manifold. Disconnect the purge solenoid at the manifold when leak checking. In addition, a pinched hose fault (P1486) could set if the purge solenoid does not purge the fuel system properly (blocked seat). The purge solenoid must vent the fuel system prior to the LDP system test. If the purge solenoid cannot properly vent the system the LDP cannot properly complete the test for P1486 and this fault can be set due to pressure being in the EVAP system during the test sequence.

Multiple actuation's of the DRBIII® Leak Detection Pump (LDP) Monitor Test can hide a 0.020 leak because of excess vapor generation. Additionally, any source for additional vapor generation can hide a small leak in the EVAP system. Excess vapor generation can delay the fall of the LDP diaphragm thus hiding the small leak. An example of this condition could be bringing a cold vehicle into a warm shop for testing for high ambient temperatures.

Fully plugged and partially plugged underhood vacuum lines have been known to set MIL conditions. P1494 and P0456 can be set for this reason. Always, thoroughly, check plumbing for pinches or blockage before condemning components.

TEST EQUIPMENT

The Evaporative Emission Leak Detector (EELD) Miller Special Tool 8404 is capable of visually detecting leaks in the evaporative system and will take the place of the Evap System Diagnostic Kit.

The EELD utilizes shop air and a smoke generator to visually detect leaks down to 0.020 or smaller. The food grade oil used to make the smoke includes an UV trace dye that will leave telltale signs of the leak under a black light. This is helpful when components have to be removed to determine the exact leak location. For detailed test instructions, follow the operators manual packaged with the EELD.

IMPORTANT

Be sure that the PCM has the latest software update. Reprogram as indicated by any applicable Technical Service Bulletin. After LDP repairs are completed, verify the repair by running the DRBIII® Leak Detection Pump (LDP) Monitor Test as described in Technical Service Bulletin 18-12-99.

3.2.4 NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems, and conditions even though they could have malfunctions that result in driveability problems. A diagnostic code may not be displayed for the following conditions. However, problems with these systems may cause a diagnostic code to be displayed for other systems. For example, a fuel pressure problem will not register a diagnostic code directly, but could cause a rich or lean condition. This could cause an oxygen sensor, fuel system, or misfire monitor trouble code to be stored in the PCM.

Engine Timing − The PCM cannot detect an incorrectly indexed timing chain, camshaft sprocket, or crankshaft sprocket. The PCM also cannot detect an incorrectly indexed distributor or Cam Sensor.(*)

Fuel Pressure − Fuel pressure is controlled by the fuel pressure regulator. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line filter, or a pinched fuel supply.(*)

Fuel Injectors − The PCM cannot detect a clogged fuel injector, a sticking pintle, or that an incorrect injector is installed.(*)

Fuel Requirements − Poor quality gasoline can cause problems such as hard starting, stalling, and stumble. Use of methanol-gasoline blends may result in starting and driveability problems. (See individual symptoms and their definitions in Section 6.0 Glossary of Terms).

PCM Grounds − The PCM cannot detect a poor system ground. However, a diagnostic trouble code may be stored in the PCM as a result of this condition.

Throttle Body Air Flow − The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.(*)

Exhaust System − The PCM cannot detect a plugged, restricted, or leaking exhaust system.(*)

Cylinder Compression − The PCM cannot detect uneven, low, or high engine cylinder compression.(*)

Excessive Oil Consumption − Although the PCM monitors the exhaust oxygen content through the oxygen sensor when the system is in a closed loop, it cannot determine excessive oil consumption.

NOTE: Any of these conditions could result in a rich or lean condition causing an oxygen sensor trouble code to be stored in the PCM, or the vehicle may exhibit one or moer of the driveability symptoms listed in the Table of Contents.

3.2.5 SKIS OVERVIEW

The Sentry Key Immobilizer System (SKIS) is an immobilizer system designed to prevent unauthorized vehicle operation. The system consists of Sentry Key Immobilizer Module (SKIM) sends a PCI Bus message to the engine controller indicating ignition key status. Upon receiving this message the PCM will terminate engine operation or allow the engine to continue to operate.

3.2.6 SKIM ON-BOARD DIAGNOSTICS

The SKIM has been programmed to transmit and monitor many different coded messages as well as PCI Bus messages. This monitoring is called “On-Board Diagnosis”.

Certain criteria must be met for a diagnostic trouble code to be entered into the SKIM memory. The criteria may be a range of Input voltage, PCI Bus message, or coded messages to the SKIM. If all of the criteria for monitoring a circuit or function are met and a fault is sensed, a diagnostic trouble code will be stored in the SKIM memory.

3.2.7 SKIS OPERATION

When ignition power is supplied to the SKIM, the SKIM performs an internal self-test. After the self-test is completed, the SKIM energizes the antenna (this activates the transponder chip) and sends a challenge to the transponder chip. The transponder chip responds to the challenge by generating an encrypted response message using the following:

Secret Key - This is an electronically stored value (identification number) that is unique to each SKIS. The secret key is stored in the SKIM, PCM, and all ignition key transponders.

Challenge - This is a random number that is generated by the SKIM at each ignition key cycle. The secret key and challenge are the two variables used in the algorithm that produces the crypto algorithm to receive, decode and respond to the message sent by the SKIM. After responding to the coded message, the transponder sends a transponder ID message to the SKIM. The SKIM compares the transponder ID to the available valid ignition key codes in the SKIM memory (8 key maximum). After validating the key, the SKIM sends a PCI Bus message called a “Seed Request” to the engine controller then waits for a PCM response. If the PCM does not respond, the SKIM will send the seed request again. After three failed attempts, the SKIM will stop sending the seed request and store a trouble code. If the PCM sends a seed response, the SKIM sends a valid/invalid key message to the PCM. This is an encrypted message that is generated using the following:

VIN - Vehicle Identification Number

Seed - This is a random number that is generated by the PCM at each ignition key cycle.

The VIN and seed are the two variables used in the rolling code algorithm that encrypts the “valid/invalid key” message. The PCM uses the rolling code algorithm to receive, decode and respond to the valid/invalid key message sent by the SKIM. After sending the valid/invalid key message the SKIM waits 3.5 seconds for a PCM status message from the PCM. If the PCM does not respond with a valid key message to the SKIM, a fault is detected and a trouble code is stored. The SKIS incorporates a warning lamp located in the instrument cluster. The lamp receives power and ground from the instrument cluster. The lamp is actuated when the SKIM sends a PCI Bus message to the instrument cluster requesting the lamp on. The SKIM will request warning lamp illumination for:

– bulb checks at ignition on
– to alert the vehicle operator to a SKIS malfunction
– customer key programming mode

For all faults except transponder faults and VIN mismatch, the lamp remains on steady. In the event of a transponder fault the light flashes at a rate of 1 Hz (once per second). If a fault is present the lamp will remain on or flashing for the complete ignition cycle. If a fault is stored in SKIM memory which prevents the system from operating properly, the PCM will allow the engine to start and run (for two seconds) up to six times. After the sixth attempt the PCM will not allow engine to start.

3.2.8 PROGRAMMING THE POWERTRAIN CONTROL MODULE

Important Notice: Before replacing the PCM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM driver/control circuit failures are caused by internal failure to components (i.e. relay and solenoids) and short circuits (i.e. 12-volt pull-ups, drivers and ground sensors). These failures are difficult to detect when a double fault has occurred and only one DTC has set.

NOTE: If the PCM and the SKIM are replaced at the same time, program the VIN into the PCM first. All vehicle keys will then need to be replaced and programmed to the new SKIM.

The SKIS “Secret Key” is an ID code that is unique to each SKIS. This code is programmed and stored in the SKIM, PCM and transponder chip (ignition key). When replacing the PCM it is necessary to program the secret key into the PCM.

1. Turn the ignition on (transmission in park/neutral).
2. Use the DRBIII® and select “THEFT ALARM”, “SKIM” then “MISCELLANEOUS”.
3. Select “PCM REPLACED”.
4. Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: If three attempts are made to enter the secure access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit ths lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned off. Also, monitor the battery state and connect a battery charger if necessary).

5. Press “ENTER” to transfer the secret key (the SKIM will send the secret key to the PCM).

3.2.9 PROGRAMMING THE SENTRY KEY IMMOBILIZER MODULE

NOTE: If the PCM and the SKIM are replaced at the same time, program the VIN into the PCM first. All vehicle keys will then need to be replaced and programmed to the new SKIM.

1. Turn the ignition on (transmission in park/neutral).
2. Use the DRBIII® and select “THEFT ALARM”, “SKIM”, then “MISCELLANEOUS”.
3. Select “SKIM MODULE REPLACEMENT (GASOLINE)”.
4. Program the vehicle four-digit PIN into the SKIM.
5. Select “COUNTRY CODE” and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, the SKIM must be replaced.

6. Select “UPDATE VIN” (the SKIM will learn the VIN from the PCM).
7. Press “ENTER” to transfer the VIN (the PCM will send the VIN to the SKIM).
8. The DRBIII® will ask if you want to transfer the secret key from the PCM. This will ensure the current vehicle ignition keys will still operate the SKIS system.

3.2.10 PROGRAMMING THE IGNITION KEYS TO THE SENTRY KEY IMMOBILIZER MODULE

1. Turn the igntion on (transmission in park/ neutral).
2. Use the DRBIII® and select “THEFT ALARM”, “SKIM” then “MISCELLANEOUS”.
3. Slect “PROGRAM IGNITION KEYS”.
4. Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM, the key cannot be transferred to another vehicle.

If ignition key programming is unsuccessful, the DRB III® will display one of the following messages:

Program Not Attempted - The DRBIII® attempts to read the programmed key status and there are no keys programmed in the SKIM memory.

Programming Key Failed - (Possible Used Key From Wrong Vehicle) - SKIM is unable to program key due to one of the following:

– faulty ignition key transponder
– ignition key is programmed to another vehicle.

8 Keys Already Learned, Programming Not Done - SKIM transponder ID memory is full.

– Obtain ignition keys to be programmed from customer (8 keys maximum).
– Using the DRBIII®, erase all ignition keys by selecting “MISCELLANEOUS” and “ERASE ALL CURRENT IGN. KEYS”.
– Program all ignition keys.

Learned Key In Ignition - Ignition key transponder ID is currently programmed in SKIM memory.

3.3 DIAGNOSTIC TROUBLE CODES

Each diagnostic trouble code is diagnosed by following a specific testing procedure. The diagnostic test procedures contain step-by-step instructions for determining the cause of trouble codes as well as no trouble code problems. It is not necessary to perform all of the tests in this book to diagnose an individual code.

Always begin by reading the diagnostic trouble codes using the DRBIII®.

3.3.1 HARD CODE

A diagnostic trouble code that comes back within one cycle of the ignition key is a “hard” code. This means that the defect is present when the PCM checks that circuit or function. Procedures in this manual verify if the trouble code is a hard code at the beginning of each test. When it is not a hard code, an “intermittent” test must be performed.

Codes that are for OBDII/EUROIII monitors will not set with just the ignition key on. Comparing these to non-emission codes, they will seem like an intermittent. These codes require a set of parameters to be performed (The DRBIII® pre-test screens will help with this for MONITOR codes), this is called a “TRIP”. All OBDII/EUROIII DTCs will set after two or in some cases one trip failures, and the MIL will be turned on. These codes require three successful, no failures, TRIPS to extinguish the MIL, followed by 40 warm-up cycles to erase the code. For further explanation of TRIPS, Pre-test screens, Warm-up cycles, and the use of the DRBIII®, refer to the On Board Diagnostic training booklet #81-699-97094.

3.3.2 INTERMITTENT CODE

A diagnostic trouble code that is not present every time the PCM checks the circuit is an “intermittent” code. Most intermittent codes are caused by wiring or connector problems. Intermittents that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. The following procedures may assist you in identifying a possible intermittent problem:

- Visually inspect related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.
- Visually inspect the related harnesses. Look for chafed, pierced, or partially broken wire.
- Refer to any S.T.A.R. Hotline Newsletters or technical service bulletins that may apply.
- Use the DRBIII® data recorder or co-pilot.

3.3.3 STARTS SINCE SET COUNTER

This reset counter counts the number of times the vehicle has been started since codes were last set or erased. This counter will count up to 255 start counts.

The number of starts helps determine when the trouble code actually happened. This is recorded by the PCM and can be viewed on the DRBIII® as STARTS since set.

When there are no trouble codes stored in memory, the DRBIII® will display "NO TROUBLE CODES FOUND" and the reset counter will show "STARTS since set = XXX."

OBDII/EUROIII vehicles will also display a DTC Specific or Global "Good Trip" counter which will indicate the number of "Good Trips" since the DTC was set. After 3 consecutive "Good Trips," the MIL is extinguished and the good trip counter is replaced by a "Warm Up Cycle" counter. 40 Warm-up Cycles will erase the DTC and Freeze Frame information.

3.3.4 NO START INFORMATION

IMPORTANT NOTE:

If the Powertrain Control Module has been programmed, <u>a DTC will set</u> in the ABS and Air bag modules. In addition, if the vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data <u>must be updated to enable</u> starting.

FOR ABS AND AIR BAG SYSTEMS:

1. Enter correct VIN and Mileage in PCM.
2. Erase codes in ABS and Air Bag modules.

FOR SKIM THEFT ALARM:

1. Connect the DRBIII® to the data link connector.
2. Go to Theft Alarm, SKIM, Misc. and place the SKIM in *secured access* mode, by using the appropriate PIN code for this vehicle.
3. Select Update the Secret Key data, data will be transferred from the SKIM to the PCM (This is required to allow the vehicle to start with the new PCM).
4. If three attempts are made to enter *secured access* mode using the incorrect PIN, *secured access* mode will be locked out for one hour. To exit this lock out mode, leave the ignition key in the Run/Start position for one hour. Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary.

After reading Section 3.0 (System Description and Functional Operation), you should have a better understanding of the theory and operation of the on-board diagnostics, and how this relates to the diagnosis of a vehicle that may have a driveability-related symptom or complaint.

3.4 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.

3.5 DRBIII® ERROR MESSAGES AND BLANK SCREEN

Under normal operation, the DRBIII® will display one of only two error messages:

– User-Requested WARM Boot by pressing MORE and NO at the same time.

```
ver: 2.29
date: 1 Oct 93
file: key_itf.cc
date: Jan 12 1994
line: 544
err: 0x1
User-Requested WARM Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

or

– User-Requested COLD Boot by pressing MORE and YES at the same time.

```
ver: 2.29
date: 1 Oct 99
file: key_hnd1.cc
date: Mar 8 2000
line: 1297
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

If the DRBIII® should display any other error message, record the entire display and call the Star Center.

3.5.1 DRBIII® DOES NOT POWER UP

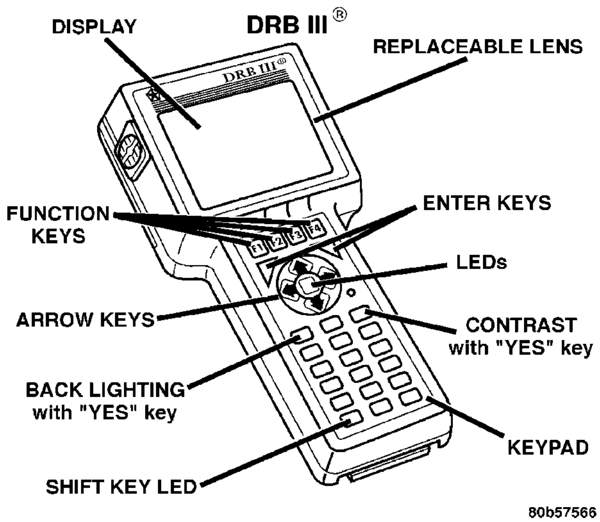
If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link connector cavity 16). Check for proper ground connection at DLC cavity. A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, and inoperative DRBIII®

may be the result of faulty cable or vehicle wiring. For a blank screen, refer to the appropriate body diagnostics manual.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY, WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a powertrain system problem, it is important to follow approved procedures where applicable. These procedures can be found in service manual procedures. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the powertrain system are intended to be serviced as an assembly. Attempting to remove or repair certain system sub-components may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

Follow the vehicle manufacturer's service specifications at all times.

- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips, or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz

FUNCTION	INPUT LIMIT
Temperature	-50 - 600°C -58 - 1100°F

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- A 10A fuse or circuit breaker must be used to protect the circuit being tested.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS AND CAUTIONS

4.3.1 ROAD TEST WARNINGS

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read the DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

4.3.2 VEHICLE DAMAGE CAUTIONS

Before disconnecting any control module, make sure the ignition is "off". Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation; this will damage the insulation and wire and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second DTC could be set, making diagnosis of the original problem more difficult.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box) scan tool
Evaporative Emissions Leak Detector #8404
Fuel pressure kit #8978
fuel filler adapter #8382
fuel pressure adapter (C-6631) or #6539
fuel pressure kit (C-4799-B) or #5069
fuel release hose (C-4799-1)
Mirco 420 battery system tester
min air flow fitting #6714
jumper wires
ohmmeter
oscilloscope
vacuum gauge
voltmeter
12-volt test light minimum 25 ohms resistance with probe #6801

CAUTION: A 12-volt test light should not be used for the following circuits, damage to the powertrain controller will occur.

- 5-Volt Supply
- 8 Volt Supply
- J1850 PCI Bus
- CCD Bus
- CKP Sensor Signal
- CMP Sensor Signal
- Vehicle Speed Sensor Signal
- O2 Sensor Signal

6.0 ACRONYMS

A/C	air conditioning
ABS	anti-lock brake system
ASD Relay	auto shutdown relay
APPS	accelerator pedal position sensor
Baro	barometric pressure
BCM	body control module
BTS	battery temperature sensor
CAA	clean air act

CAB	controller antilock brakes
CARB	California air resources board
CCD Bus	Chrysler collision detection bus
CKP Sensor	crank position sensor
CMP Sensor	camshaft position sensor
CO	carbon monoxide
DCP Solenoid	duty-cycle purge solenoid
DLC	data link connector
DRBIII®	diagnostic readout box – 3rd generation
DTC	diagnostic trouble code
DVOM	digital volt ohm meter
EATX II	electronic automatic transmission controller – 2nd Generation
EC	European community
ECT Sensor	engine coolant temperature sensor
EEPROM	electrically erasable programmable read only memory
EGR Valve	exhaust gas recirculation valve
EMCC	electronic modulated converter clutch
EMI	electro-magnetic interference
EOBD	European OBD (based upon Euro Stage III)
EPA	Environmental Protection Agency
EPP	engine position pulse
Eu	European Union
EVAP	evaporative emission system
EVR	electronic voltage regulator
EWMA	exponentially weighted moving average
FTP	federal test procedure
HC	hydrocarbons
HO2S	heated oxygen sensor
Generator	previously called “alternator”
IAC Motor	idle air control motor
IAT Sensor	intake air temperature sensor
I/M	inspection and maintenance testing
JTEC	Jeep/Truck engine controller
LDP	leak detection pump
LSIACV	linear solenoid idle air control valve
MAF	mass air flow
MAP Sensor	manifold absolute pressure sensor
MDS_2®	Mopar diagnostic system – 2nd generation
MIL	malfunction indicator lamp
MTV	manifold tuning valve
NGC	next generation controller
NTC	negative temperature coefficient
NVLD	natural vacuum leak detection
O_2Sensor	oxygen sensor
O2S	oxygen sensor
OBD I	on board diagnostics – 1st generation
OBD II	on-board diagnostics – 2nd generation
ORVR	on-board refueling vapor recovery
PCI Bus	programmable communications interface bus (J1850)
PCM	powertrain control module
PCV	positive crankcase ventilation
PDC	power distribution center
PEP	peripheral expansion port
P/N	park/neutral
PPS	proportional purge solenoid
PS	power steering
PSP	power steering pressure (switch)
PTC	positive temperature coefficient
PWM	pulse-width modulation
RAM	random access memory
RFI	radio frequency interference

RKE	remote keyless entry
RPM	revolutions per minute
SAE	Society of Automotive Engineers
SBEC	single board engine controller
SCW	Similar Conditions Window
SKIM	sentry key immobilizer module
SRV	short runner valve
TCC	torque converter clutch
TCM	transmission control module
TDC	top dead center
TPS	throttle position sensor
TRS	transmission range sensor
VSS	vehicle speed sensor
WOT	wide open throttle

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
*NO RESPONSE FROM PCM (PCI BUS)

POSSIBLE CAUSES
PCM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRBIII®, enter Body then Electro/Mechanical Cluster (MIC). With the DRBIII®, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	With the DRBIII® read PCM Diagnostic Trouble Codes. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRBIII® will not read PCM DTC's, follow the NO RESPONSE TO PCM (SCI only) symptom path.** **NOTE: If the vehicle will not start and the DRBIII® displays a no response message, refer to the appropriate symptom in the powertrain diagnostic procedures.** Turn the ignition off. Disconnect the PCM C3 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Install DRBIII® SuperCard 2 CH8361 into DRBIII®. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCI Bus circuit in the PCM connector. Turn the ignition on. Observe the voltage display on the DRBIII® Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the PCI Bus circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:

*NO RESPONSE FROM PCM (SCI ONLY)

POSSIBLE CAUSES
CHECK PCM POWERS AND GROUNDS
CONTROLLER ANTILOCK BRAKE
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI RECEIVE CIRCUIT SHORTED TO VOLTAGE
SCI CIRCUITS SHORTED TOGETHER
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking PCM Power and Ground Circuits in the Driveability category. **NOTE: With the DRBIII® in the generic scan tool mode, attempt to communicate with the PCM.** **NOTE: If the DRBIII® can communicate with the PCM in the generic scan tool mode, it may not be necessary to perform this step.** Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Disconnect the CAB harness connector (if equipped). **NOTE: If vehicle is not equipped with antilock brakes, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Replace the Controller Antilock Brake in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the TCM harness connector (if equipped). **NOTE: If vehicle is not equipped with a TCM, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Transmission Control Module in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
5	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Disconnect the TCM harness connector (if equipped). Disconnect the CAB harness connector (if equipped). Turn the ignition on. Measure the voltage of the SCI Transmit circuit at the DLC connector (cav 7). Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Turn the ignition on. Measure the voltage of the SCI Receive circuit at the DLC connector (cav 6). Is the voltage above 1.0 volt? Yes → Repair the SCI Receive circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Measure the resistance between the SCI Transmit circuit and the SCI Receive circuit at the PCM connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the SCI Transmit and the SCI Receive circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Receive circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Receive circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 9	All

*NO RESPONSE FROM PCM (SCI ONLY) — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Receive circuit between the PCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the SCI Receive circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the PCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the SCI Transmit circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE INSTRUMENT CLUSTER
GROUND CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
SENTRY KEY IMMOBILIZER MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Electro/Mech Cluster. Was the DRB able to I/D or communicate with the Instrument Cluster? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the Instrument Cluster. Perform SKIS VERIFICATION.	All
2	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Disconnect the SKIM harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open. Perform SKIS VERIFICATION.	All
4	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to ground, probe the Fused B(+) circuit. Is the test light illuminated? Yes → Go To 5 No → Check the Fuse in the Fuse Block for an open. Refer to the wiring diagrams. If OK, repair the Fused B+ circuit for an open. Perform SKIS VERIFICATION.	All

*NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE — Continued

TEST	ACTION	APPLICABILITY
5	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the SKIM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the SKIM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 6 No → Repair the PCI Bus circuit for an open. Perform SKIS VERIFICATION.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All

Symptom:
*PCI BUS COMMUNICATION FAILURE

POSSIBLE CAUSES
WIRING HARNESS INTERMITTENT
OPEN PCI BUS CIRCUIT AT THE DATA LINK CONNECTOR (DLC)
PCI BUS CIRCUIT SHORTED TO VOLTAGE
MODULE SHORT TO VOLTAGE
PCI BUS CIRCUIT SHORTED TO GROUND
MODULE SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	**Note: Determine which modules this vehicle is equipped with before beginning.** **Note: When attempting to communicate with any of the modules on this vehicle, the DRB will display 1 of 2 different communication errors: a NO RESPONSE message or a BUS +/- SIGNALS OPEN message.** Turn the ignition on. Using the DRB, attempt to communicate with the following control modules: Airbag Control Module SKIM (SENTRY KEY IMMOBILIZER) MIC (INSTRUMENT CLUSTER) Was the DRBIII® able to communicate with one or more Module(s)? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: If the DRB can not communicate with a single module, refer to the category list for the related symptom.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All
3	Turn the ignition off. Disconnect the PCM harness connector. Disconnect the DRB from the Data Link Connector (DLC). Disconnect the negative battery cable. Measure the resistance of the PCI Bus circuit between the Data Link Connector (DLC) and the PCM connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Reconnect the PCM harness connector and the negative battery cable.** Turn the ignition on. Measure the voltage of the PCI Bus circuit at the Data Link Connector (DLC). Is the voltage above 7.0 volts? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Using a voltmeter, connect one end to the PCI Bus circuit at the DLC, and the other end to ground. **Note: When performing the next step turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on to check for a short to voltage.** Turn the ignition on. While monitoring the voltmeter, disconnect each module the vehicle is equipped with one at a time. Is the voltage steadily above 7.0 volts with all the modules disconnected? Yes → Repair the PCI Bus circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to voltage was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the negative battery cable. Using a ohmmeter, connect one end to the PCI Bus circuit at the DLC, and the other end to ground. While monitoring the ohmmeter, disconnect each module the vehicle is equipped with one at a time. **NOTE: Total bus resistance to ground thru all of the modules is typically between 350 to 1000 ohms. The more modules on the bus, the lower the total bus resistance will be.** Is the resistance below 150.0 ohms with all the modules disconnected? Yes → Repair the PCI Bus circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to ground was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
INTERMITTENT CONDITION

POSSIBLE CAUSES
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	**NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Refer to any Technical Service Bulletins (TSBs) that may apply. Review the DRBIII® Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set. With the engine running at normal operating temperature, monitor the DRBIII® parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set. Turn the ignition off. Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals. Perform a voltage drop test on the related circuits between the suspected faulty component and the PCM. Inspect and clean all PCM, engine, and chassis grounds. If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits For any Relay DTCs, actuate the Relay with the DRBIII® and wiggle the related wire harness to try to interrupt the actuation. For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap. For intermittent Misfire DTC's check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt. Use the DRBIII® to perform a System Test if one applies to failing component. A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions. Were any problems found during the above inspections? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW
P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH
P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW
P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH
P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW
P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW.

When Monitored and Set Condition:

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not match Actual state.

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

Set Condition: Desired state does not equal Actual state.

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not equal Actual state.

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

Set Condition: Desired state does not equal Actual state.

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.

Set Condition: Desired state does not equal Actual state.

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH

When Monitored: Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.

Set Condition: Desired state does not equal Actual state.

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW — Continued

POSSIBLE CAUSES
O2 HEATER TEST
O2 SENSOR HEATER ELEMENT
(F142) FUSED ASD RELAY OUTPUT CIRCUIT
HEATER CONTROL CIRCUIT OPEN
HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. **NOTE: If P0136 is set with the P0031 or P0051, inspect the related fuse and repair as necessary.** With the DRBIII®, actuate the O2 Heater test. Monitor the O2 Heater Voltage for 5 minutes. Did the voltage drop below 0.5 of a volt during the Heater test? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2 **NOTE: Stop the actuation before continuing.**	All
2	Turn the ignition off. Disconnect the O2 Sensor harness connector. Measure the resistance of the O2 Heater Element at the O2 Sensor connector (component side). Is the resistance between 2.0 and 30 ohms? Yes → Go To 3 No → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
3	Ignition on, engine not running and the Sensor harness connector still disconnected. With the DRBIII®, perform the O2 Heater Test. Using a 12-volt test light connected to ground, probe the (F142) Fused ASD Relay Output at the O2 Sensor harness connector. Did the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground in the (F142) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the O2 Heater Control circuit (PWM) from the O2 Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the O2 Heater Control (PWM) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between ground and the O2 Heater Control (PWM) circuit at the Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Heater Control (PWM) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE

When Monitored and Set Condition:

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE

When Monitored: With the ignition on and no Battery Temperature Sensor Open or Short Faults present.

Set Condition: After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Battery Temperature has changed less than 4°C (7.2°F) change in temperature. One trip fault.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(K118) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
BATTERY TEMPERATURE SENSOR
RESISTANCE IN THE (K118) BATTERY TEMP SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K4) SENSOR GROUND CIRCUIT
(K118) BATTERY TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Battery Temp Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K118) Battery Temp Signal circuit at the Sensor connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage on the (K118) Batt Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, read the Battery Temp Sensor voltage with the Batt Temp Sensor still disconnected. Is the voltage above 4.6 volts? Yes → Go To 4 No → Go To 7	All
4	Connect a jumper wire between the (K118) Battery Temp Signal circuit and the (K4) Sensor ground circuit at the Sensor harness connector. With the DRBIII®, read the Battery Temp Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Connect the Battery Temp Sensor harness connector. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity.** Backprobe the (K118) Battery Temp Sensor Signal circuit at the Sensor harness connector and the PCM harness connector with both voltmeter leads. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 6 No → Repair the excessive resistance in the (K118) Battery Temp Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity.** Backprobe the (K4) Sensor ground circuit at the Battery Temperature Sensor harness connector and the PCM harness connector using both voltmeter leads. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 8 No → Repair the excessive resistance in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K118) Battery Temp Signal circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K118) Battery Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0107-MAP SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0107-MAP SENSOR VOLTAGE TOO LOW

When Monitored: With the engine RPM above 416 but less than 1500, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts.

Set Condition: The MAP Sensor signal voltage is below 0.1 of a volt for 2.0 seconds with the engine running.

POSSIBLE CAUSES
MAP SENSOR VOLTAGE BELOW 0.1 VOLT
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
MAP SENSOR
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO THE (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Start the engine. With the DRBIII®, read the MAP Sensor voltage. Is the voltage below 0.1 of a volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage of the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the voltage between 4.5 and 5.2 volts? Yes → Go To 3 No → Go To 6	All

P0107-MAP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, monitor the MAP Sensor voltage with the ignition on and Map Sensor still disconnected. Is the voltage above 1.2 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K1) MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Measure the resistance between the (K1) MAP Sensor Signal circuit and the (K4) Sensor ground circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance in the (K7) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Measure the resistance between ground and the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:

P0108-MAP SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0108-MAP SENSOR VOLTAGE TOO HIGH

When Monitored: With the engine RPM above 400, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts

Set Condition: The MAP Sensor signal voltage is greater than 4.88 volts at start or with the engine running for 2.2 seconds.

POSSIBLE CAUSES
MAP SENSOR VOLTAGE ABOVE 4.6 VOLTS
MAP SENSOR
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K1) MAP SENSOR SIGNAL CIRCUIT OPEN
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO (K7) 5-VOLT SUPPLY CIRCUIT
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Start the engine. With the DRBIII®, read the MAP Sensor voltage. Is the voltage above 4.6 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Connect a jumper wire between the (K1) MAP Sensor Signal circuit and the (K4) Sensor ground circuit in the Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the MAP Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0108-MAP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K1) MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (K1) MAP Sensor Signal circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between the (K1) MAP Sensor Signal circuit and the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K7) 5-volt Supply circuit and the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Measure the resistance of the (K4) Sensor ground circuit from the PCM harness connector to the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Go To 7 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0111-INTAKE AIR TEMP PERFORMANCE

When Monitored and Set Condition:

P0111-INTAKE AIR TEMP PERFORMANCE

When Monitored: With the ignition on and no Intake Air Temperature Sensor open/ shorted faults present.

Set Condition: After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Intake Air Temperature has had less than 5°C (9°F) change in temperature.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
IAT SENSOR VOLTAGE BELOW 1.0 VOLT
RESISTANCE IN THE (K21) IAT SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Intake Air Temperature Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the IAT Sensor voltage. Is the voltage above 4.6 volts? Yes → Go To 3 No → Go To 4	All
3	Connect a jumper wire across the IAT Sensor harness connector. With the DRBIII®, read the IAT Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the Intake Air Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4 **NOTE: Remove the jumper wire and connect the Sensor harness connector before continuing.**	All

P0111-INTAKE AIR TEMP PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity.** Perform a voltage drop test by back probing the (K21) IAT Sensor Signal circuit at the IAT Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the excessive resistance in the (K21) IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity.** Perform a voltage drop test by back probing the (K4) Sensor ground circuit at the IAT Sensor harness connector and PCM harness connector. Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 6 No → Repair the excessive resistance in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. **NOTE: Turn the ignition off before continuing.**	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Intake Air Temperature (IAT) Sensor circuit voltage at the PCM goes below 0.8 of a volt.

POSSIBLE CAUSES
IAT SENSOR VOLTAGE BELOW 1.0 VOLT
IAT SENSOR
(K21) IAT SENSOR SIGNAL SHORTED TO GROUND
(K21) IAT SENSOR SIGNAL SHORTED TO (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, read the IAT Sensor voltage. Is the voltage below 1.0 volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Intake Air Temp Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read IAT Sensor voltage. Is the voltage above 1.0 volt? Yes → Replace the IAT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K21) IAT Sensor Signal circuit in the IAT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K21) IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance between the (K21) IAT Sensor Signal circuit and the (K4) Sensor ground circuit at the IAT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K21) IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0113-INTAKE AIR TEMP SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0113-INTAKE AIR TEMP SENSOR VOLTAGE TOO HIGH

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Intake Air Temperature (IAT) Sensor circuit voltage at the PCM goes above 4.9 volts.

POSSIBLE CAUSES
IAT SENSOR VOLTAGE ABOVE 4.8 VOLTS
(K21) IAT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
IAT SENSOR
(K21) IAT SENSOR SIGNAL CIRCUIT OPEN
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, read the IAT Sensor voltage. Is the voltage above 4.8 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Intake Air Temp Sensor harness connector. Connect a jumper wire between the (K21) IAT Sensor Signal circuit and the (K4) Sensor ground circuit at the Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read the IAT Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the IAT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0113-INTAKE AIR TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K21) IAT Sensor Signal circuit at the Sensor harness connector. Is the voltage above 0 volts? Yes → Repair the short to voltage in the (K21) IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (K21) IAT Sensor Signal circuit from the IAT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K21) IAT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance of the (K4) Sensor ground circuit from the IAT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0117-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0117-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO LOW

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Engine Coolant Temperature (ECT) Signal circuit voltage at the PCM goes below 0.8 of a volt for more than 3 seconds.

POSSIBLE CAUSES
ECT VOLTAGE BELOW 1.0 VOLT
ECT SENSOR
(K2) ECT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SENSOR SIGNAL SHORTED TO (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, read the ECT Sensor voltage. Is the voltage below 1.0 volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Engine Coolant Temp Sensor harness connector. Ignition on, engine not running. With the DRBIII®, read ECT voltage. Is the voltage above 1.0 volt? Yes → Replace the ECT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K2) ECT Sensor Signal circuit at the ECT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K2) ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0117-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance between the (K2) ECT Sensor Signal circuit and the (K4) Sensor ground circuit at the ECT Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K2) ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH

When Monitored: With the ignition on and battery voltage greater than 10.4 volts.

Set Condition: The Engine Coolant Temperature (ECT) Sensor circuit voltage at the PCM goes above 4.94 volts for more than 3 seconds.

POSSIBLE CAUSES
ECT VOLTAGE ABOVE 4.9 VOLTS
ECT SENSOR
(K2) ECT SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K2) ECT SENSOR SIGNAL CIRCUIT OPEN
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, read the ECT Sensor voltage. Is the voltage above 4.9 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Engine Coolant Temp Sensor harness connector. Ignition on, engine not running. Connect a jumper wire between the (K2) ECT Sensor Signal circuit and the (K4) Sensor ground circuit in the ECT Sensor harness connector. With the DRBIII®, read the ECT Sensor voltage. Is the voltage below 1.0 volt? Yes → Replace the ECT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K2) ECT Sensor Signal circuit in the ECT Sensor harness connector. Is the voltage above 0 volts? Yes → Repair the short to voltage in the (K2) ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (K2) ECT Sensor Signal circuit from the ECT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K2) ECT Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance of the (K4) Sensor ground circuit from the ECT Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR

When Monitored and Set Condition:

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR

When Monitored: With the engine running and no MAP sensor or TPS DTC's set. Engine speed must be greater than 1600 RPM.

Set Condition: The PCM performs two separate tests. When the manifold vacuum is low, the TPS signal should be high. When the manifold vacuum is high, the TPS signal should be low. If the proper TPS voltage is not detected when the two conditions are met, a DTC will be set after 4 seconds.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
RESISTANCE IN (K7) MAP 5-VOLT SUPPLY CIRCUIT
(K7) MAP 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
MAP SENSOR
RESISTANCE IN THE (K1) MAP SENSOR SIGNAL CIRCUIT
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K4) MAP SENSOR GROUND CIRCUIT
TP SENSOR OPERATION
RESISTANCE IN (K7) TP SENSOR 5-VOLT SUPPLY CIRCUIT
(K7) TP SENSOR 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
THROTTLE POSITION SENSOR
RESISTANCE IN (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K4) SENSOR GROUND CIRCUIT
PCM

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. **NOTE: Diagnose any TP Sensor or MAP component DTCs before continuing.** **NOTE: If the P0500 - No Vehicle Speed Signal is set along with this DTC, refer to the P0500 diagnostics before continuing.** **NOTE: The throttle plate and linkage should be free of binding and carbon build up.** **NOTE: Ensure the throttle plate is at the idle position.** Ignition on, engine not running. **NOTE: Repair any vacuum leaks that are present before continuing.** With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Start the engine. With the DRBIII®, monitor the MAP Sensor voltage. Snap the throttle. Does the DRBIII® display MAP voltage from below 2.0 volts at idle to above 3.5 volts at WOT? Yes → Go To 3 No → Go To 10	All
3	Ignition on, engine not running. With the DRBIII®, monitor the TP Sensor voltage while slowly pressing the accelerator pedal from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Disconnect the TP Sensor harness connector. Disconnect the PCM harness connectors. Measure the resistance of the (K7) 5-volt Supply circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the excessive resistance in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between ground and the (K7) 5-volt Supply circuit at the TP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
6	Connect the PCM harness connectors. Ignition on, engine not running. With the DRBIII®, monitor the TP Sensor voltage. Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K4) Sensor ground circuit in the Sensor harness connector. Does the DRBIII® display TP Sensor voltage from approximately 4.9 volts to below 0.5 of a volt? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7 **NOTE: Remove the jumper wire before continuing.**	All
7	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector. Is the resistance below 100 ohms? Yes → Go To 9 No → Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	Measure the resistance of the (K4) Sensor ground circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 16 No → Repair the excessive resistance in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Turn the ignition off. Disconnect the MAP Sensor harness connector. Disconnect the PCM harness connectors. Measure the resistance of the (K7) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the excessive resistance in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
11	Measure the resistance between ground and the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the resistance above 100k ohms? Yes → Go To 12 No → Repair the short to ground in the (K7) MAP 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
12	Connect the PCM harness connector. Ignition on, engine not running. With the DRBIII®, monitor the MAP Sensor voltage. Connect a jumper wire between the (K1) MAP Sensor Signal circuit and the (K4) Sensor ground circuit in the Sensor harness connector. Cycle the ignition switch from off to on. Does the DRBIII® display MAP voltage from approximately 4.9 volts to below 0.5 of a volt? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13 **NOTE: Disconnect the jumper wire before continuing.**	All
13	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K1) MAP Sensor Signal circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 14 No → Repair the excessive resistance in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
14	Measure the resistance between ground and the (K1) MAP Sensor Signal circuit from the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Go To 15 No → Repair the short to ground in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
15	Measure the resistance of the (K4) Sensor ground circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 16 No → Repair the excessive resistance in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
16	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0122-THROTTLE POSITION SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P0122-THROTTLE POSITION SENSOR VOLTAGE TOO LOW

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: Throttle Position Sensor voltage at the PCM is lower than 0.1 of a volt for 1.3 seconds.

POSSIBLE CAUSES
TP SENSOR SWEEP
INTERMITTENT CONDITION
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
TP SENSOR
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO (K4) SENSOR GROUND CIRCUIT
TCM INTERNALLY SHORTED THROTTLE POSITION SIGNAL CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, read the Throttle Position Sensor voltage. Is the voltage below 0.2 of a volt? Yes → Go To 2 No → Go To 10	All
2	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit in the TP Sensor harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 3 No → Go To 7	All
3	With the DRBIII®, monitor the TP Sensor voltage with the Sensor disconnected. Is the voltage above 4.5 volts? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All

P0122-THROTTLE POSITION SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K4) Sensor ground circuit in the TP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: If the vehicle is not equipped with a TCM, answer No to this test and continue.** Connect the PCM harness connectors. Disconnect the TCM harness connector. Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Is the voltage above 4.5 volts? Yes → Replace the TCM in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
7	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K7) 5-volt Supply circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Measure the resistance between ground and the (K7) 5-volt Supply circuit in the TP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All

P0122-THROTTLE POSITION SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. **NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Slowly open the throttle from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0123-THROTTLE POSITION SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0123-THROTTLE POSITION SENSOR VOLTAGE TOO HIGH

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: Throttle Position Sensor signal voltage at the PCM goes above 4.5 volts for 3.2 seconds.

POSSIBLE CAUSES
TP SENSOR SWEEP
TP SENSOR
INTERMITTENT CONDITION
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO (K7) 5-VOLT SUPPLY CIRCUIT
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. **NOTE: Ensure the throttle is fully closed and free from binding or carbon build up.** Start the engine. With the DRBIII®, read the Throttle Position Sensor voltage. Is the voltage above 4.5 volts? Yes → Go To 2 No → Go To 8	All
2	Turn the ignition off. Disconnect the Throttle Position Sensor harness connector. Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K4) Sensor ground circuit in the Sensor harness connector. Ignition on, engine not running. With the DRBIII®, monitor the TP Sensor voltage. Is the voltage below 0.5 of a volt? Yes → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0123-THROTTLE POSITION SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Measure the voltage on the (K22) TP Sensor No.1 Signal circuit at the TP Sensor harness connector. **NOTE: If the voltage reading is below 5.2 volts answer NO to this test and continue.** If the voltage is above 5.3 volts, disconnect the Clock Spring harness connector per Service Information. If the Clockspring harness connector is disconnected and the TP Sensor voltage drops to 5.0 volts, replace the Clockspring per Service Information. Is the voltage above 5.3 volts with the Clock Spring harness disconnected? Yes → Repair the short to voltage in the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4 **NOTE: Turn the ignition off and connect the Clockspring harness connectors per Service Information before continuing.**	All
4	Disconnect the PCM harness connectors. Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K7) 5-volt Supply circuit at the TP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the (K7) 5-volt Supply circuit and the (K22) TP Sensor No.1 Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Measure the resistance of the (K4) Sensor ground circuit from the TP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0123-THROTTLE POSITION SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
8	Ignition on, engine not running. With the DRBIII®, monitor the Throttle Position Sensor voltage. Slowly open the throttle from the idle position to the wide open throttle position. Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0125-CLOSED LOOP TEMP NOT REACHED

When Monitored and Set Condition:

P0125-CLOSED LOOP TEMP NOT REACHED

When Monitored: With battery voltage greater than 10.4 volts, after engine is started, for ten minutes.

Set Condition: The engine temperature does not go above 18 deg. F after the engine has been running for 10 minutes. Two trips are required to set this DTC.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
LOW COOLANT LEVEL
THERMOSTAT OPERATION
ECT SENSOR

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	**NOTE: If a ECT Sensor DTC set along with this code, diagnose the ECT Sensor DTC first.** **NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.** **NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.** **Note: Extremely cold outside ambient temperatures may have caused this DTC to set.** **WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Allow the engine to cool before opening the cooling system.** Check the coolant system to make sure that the coolant is in good condition and at the proper level. Is the coolant level and condition OK? Yes → Go To 3 No → Inspect the vehicle for a coolant leak and add the necessary amount of coolant. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0125-CLOSED LOOP TEMP NOT REACHED — Continued

TEST	ACTION	APPLICABILITY
3	**Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F) . Also monitor the actual coolant temperature with a thermometer. **NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg in the DRBIII® values should stay relatively close to each other.** Using the appropriate service information, determine the proper opening temperature of the thermostat. Did the thermostat open at the proper temperature? Yes → Go To 4 No → Replace the thermostat. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII® in sensors, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the surrounding temperature (ambient temperature). **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the engine. During engine warm-up, monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Was the Eng Coolant Tmp Deg value increase a smooth transition and did it reach at least 180°? Yes → Test Complete. No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE LOW
P0137-O2 SENSOR 1/2 CIRCUIT VOLTAGE LOW
P0151-O2 SENSOR 2/1 CIRCUIT VOLTAGE LOW
P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE LOW

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE LOW.

When Monitored and Set Condition:

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE LOW

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0137-O2 SENSOR 1/2 CIRCUIT VOLTAGE LOW

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0151-O2 SENSOR 2/1 CIRCUIT VOLTAGE LOW

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE LOW

When Monitored: At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.

Set Condition: The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

POSSIBLE CAUSES
O2 SENSOR BELOW 0.16 OF A VOLT
O2 SENSOR OPERATION
O2 SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR SIGNAL CIRCUIT SHORTED TO (K4) SENSOR GROUND CIRCUIT

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE LOW — Continued

POSSIBLE CAUSES
O2 SENSOR SIGNAL SHORTED TO HEATER GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. Start the engine. Allow the engine to idle for 4 to 5 minutes. With the DRBIII®, read the O2 Sensor voltage. Does the voltage stay below 0.16 of a volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Disconnect the O2 Sensor harness connector. Start the engine. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage above 0.16 of a volt? Yes → Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the O2 Sensor Signal circuit at the O2 Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Measure the resistance between the O2 Sensor Signal circuit and the (K4) Sensor ground circuit at the O2 Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground circuit and the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE LOW — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: There may be two types of O2 Sensor Heater ground circuits used on this vehicle. One type uses an engine ground and the other type uses the PCM as a ground through the Pulse Width Modulated circuit.** * Measure the resistance between the PWM O2 Sensor Heater Control circuit and the O2 Sensor Signal circuit if it applies to the O2 Sensor being tested. OR * Measure the resistance between the O2 Sensor Signal circuit and the O2 Heater ground circuit if it applies to the O2 Sensor being tested. Is the resistance below 100 ohms? Yes → Repair the short between the O2 Sensor Signal circuit and the Heater ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE HIGH
P0138-O2 SENSOR 1/2 CIRCUIT VOLTAGE HIGH
P0152-O2 SENSOR 2/1 CIRCUIT VOLTAGE HIGH
P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE HIGH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE HIGH.

When Monitored and Set Condition:

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE HIGH

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0138-O2 SENSOR 1/2 CIRCUIT VOLTAGE HIGH

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0152-O2 SENSOR 2/1 CIRCUIT VOLTAGE HIGH

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE HIGH

When Monitored: With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.

Set Condition: The oxygen sensor voltage is above 1.5 volts.

POSSIBLE CAUSES
O2 SENSOR ABOVE 1.5 VOLTS
O2 SENSOR OPERATION
O2 SENSOR SIGNAL CIRCUIT OPEN
O2 SENSOR SIGNAL CIRCUIT SHORTED TO O2 HEATER SUPPLY CIRCUIT
(K4) SENSOR GROUND CIRCUIT OPEN
O2 SENSOR HEATER CONTROL CIRCUIT OPEN
O2 SENSOR HEATER SUPPLY CIRCUIT OPEN

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE HIGH — Continued

POSSIBLE CAUSES
O2 SENSOR SIGNAL SHORTED TO VOLTAGE
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. Start the engine. Allow the engine to idle for 4 to 5 minutes. With the DRBIII®, read the O2 Sensor voltage. Is the voltage above 1.5 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	**WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Turn the ignition off. Disconnect the O2 Sensor harness connector. Start the engine. With the DRBIII®, monitor the O2 Sensor voltage. Is the O2 Sensor voltage below 1.5 volts? Yes → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the O2 Sensor Signal circuit from the O2 Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**NOTE: Two relays may be used for the different types of Heated O2 Sensors. One uses the ASD Relay which is only used with PWM Heated O2 Sensors, while the other uses an O2 Heater Relay.** Verify which relay is used to supply power for the O2 Sensor Heater being tested. Measure the resistance between the O2 Sensor Signal circuit and the O2 Heater Supply circuit at the O2 Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the O2 Sensor Signal circuit and the ASD Relay Output or O2 Heater Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE HIGH — Continued

TEST	ACTION	APPLICABILITY
5	Measure the resistance of the (K4) Sensor ground circuit from the O2 Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: The O2 Sensor Heater ground may be a Pulse Width Modulated circuit or an engine ground depending on the type of O2 Sensor being tested.** * Measure the resistance of the PWM O2 Sensor Heater Control circuit from the O2 Sensor harness connector to the PCM harness connector if it applies to the O2 Sensor being tested OR * Measure the resistance between ground and the O2 Sensor Heater ground circuit at the O2 Sensor harness connector if it applies to the O2 Sensor being tested. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the O2 Sensor (PWM) Heater Control or Heater ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	The PCM harness connectors and O2 Sensor harness connector still disconnected. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the O2 Sensor Signal circuit at the O2 Sensor harness connector. Does the test light illuminate brightly? Yes → Repair the short to voltage in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	Turn the ignition off. Connect the PCM harness connectors. Ignition on, engine not running. With the DRBIII® actuate the O2 Heater Test. Measure the voltage on the O2 Heater Supply circuit. Is the voltage above 11.0 volts? No → Repair the open in the Heater Supply circuit. The Heater Supply circuit can be an output from the ASD Relay or the O2 Heater Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5. Yes → Go To 9	All
9	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0133-O2 SENSOR 1/1 SLOW RESPONSE
P0139-O2 SENSOR 1/2 SLOW RESPONSE
P0153-O2 SENSOR 2/1 SLOW RESPONSE
P0159-O2 SENSOR 2/2 SLOW RESPONSE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0133-O2 SENSOR 1/1 SLOW RESPONSE.

When Monitored and Set Condition:

P0133-O2 SENSOR 1/1 SLOW RESPONSE

When Monitored: With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.

Set Condition: The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

P0139-O2 SENSOR 1/2 SLOW RESPONSE

When Monitored: Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

P0153-O2 SENSOR 2/1 SLOW RESPONSE

When Monitored: With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.

Set Condition: The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

P0159-O2 SENSOR 2/2 SLOW RESPONSE

When Monitored: Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

P0133-O2 SENSOR 1/1 SLOW RESPONSE — Continued

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
EXHAUST LEAK
RESISTANCE IN THE O2 SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K4) SENSOR GROUND CIRCUIT
O2 SENSOR

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. **NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Start the engine. Inspect the exhaust for leaks between the engine and the related O2 Sensor. Are there any exhaust leaks? Yes → Repair or replace the leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Backprobe the O2 Sensor Signal circuit at the O2 Sensor harness connector and PCM harness connector. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection and are connected for positive polarity.** Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 4 No → Repair the excessive resistance in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0133-O2 SENSOR 1/1 SLOW RESPONSE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Backprobe the (K4) Sensor ground circuit at the O2 Sensor harness connector and PCM harness connector. **NOTE: Ensure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.** **NOTE: Ensure the voltmeter leads are connected for positive polarity** Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the excessive resistance in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. **NOTE: Turn the ignition off before continuing.**	All
5	If there are no possible causes remaining, view repair. Repair Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0135-O2 SENSOR 1/1 HEATER FAILURE
P0141-O2 SENSOR 1/2 HEATER FAILURE
P0155-O2 SENSOR 2/1 HEATER FAILURE
P0161-O2 SENSOR 2/2 HEATER FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0135-O2 SENSOR 1/1 HEATER FAILURE.

When Monitored and Set Condition:

P0135-O2 SENSOR 1/1 HEATER FAILURE

When Monitored: With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

P0141-O2 SENSOR 1/2 HEATER FAILURE

When Monitored: With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

P0155-O2 SENSOR 2/1 HEATER FAILURE

When Monitored: With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

P0161-O2 SENSOR 2/2 HEATER FAILURE

When Monitored: With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.

Set Condition: O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
O2 SENSOR HEATER OPERATION
O2 HEATER ELEMENT
O2 HEATER SUPPLY CIRCUIT OPEN

P0135-O2 SENSOR 1/1 HEATER FAILURE — Continued

POSSIBLE CAUSES
HEATER CONTROL CIRCUIT OPEN
HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Check for any related TSBs. Turn the ignition off. **NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor O2 Sensor voltage for at least 2 minutes. Does the voltage stabilize between 0.1 and 0.3 of a volt during the Heater test? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. **NOTE: Allow the O2 Sensor to cool to room temperature.** Disconnect the O2 Sensor harness connector. Measure the resistance across the O2 Sensor Heater element component side. Is the resistance value between 2.0 and 30 ohms? Yes → Go To 4 No → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	**NOTE: The O2 Heater Supply circuit may be a fused ASD Relay Output or an O2 Sensor Heater Relay Output, depending on the O2 Sensor being tested.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. Measure the voltage on the O2 Heater Supply circuit at the O2 Sensor harness connector. Is the voltage above 10.0 volts? Yes → Go To 5 No → Repair the open in the O2 Sensor Heater Supply cricuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0135-O2 SENSOR 1/1 HEATER FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the PCM harness connectors. Remove the O2 Heater Relay, if it applies to the O2 Sensor being tested. * Measure the resistance of the O2 Heater Control circuit (PWM) from the O2 Sensor to the PCM harness connector if it applies to the O2 Sensor being tested. OR * Measure the resistance of the (K512) O2 Heater Relay Control circuit from the O2 Heater Relay to the PCM harness connector, if it applies to the O2 Sensor being tested. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the excessive resistance in the O2 Heater Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: Before beginning this test, verify what type of Heated O2 Sensor is being tested, either the PWM Heated O2 Sensor or the Heater Relay controlled Heated O2 Sensor.** Remove the O2 Heater Relay if it applies to the type of Heated O2 Sensor being tested. * Measure the resistance between ground and the PWM circuit at the O2 Sensor harness connector if it applies to the Heated O2 Sensor being tested. OR * Measure the resistance between ground and the (K512) O2 Heater Relay Control circuit if it applies to the Heated O2 Sensor being tested. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Heater Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION

When Monitored and Set Condition:

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION

When Monitored: Ignition ON, with battery voltage greater than 10.4 volts.

Set Condition: The state of the PCM relay control circuit, between the PCM and relay coil, does not match the desired state.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
O2 SENSOR HEATER RELAY
(F142) FUSED ASD RELAY OUTPUT CIRCUIT
(K512) O2 HEATER RELAY CONTROL CIRCUIT OPEN
(K512) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND
O2 HEATER ELEMENT
(A242) O2 HEATER RELAY OUTPUT CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. **NOTE: If P0031 and P0051 are set along with P0136, inspect the related fuse and repair as necessary.** Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Remove the Heater Relay from the PDC. Measurement is taken at the Heater Relay component. Measure the resistance of the O2 Sensor Heater Relay Coil. Is the resistance above 100 ohms? Yes → Replace the O2 Sensor Heater Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground, probe the (F142) Fused ASD Relay Output circuit of the O2 Heater Relay in the PDC. Does the test light illuminate brightly when the relay actuates? Yes → Go To 4 No → Repair the open or short to ground in the (F142) ASD Relay Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K512) O2 Heater Relay Control circuit from the PDC (Heater Relay) connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K512) O2 Heater Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between ground and the (K512) O2 Heater Relay Control circuit at the PDC connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K512) O2 Sensor Heater Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. **NOTE: Allow the O2 Sensor to cool to room temperature.** Disconnect the 1/2 and 2/2, if applicable, O2 Sensor harness connectors. Measure the resistance across each of the O2 Sensor Heater elements, component side. Is the resistance value between 2.0 and 30 ohms? Yes → Go To 7 No → Replace the O2 Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Install the O2 Sensor Heater Relay. Connect the PCM harness connectors. Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. Using a 12-volt test light connected to ground, probe the (A242) O2 Heater Relay Output circuit at the 1/2 and 2/2, if applicable, O2 Sensor harness connectors. Does the test light illuminate brightly when the Relay is actuated? Yes → Go To 8 No → Repair the open or short to ground in the (A242) O2 Heater Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION — Continued

TEST	ACTION	APPLICABILITY
8	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are not possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:
P0171-1/1 FUEL SYSTEM LEAN
P0174-2/1 FUEL SYSTEM LEAN

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0171-1/1 FUEL SYSTEM LEAN.

When Monitored and Set Condition:

P0171-1/1 FUEL SYSTEM LEAN

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

P0174-2/1 FUEL SYSTEM LEAN

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
FUEL PRESSURE OUT OF SPECS
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SENSOR
O2 SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR HEATER OPERATION
TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED
TP SENSOR SWEEP
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL PROBLEM
FUEL FILTER/PRESSURE REGULATOR
INTERMITTENT CONDITION
PCM

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	**Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Turn the ignition off. Choose a conclusion that best matches your fuel pressure reading. Below Specification Go To 3 Within Specification Go To 6 Above Specification Replace the fuel filter/pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 5. **CAUTION: Stop All Actuations.**	All
3	Turn the ignition off. **Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module. Install special 5/16 fuel line adapter tool #6539 or #6631 between disconnected fuel line and the fuel pump module. Attach a fuel pressure test gauge to the T fitting on tool #6539 or #6631. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Is the fuel pressure within specification? Yes → Repair or replace fuel supply line as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4 **Caution: Stop All Actuations.**	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. **WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor and Exhaust System to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, monitor all of the O2 Sensor voltage readings. Is the voltage above 4.5 volts for all of the O2 Sensors? Yes → Go To 7 No → Go To 13	All
7	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor all O2 Sensor voltage readings for at least 2 minutes. Does the voltage stay above 4.5 volts for any of the O2 Sensors? Yes → Replace the O2 Sensor that had the voltage reading above 4.5 volts. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	Ignition on, engine not running. With the DRBIII®, read TP Sensor voltage. **NOTE: The throttle must be against the stop.** Is the voltage 0.92 of a volt or less with the Throttle closed? Yes → Go To 9 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	With the DRBIII®, read the TP Sensor voltage. While monitoring the DRBIII®, slowly open and close the throttle. Does the voltage increase and decrease smoothly? Yes → Go To 10 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Connect a Vacuum Gauge to a Manifold Vacuum source. Start the engine. Allow the engine to idle. **Note: If engine will not idle, maintain a constant RPM above idle.** With the DRBIII® in Sensors, read the MAP Sensor vacuum value. Is the DRBIII® reading within 1″ of the Vacuum Gauge reading? Yes → Go To 11 No → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. **NOTE: Remove the vacuum gauge before continuing.**	All
11	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Did the Engine Coolant Temperature increase smoothly and did it reach at least 82°C (180°F)? Yes → Go To 12 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
12	Check for any of the following conditions/mechanical problems. AIR INDUCTION SYSTEM - must be free from leaks. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0171-1/1 FUEL SYSTEM LEAN — Continued

TEST	ACTION	APPLICABILITY
13	**NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.** Ignition on, engine not running. Disconnect the harness connector(s) of the O2 Sensor(s) that had a voltage reading below 4.5 volts in the previous step. With the DRBIII®, monitor the O2 Sensor voltage reading(s). Is the O2 Sensor voltage above 4.5 volts? Yes → Replace the O2 Sensor that had the voltage reading above 4.5 volts. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14	All
14	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the O2 Sensor Signal circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	All
15	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:
P0172-1/1 FUEL SYSTEM RICH
P0175-2/1 FUEL SYSTEM RICH

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0172-1/1 FUEL SYSTEM RICH.

When Monitored and Set Condition:

P0172-1/1 FUEL SYSTEM RICH

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and the result is below a certain value for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

P0175-2/1 FUEL SYSTEM RICH

When Monitored: With the engine running in closed loop mode, the ambient/battery temperature above 20° F and altitude below 8000 ft.

Set Condition: If the PCM multiplies short term compensation by long term adaptive and the result is below a certain value for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
O2 SENSOR
O2 SENSOR SIGNAL CIRCUIT OPEN
O2 SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
O2 SENSOR HEATER OPERATION
EVAP SYSTEM OPERATION
TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED
TP SENSOR SWEEP
FUEL FILTER/PRESSURE REGULATOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL PROBLEM
INTERMITTENT CONDITION
PCM

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. **NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. **NOTE: Any O2 Sensor, TPS, ECT, MAP, or EVAP DTCs must be repaired before continuing.** Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. **Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Choose a conclusion that best matches your fuel pressure reading. Within Specification Go To 3 Above Specification Replace the fuel filter/pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 5. **Caution: Stop All Actuations.**	All
3	Ignition on, engine not running. With the DRBIII®, monitor all of the O2 Sensor voltage readings. Is the voltage above 4.5 volts for all of the O2 Sensors? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off. **NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4 and 5 volts.** Ignition on, engine not running. With the DRBIII®, actuate the O2 Heater Test. With the DRBIII®, monitor all of the O2 Sensor voltage values for at least 2 minutes. Does the voltage stay above 4.5 volts for any of the O2 Sensors? Yes → Replace the O2 Sensor that had the voltage reading above 4.5 volts. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
5	**NOTE: The engine must be at operating temperature and in closed loop to perform this test.** Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Allow the engine to reach normal operating temperature. With the DRBIII® select System Tests, perform the Purge Vapors Test. Observe the Short Term Adaptive value and press 3 to flow. **NOTE: Short Term Adaptive value change.** Did the Short Term Adaptive value change? Yes → Go To 6 No → Refer to the Driveability category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Ignition on, engine not running. With the DRBIII®, read TP Sensor voltage. **NOTE: The throttle must be against the stop.** Is the voltage 0.92 of a volt or less with the Throttle closed? Yes → Go To 7 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	With the DRBIII®, read the TP Sensor voltage. While monitoring the DRBIII®, slowly open and close the throttle. Does the voltage increase and decrease smoothly? Yes → Go To 8 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Turn the ignition off. Connect a Vacuum Gauge to a Manifold Vacuum source. Start the engine. Allow the engine to idle. **Note: If engine will not idle, maintain a constant RPM above idle.** With the DRBIII® in Sensors, read the MAP Sensor vacuum value. Is the DRBIII® reading within 1″ of the Vacuum Gauge reading? Yes → Go To 9 No → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. **NOTE: Remove the vacuum gauge before continuing.**	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
9	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soak)** Ignition on, engine not running. With the DRBIII®, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature. **Note: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.** Start the Engine. During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F). Did the Engine Coolant Temperature value increase smoothly and reach at least 82°C? Yes → Go To 10 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Check for any of the following conditions/mechanical problems. AIR INDUCTION SYSTEM - must be free from restrictions. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
11	Turn the ignition off. Disconnect the sensor harness connector of the O2 Sensor(s) that had a voltage value greater than 4.5 volts in the previous step. Ignition on, engine not running. With the DRBIII®, monitor the O2 Sensor voltage reading(s). Is the O2 Sensor voltage above 4.5 volts? Yes → Replace the O2 Sensor that had the voltage reading above 4.5 volts. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 12	All

P0172-1/1 FUEL SYSTEM RICH — Continued

TEST	ACTION	APPLICABILITY
12	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the O2 Sensor Signal circuit from the PCM harness connector to the O2 Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Go To 13 No → Repair the open in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
13	Leave the O2 Sensor and PCM harness connectors disconnected. Ignition on, engine not running. Measure the voltage on the O2 Sensor Signal circuit at the O2 Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 14 **NOTE: Turn the ignition off before continuing.**	All
14	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0201-INJECTOR #1 CONTROL CIRCUIT
P0202-INJECTOR #2 CONTROL CIRCUIT
P0203-INJECTOR #3 CONTROL CIRCUIT
P0204-INJECTOR #4 CONTROL CIRCUIT
P0205-INJECTOR #5 CONTROL CIRCUIT
P0206-INJECTOR #6 CONTROL CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0201-INJECTOR #1 CONTROL CIRCUIT.

When Monitored and Set Condition:

P0201-INJECTOR #1 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0202-INJECTOR #2 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0203-INJECTOR #3 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0204-INJECTOR #4 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0205-INJECTOR #5 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

P0201-INJECTOR #1 CONTROL CIRCUIT — Continued

P0206-INJECTOR #6 CONTROL CIRCUIT

When Monitored: With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.

Set Condition: This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(F42) ASD RELAY OUTPUT CIRCUIT
FUEL INJECTOR
FUEL INJECTOR CONTROL CIRCUIT OPEN
FUEL INJECTOR CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **NOTE: Diagnose any Misfire DTCs before continuing. If a Misfire is detected for a particular cylinder, the PCM will shut down that Injectors Control circuit.** With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Fuel Injector harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (F42) ASD Relay Output circuit at the Fuel Injector harness connector. With the DRBIII®, actuate the ASD Relay. Did the test light illuminate brightly when the ASD Relay was actuating? Yes → Go To 3 No → Repair the open or short to ground in the (F42) ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0201-INJECTOR #1 CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Using a 12-volt test light connected to 12-volts, probe the Fuel Injector Control circuit. With the DRBIII®, actuate the Fuel Injector. What is the state of the test light while actuating the Fuel Injector? Brightly blinking. Replace the Fuel Injector. Perform POWERTRAIN VERIFICATION TEST VER - 5. ON constantly. Go To 4 OFF constantly. Go To 5	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the Fuel Injector Control circuit in the Fuel Injector harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Fuel Injector Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the Fuel Injector Control circuit from the Fuel Injector harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the Fuel Injector Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair. Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0300-MULTIPLE CYLINDER MIS-FIRE
P0301-CYLINDER #1 MISFIRE
P0302-CYLINDER #2 MISFIRE
P0303-CYLINDER #3 MISFIRE
P0304-CYLINDER #4 MISFIRE
P0305-CYLINDER #5 MISFIRE
P0306-CYLINDER #6 MISFIRE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0300-MULTIPLE CYLINDER MIS-FIRE.

When Monitored and Set Condition:

P0300-MULTIPLE CYLINDER MIS-FIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0301-CYLINDER #1 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0302-CYLINDER #2 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0303-CYLINDER #3 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0304-CYLINDER #4 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

P0305-CYLINDER #5 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

P0306-CYLINDER #6 MISFIRE

When Monitored: Any time the engine is running, and the adaptive numerator has been successfully updated.

Set Condition: When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

POSSIBLE CAUSES
INTERMITTENT MISFIRE
VISUAL INSPECTION
IGNITION WIRE
(F42) ASD RELAY OUPUT CIRCUIT
ENGINE MECHANICAL PROBLEM
IGNITION COIL
COIL CONTROL CIRCUIT
SPARK PLUG
CHECKING FUEL PRESSURE
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
CHECKING FUEL LEAK DOWN
FUEL INJECTOR
INJECTOR CONTROL CIRCUIT
PCM

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Check for any TSB's that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.** Read and record the FREEZE FRAME DATA. Select OBD II MONITORS. Read and record the MIS-FIRE SIMILAR CONDITIONS WINDOW DATA. With these screens, attempt to duplicate the condition(s) that has set this DTC. When the vehicle is operating in the SIMILAR CONDITIONS WINDOW, refer to the WHICH CYLINDER IS MISFIRING screen. Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute. Is there a misfire present? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	**NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.** **NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.** - Visually inspect the engine for any of the following conditions. - Worn serpentine belt - Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump. - Misaligned Water pump, P/S Pump and A/C Compressor pulleys - Corroded PCM power and ground circuits. - Improper CKP, CMP, MAP, and TP Sensor mounting - Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc. - Vacuum leaks - Restricted Air Induction system or Exhaust system. Were any of the above conditions present? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Disconnect the Ignition Coil harness connector. Disconnect the Fuel Injector harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground, probe the (F42) ASD Relay Output circuit at the Ignition Coil harness connector and Fuel Injector harness connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the excessive resistance or short to ground in the (F42) ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Ignition wire from the spark plug of the cylinder(s) misfiring. Disconnect the Fuel Injector harness connector of the cylinder(s) being tested. **NOTE: Before continuing inspect the ignition wire for damage or carbon tracking. Replace as necessary.** Install a spark tester on the ignition wire. While cranking the engine observe the spark coming from the spark tester. **NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.** Is good spark present? Yes → Go To 5 No → Go To 14	All
5	Turn the ignition off. Remove the Spark Plug of the misfiring cylinder. Inspect the Spark Plug for the following conditions. - Cracks - Carbon Tracking - Foreign Material - Gap size out of specifications - Loose or broke electrode **NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.** Were any of the above condition present? Yes → Replace the Spark Plug. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge. Start the engine and observe the fuel pressure reading. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Choose a conclusion that best matches your fuel pressure reading. Within Specification Go To 7 Below Specification Go To 12 Above Specification Replace the fuel filter/pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
7	**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.** Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install special tool #6539 (5/16″) fuel line adapter. Install the fuel pressure gauge. Start the engine and allow the fuel system to reach maximum pressure. Turn the ignition off. **NOTE: Fuel specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine. Monitor the fuel pressure gauge for a minimum of 5 minutes. **NOTE: The pressure should not fall below 241 KPa (35 psi)** Does the Upstream gauge fall below the above specification? Yes → Replace the leaking Fuel Injector(s). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	**Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** **CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.** Remove special tool #C4390. Start the engine and allow the fuel pressure to reach maximum pressure. Ignition on, engine not running. Using the DRBIII®, actuate the Fuel Injector for the cylinder that indicated the misfire. Monitor the fuel pressure gauge. Does the fuel pressure gauge indicate a drop in fuel pressure? Yes → Go To 9 No → Go To 10 **NOTE: Turn the ignition off, remove the fuel pressure gauge, and connect the fuel lines before continuing.**	All
9	Check for any of the following conditions/mechanical problems. ENGINE VACUUM - must be at least 13 inches in neutral ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. ENGINE PCV SYSTEM - must flow freely TORQUE CONVERTER STALL SPEED - must be within specifications POWER BRAKE BOOSTER - no internal vacuum leaks FUEL - must be free of contamination CAM LOBES - must not be worn excessively CYLINDER LEAKAGE TEST - must be within specifications VALVE SPRINGS - cannot be weak or broken Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 17	All

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
10	Turn the ignition off. Disconnect the Fuel Injector harness connector. Ignition on, engine not running. **NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.** With the DRBIII®, erase DTCs. Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit. With the DRBIII®, actuate the Fuel Injector. Does the test light blink/flicker? Yes → Replace the Fuel Injector. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11	All
11	Turn the ignition off. Disconnect the PCM harness connectors. Check the Injector Control circuit for an open, short to ground, and short to voltage. Was a problem found with the Injector Control circuit? Yes → Repair the excessive resistance or short to ground in the Injector Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 17	All
12	Turn the ignition off. **Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module. Install special tool #6539 (5/16″) fuel line adapter fuel pressure gauge between the fuel supply line and the fuel pump module. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Is the fuel pressure within specification? Yes → Repair or replace fuel supply line as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	All
13	Turn the ignition off. **Warning: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose,fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → NOTE: Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Ensure the ground circuit is operating properly. Repair as necessary. Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0300-MULTIPLE CYLINDER MIS-FIRE — Continued

TEST	ACTION	APPLICABILITY
14	Turn the ignition off. Remove the ignition wire. Measure the resistance of the ignition wire. Is the resistance below 10K ohms? Yes → Go To 15 No → Replace the Ignition Wire. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
15	Turn the ignition off. Disconnect the Ignition Coil harness connector. Remove the Fuel Pump Relay or ASD Relay. Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit. Crank the engine for 5 second while observing the test light. **NOTE: The resistance of the Primary Ignition Coil on a 2.4L is 0.51 to 0.61 of an ohm and the 4.0L Primary Coil Rail resistance is 0.53 to 0.63 of an ohm at 77°F (25°C).** Does the test light brightly blink/flicker? Yes → Replace the Ignition Coil. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 16	All
16	Turn the ignition off. Disconnect the PCM harness connectors. Check the Coil Control circuit for an open, short to ground, and short to voltage. Was a problem found with the Coil Control circuit? Yes → Repair the Coil Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 17	All
17	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0320-NO CRANK REFERENCE SIGNAL AT PCM

When Monitored and Set Condition:

P0320-NO CRANK REFERENCE SIGNAL AT PCM

When Monitored: With the ignition on.

Set Condition: No signal from the Crankshaft Position Sensor is present during engine cranking, and at least 3 Camshaft Position Sensor signals have occurred.

POSSIBLE CAUSES
INTERMITTENT CRANK POSITION SIGNAL
CAM POSITION SENSOR SIGNAL
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K24) CKP SENSOR SIGNAL CIRCUIT OPEN
(K24) CKP SENSOR SIGNAL CIRCUIT SHORTED GROUND
(K24) CKP SENSOR SIGNAL SHORTED TO (K7) 5-VOLT SUPPLY CIRCUIT
(K4) SENSOR GROUND CIRCUIT OPEN
CRANKSHAFT POSITION SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, erase DTCs. Start the engine. If the DTC does not set right away it may be necessary to take the vehicle on a test drive. Does the DTC return? Yes → Go To 2 No → Go To 14	All
2	Turn the ignition off. Disconnect the CKP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit in the CKP Sensor harness connector. Is the voltage between 4.8 and 5.2 volts? Yes → Go To 3 No → Go To 10	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
3	Measure the voltage on the (K24) CKP Sensor Signal circuit in the CKP Sensor harness connector. Is the voltage between 4.5 and 5.0 volts? Yes → Go To 4 No → Go To 6	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K4) Sensor ground circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K24) CKP Sensor Signal circuit in the CKP Sensor harness connector. Did the voltage increase above 5.2 volts with the Ignition on? Yes → Repair the short to voltage in the (K24) CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Turn the ignition off. Measure the resistance of the (K24) CKP Sensor Signal circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the (K24) CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Measure the resistance between ground and the (K24) CKP Sensor Signal circuit in the CKP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K24) CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
9	Measure the resistance between the (K24) CKP Sensor Signal circuit and the (K7) 5-volt Supply circuit in the CKP Sensor harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the (K7) 5-volt Supply circuit and the (K24) CKP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	All
10	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit at the CKP Sensor harness connector. Did the voltage increase above 5.2 volts with the Ignition on? Yes → Repair the short to voltage in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11 **NOTE: Turn the ignition off before continuing.**	All
11	Turn the ignition off. Measure the resistance of the (K7) 5-volt Supply circuit from the CKP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the open in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
12	Measure the resistance between ground and the (K7) 5-volt Supply circuit at the CKP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	All
13	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0320-NO CRANK REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
14	**NOTE: The following tests may help in identifying a possible intermittent condition with the Crank Sensor or its related wire harness.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Crank Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Crank Sensor and wiggle the CKP Sensor connector and the related wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CKP Sensor. Did the CKP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Crank Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	All
15	**NOTE: An intermittent failure with the Cam Position Sensor may cause the P0320 code to set.** Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP Sensor connector and the PCM harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Ignition on, engine not running. Wiggle the related wire harness and gently tap on the Cam Position Sensor. Monitor the lab scope screen. Start the engine. Lightly tap on the CMP Sensor and wiggle the related wire harness. Observe the lab scope screen, looking for any erratic pulses generated by the CMP Sensor. Did the CMP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Cam Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P0340-NO CAM REFERENCE SIGNAL AT PCM

When Monitored and Set Condition:

P0340-NO CAM REFERENCE SIGNAL AT PCM

When Monitored: Engine cranking/running.

Set Condition: At least 5 seconds have elapsed with Crankshaft Position Sensor signals present but no Camshaft Position Sensor signal.

POSSIBLE CAUSES
CHECKING INTERMITTENT CMP SIGNAL WITH LAB SCOPE
CRANK POSITION SENSOR SIGNAL
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K44) CMP SENSOR SIGNAL CIRCUIT OPEN
(K44) CMP SENSOR SIGNAL CIRCUIT SHORTED GROUND
(K44) CMP SENSOR SIGNAL SHORTED TO (K7) 5-VOLT SUPPLY CIRCUIT
(K4) SENSOR GROUND CIRCUIT OPEN
CAMSHAFT POSITION SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, erase DTCs. Start the engine. If the DTC does not set right away it may be necessary to take the vehicle on a test drive. Does the DTC return? Yes → Go To 2 No → Go To 14	All
2	Turn the ignition off. Disconnect the CMP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit at the CMP Sensor harness connector. Is the voltage between 4.8 and 5.2 volts? Yes → Go To 3 No → Go To 10	All

P0340-NO CAM REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
3	Measure the voltage on the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the voltage between 4.5 and 5.0 volts? Yes → Go To 4 No → Go To 6	All
4	Turn the Ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K4) Sensor ground circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.** If there are no possible causes remaining, view repair. Repair Replace the Camshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the (K44) CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Turn the ignition off. Measure the resistance of the (K44) CMP Sensor Signal circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the (K44) CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
8	Measure the resistance between ground and the (K44) CMP Sensor Signal circuit at the CMP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K44) CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All

P0340-NO CAM REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
9	Measure the resistance between the (K44) CMP Sensor Signal circuit and the (K7) 5-volt Supply circuit in the CMP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K7) 5-volt Supply circuit and the (K44) CMP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	All
10	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit at the CMP Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 11	All
11	Turn the ignition off. Measure the resistance of the (K7) 5-volt Supply circuit from the CMP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the open in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
12	Measure the resistance between ground and the (K7) 5-volt Supply circuit at the CMP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 13	All
13	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0340-NO CAM REFERENCE SIGNAL AT PCM — Continued

TEST	ACTION	APPLICABILITY
14	**NOTE: The following tests may help in identifying a possible intermittent condition with the Cam Sensor or its related wire harness.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Cam Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Cam Sensor and wiggle the CMP Sensor connector and wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CMP Sensor. Did the CMP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Cam Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 15	All
15	**NOTE: An intermittent Crank Position Sensor failure may cause the P0340 code to set.** Ignition on, engine not running. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Crank Sensor connector and the PCM harness connector. Wiggle the related wire harness and connections. Monitor the lab scope screen. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Lightly tap on the Crank Sensor and wiggle the CKP Sensor connector and wire harness. Observe the lab scope screen. Look for any erratic pulses generated by the CKP Sensor. Did the CKP Sensor generate any erratic pulses? Yes → Carefully inspect the wire harness and connections, repair as necessary, if ok, replace the Crank Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom List:

P0351-IGNITION COIL # 1 PRIMARY CIRCUIT
P0352-IGNITION COIL # 2 PRIMARY CIRCUIT
P0353-IGNITION COIL # 3 PRIMARY CIRCUIT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0351-IGNITION COIL # 1 PRIMARY CIRCUIT.

When Monitored and Set Condition:

P0351-IGNITION COIL # 1 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0352-IGNITION COIL # 2 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

P0353-IGNITION COIL # 3 PRIMARY CIRCUIT

When Monitored: With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.

Set Condition: Peak current is not achieved with battery based dwell plus 1.5 msec of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(F42) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL RESISTANCE
IGNITION COIL
IGNITION COIL CONTROL CIRCUIT OPEN
IGNITION COIL CONTROL CIRCUIT SHORTED TO GROUND

P0351-IGNITION COIL # 1 PRIMARY CIRCUIT — Continued

POSSIBLE CAUSES
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Ignition Coil harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Relay. Using a 12-volt test light connected to ground, probe the (F42) ASD Relay Output circuit at the coil rail harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the excessive resistance or short to ground in the (F42) ASD Relay Output circuit. Inspect the related fuses and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. **CAUTION: Stop All Actuations**	All
3	Turn the ignition off. Disconnect the Ignition Coil harness connector. **NOTE: The resistance of the 2.4L Primary Ignition Coil is 0.53 to 0.63 of an ohm and the resistance of a 4.0L Primary Coil Rail is 0.51 to 0.61 of an ohm at 70°F (21.1°C).** Measure the resistance of the primary ignition coil. Is the resistance value within the listed specifications? Yes → Go To 4 No → Replace the ignition coil. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Disconnect the Ignition Coil harness connector. Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit. Crank the engine for 5 second while observing the test light. What is the state of the test light while cranking the engine? Brightly blinking. Replace the Ignition Coil. Perform POWERTRAIN VERIFICATION TEST VER - 5. ON constantly. Go To 5 OFF constantly. Go To 6	All

P0351-IGNITION COIL # 1 PRIMARY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between the Ignition Coil Control circuit and ground. Is the resistance below 100 ohms? Yes → Repair the short to ground in the Ignition Coil Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the Ignition Coil Control circuit from the Ignition Coil connector to the PCM connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the Ignition Coil Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:
P0420-1/1 CATALYTIC CONVERTER EFFICIENCY
P0432-2/1 CATALYTIC CONVERTER EFFICIENCY

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0420-1/1 CATALYTIC CONVERTER EFFICIENCY.

When Monitored and Set Condition:

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY

When Monitored: After engine warm up to 147° F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).

Set Condition: As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one.

P0432-2/1 CATALYTIC CONVERTER EFFICIENCY

When Monitored: After engine warm up to 147° F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).

Set Condition: As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
VISUALLY INSPECT CATALYTIC CONVERTER
EXHAUST LEAK
ENGINE MECHANICAL PROBLEM
UPSTREAM O2 SENSOR OLDER THAN DOWNSTREAM O2 SENSOR
CATALYTIC CONVERTER

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY — Continued

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Inspect the Catalytic Converter for the following damage. Damaged Catalytic Converter, dent and holes. Severe discoloration caused by overheating the Catalytic Converter. Catalytic Converter broken internally. Leaking Catalytic Converter. Were any problems found? Yes → Replace the Catalytic Converter. Repair the condition that may have caused the failure. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Start Engine and let idle. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Check for exhaust leaks between the engine and the appropriate downstream O2 Sensor. Is there any exhaust leaks? Yes → Repair or replace leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	**Check the exhaust for excessive smoke from internal oil or coolant leaks.** Is there an oil or coolant consumption condition present? Yes → Repair the engine mechanical condition as necessary and replace Catalytic Converter. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. **NOTE: A new Downstream O2 Sensor along with an aging Upstream O2 Sensor may cause this trouble code to set.** Review vehicle repair history. Has the Downstream O2 Sensor been replaced without replacing the Upstream O2 Sensor? Yes → Replace the appropriate Upstream Oxygen Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	If there are no possible causes remaining, view repair. Repair Replace the Catalytic Converter. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0441-EVAP PURGE FLOW MONITOR

When Monitored and Set Condition:

P0441-EVAP PURGE FLOW MONITOR

When Monitored: With engine temperature greater than 170° F, fuel control in closed loop, engine idling for 2 minutes, no low fuel, MAP less than 15.7 inches mercury and barometric altitude less than 8,000 feet.

Set Condition: After having passed the Leak Detection Pump (LDP) test, no air flow through the evaporative system is detected by the EVAP monitor.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
INTERMITTENT CONDITION
VISUAL INSPECTION
EVAP PURGE HOSE (SOLENOID TO CANISTER)
EVAP PURGE HOSE (CANISTER TO FUEL TANK)
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE SOLENOID (LEAKING/STUCK OPEN)
EVAP PURGE SOLENOID

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Visually inspect the Evap canister. Look for any physical damage or any signs of fuel that has entered the canister. Any signs of fuel may indicate a fuel tank vent. Were any problems found? Yes → Repair or Replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0441-EVAP PURGE FLOW MONITOR — Continued

TEST	ACTION	APPLICABILITY
3	Visually inspect the Evap purge hose that goes from the Purge Solenoid to the Evap Canister. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose. Were any problems found? Yes → Repair or replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Visually inspect the Evap Purge hose that goes between the Evap canister and the fuel tank. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose. Were any problems found? Yes → Repair or replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing. Also check for a pinched or plugged hose from the throttle body to the Purge Solenoid. Inspect the vacuum nipple at the throttle body for any damage or plugging. Make sure vacuum fitting at the purge solenoid is not over installed, pushed in too far. Is the vacuum supply hose and throttle body vacuum nipple free from defects? Yes → Go To 6 No → Repair the vacuum supply hose/tube as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	**Note: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty fuel tank vent. Replace purge solenoid if contamination is found** Disconnect the vacuum hoses at the EVAP Purge Solenoid. Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side) Does the Evap Purge Solenoid hold vacuum? Yes → Go To 7 No → Replace the Evap Purge Solenoid and the Evap Canister and clean out Evap lines as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side) Ignition on, engine not running. With the DRBIII®, actuate the EVAP Purge Solenoid and observe the vacuum gauge. Does the vacuum drop when the solenoid is actuated? Yes → Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED
P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED
P0456-EVAP LEAK MONITOR SMALL (0.020) LEAK DETECTED

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED.

When Monitored and Set Condition:

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: If there is a leak larger than 0.040″ and smaller than 0.080″ in the evaporative system.

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: There is a leak larger than 0.080″ in the evaporative system.

P0456-EVAP LEAK MONITOR SMALL (0.020) LEAK DETECTED

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.

Set Condition: There is a leak larger than 0.020″ and smaller than 0.040″ in the evaporative system.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
INTERMITTENT CONDITION
EVAPORATIVE EMISSION LEAK DETECTION
EVAP PURGE SOLENOID

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. **Note: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Ensure the gas cap meets OEM specifications.** Verify with customer that the gas cap has not been tightened since the MIL illuminated. **NOTE: Engine vacuum at must be present at the LDP vacuum port.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
2	To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD). **WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.** **NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity and the fuel must be cool to properly test the Evap system.** Disconnect the vacuum supply hose at the Leak Detection Pump. Connect and apply a continuous vacuum supply (i.e. 20″Hg) to the Leak Detection Pump. A vacuum pump such as an A/C recovery unit works well. Using the DRBIII®, select Engine/System Tests and actuate the Leak Detect Pump Test (Option 3/Hold PSI). **NOTE: The above energizes the LDP solenoid and allows the constant vacuum source to apply vacuum to the LDP pump diaphragm. This lifts the diaphragm up and seals the atmospheric canister vent valve at the bottom of the Leak Detection Pump.** Connect the red power lead of Miller Tool #8404A to the battery positive terminal and the black ground lead to battery negative terminal. **NOTE: See Charts and Graph support material EELD Calibration Setup for an example.** Connect shop air to the #8404A EELD. Set the smoke/air control switch to AIR. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size). Press the remote smoke/air start button. Position the red flag on the air flow meter so it is aligned with the indicator ball. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM. Install the service port adapter #8404-14 on the vehicle's service port (if equipped) or install the #8404-ADP service adapter in the LDP filter line. Connect the Air supply hose from the EELD to the service port or the #8404-ADP. Press the remote button to activate AIR flow. **NOTE: Larger volume fuel tanks, and/or those with less fuel, may require 4 to 5 minutes to fill.** Compare the flow meter indicator ball reading to the red flag. ABOVE the red flag indicates a leak present. BELOW the red flag indicates a sealed system. Is the indicator ball above the red flag? Yes → Go To 3 No → Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED — Continued

TEST	ACTION	APPLICABILITY
3	**NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.** To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD). Remove the Air supply hose from the service port. Connect the SMOKE supply tip (black hose) to the service port if equipped or #8404-ADP. Set the smoke/air control switch to SMOKE. **NOTE: The flow meter indicator ball will not move at this point.** Press the remote smoke/air start button. **NOTE: Ensure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.** **NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.** While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke. If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultraviolet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke. The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light. Was a leak found? Yes → Repair or replace the leaking component as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 4	All
4	**NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty fuel tank vent. Replace/repair as necessary.** Turn the ignition off. Disconnect the vacuum hoses at the EVAP Purge Solenoid. Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side. **NOTE: Monitor the vacuum gauge for at least 15 seconds.** Does the Evap Purge Solenoid hold vacuum? Yes → Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

Symptom:
P0443-EVAP PURGE SOLENOID CIRCUIT

When Monitored and Set Condition:

P0443-EVAP PURGE SOLENOID CIRCUIT

When Monitored: Continuously after the ignition is turned on and the battery voltage is above 10.4 volts.

Set Condition: Not powering down, not in limp-in and time since last solenoid activation is greater than 72 micro seconds. The PCM will set a trouble code if the actual state of the solenoid does not match the intended state on two consecutive key cycles.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
EVAP PURGE SOLENOID
(F12) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Evap Purge Solenoid connector. Measure the resistance between the terminals of the Evap Purge Solenoid. Is the resistance between 29.0 and 44.0 ohms? Yes → Go To 3 No → Replace the Evap Purge Solenoid. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P0443-EVAP PURGE SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Measure the voltage on the (F12) Fused Ignition Switch Output circuit at the EVAP Purge Solenoid harness connector. Is the voltage above 10.0 volts? Yes → Go To 4 No → Repair the open or short to ground in the (F12) Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Disconnect the PCM harness connectors. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the (K52) Evap Purge Solenoid Control circuit from the PCM harness connector to the Evap Purge Solenoid harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K52) Evap Purge Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K52) Evap Purge Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom List:
P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES
P0461-FUEL LEVEL UNIT NO CHANGE OVER TIME

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES.

When Monitored and Set Condition:

P0460-FUEL LEVEL UNIT NO CHANGE OVER MILES

When Monitored: Engine running and fuel level either below 15% or above 85% of capacity.

Set Condition: The PCM sees low fuel, less than 15%, for more than 120 miles or fuel level does not change by at least 4% for more than 250 miles.

P0461-FUEL LEVEL UNIT NO CHANGE OVER TIME

When Monitored: Engine running and fuel level either below 15% or above 85% of capacity.

Set Condition: The PCM sees low fuel, less than 15%, for more than 120 miles or fuel level does not change by at least 4% for more than 250 miles.

POSSIBLE CAUSES
PHYSICALLY DAMAGED/DEFORMED/OBSTRUCTED FUEL TANK
FUEL LEVEL SENSOR

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Turn the ignition off. **WARNING: The fuel system is under a constant pressure, even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Inspect the outside of the fuel tank for defects. Remove the fuel tank. Remove the fuel pump module from the fuel tank. Inspect the inside of the fuel tank for any obstructions or deformities. Is the fuel tank free from defects? Yes → Go To 2 No → Repair or replace the fuel tank as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	If there are no possible causes remaining, view repair. Repair Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0462-FUEL LEVEL SENDING UNIT VOLTAGE TOO LOW

When Monitored and Set Condition:

P0462-FUEL LEVEL SENDING UNIT VOLTAGE TOO LOW

When Monitored: Ignition on and battery voltage above 10.4 volts.

Set Condition: The Fuel Level Sensor signal voltage goes below 0.2 of a volt at the PCM for more than 5 seconds.

POSSIBLE CAUSES
FUEL LEVEL SENSOR VOLTAGE BELOW 0.2 VOLT
FUEL LEVEL SENSOR
(K226) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K226) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORTED TO (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, read the Fuel Level Sensor voltage. Is the Fuel Level Sensor voltage below 0.2 of a volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Ignition on, engine not running. With the DRBIII®, read the Fuel Level Sensor voltage. Did the Fuel Level Sensor voltage change from below 0.2 of a volt to above 4.0 volts? Yes → Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K226) Fuel Level Sensor Signal circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K226) Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All

P0462-FUEL LEVEL SENDING UNIT VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance between the (K226) Fuel Level Sensor Signal circuit and the (K4) Sensor ground circuit. Is the resistance below 5.0 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K226) Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	**NOTE: Before continuing, check the PCM harness connectors for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0463-FUEL LEVEL SENDING UNIT VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0463-FUEL LEVEL SENDING UNIT VOLTAGE TOO HIGH

When Monitored: Ignition on and battery voltage above 10.4 volts.

Set Condition: The Fuel Level Sensor signal voltage at the PCM goes above 4.95 volts for more than 90 seconds.

POSSIBLE CAUSES
FUEL LEVEL SENSOR VOLTAGE ABOVE 4.9 VOLTS
FUEL LEVEL SENSOR
(K226) FUEL LEVEL SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
(K226) FUEL LEVEL SENSOR SIGNAL CIRCUIT OPEN
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, read the Fuel Level Sensor voltage. Is the Fuel Level Sensor voltage above 4.9 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Turn the ignition off. Disconnect the Fuel Pump Module electrical harness connector. Ignition on, engine not running. Connect a jumper wire between the (K226) Fuel Level Sensor Signal circuit and the (K4) Sensor ground circuit at the Fuel Pump Module harness connector. With the DRBIII®, read the Fuel Level Sensor voltage. Did the Fuel Level Sensor voltage change from above 4.9 volts to below 0.4 of a volt? Yes → Replace the Fuel Level Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0463-FUEL LEVEL SENDING UNIT VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K226) Fuel Level Sensor Signal circuit at the Fuel Pump Module harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to voltage in the (K226) Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (K226) Fuel Level Sensor Signal circuit from the PCM harness connector to the Fuel Pump Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K226) Fuel Level Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Measure the resistance of the (K4) Sensor ground circuit from the PCM harness connector to the Fuel Pump Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: Before continuing, check the PCM harness connectors for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0500-NO VEHICLE SPEED SIGNAL CIRCUIT

When Monitored and Set Condition:

P0500-NO VEHICLE SPEED SIGNAL CIRCUIT

When Monitored: Engine Temperature greater than 104 deg F, MAP vacuum approximately 15″ to 16″ inches of mercury and Engine RPM between 1400 and 3000 rpm.

Set Condition: No Vehicle Speed Signal for more than 15 seconds on two consecutive trips.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(K6) 5-VOLT SUPPLY CIRCUIT OPEN
(K6) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
VEHICLE SPEED SENSOR
(G7) VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G7) VEHICLE SPEED SIGNAL CIRCUIT OPEN
(G7) VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the Vehicle Speed Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K6) 5-volt Supply circuit at the VSS harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 3 No → Go To 8	All

P0500-NO VEHICLE SPEED SIGNAL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Connect a jumper wire between the (G7) Vehicle Speed Signal circuit and (K4) Sensor ground circuit in the VSS harness connector. With the DRBIII® read the Vehicle Speed Signal voltage. Does the voltage start at 5.0 volts and drop to approximately 0 volts? Yes → Replace the Vehicle Speed Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4 **NOTE: Remove the jumper wire before continuing.**	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (G7) Vehicle Speed Signal circuit at the PCM or Sensor harness connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the (G7) Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Measure the resistance of the (G7) Vehicle Speed Signal circuit from the PCM harness connector to the VSS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the open in the (G7) Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Measure the resistance between ground and the (G7) Vehicle Speed Signal circuit at the Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (G7) Vehicle Speed Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Measure the resistance of the (K4) Sensor ground circuit from the Sensor harness connector to the PCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All

P0500-NO VEHICLE SPEED SIGNAL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance in the (K6) 5-volt Supply circuit from the VSS harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the (K6) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	Measure the resistance between ground and the (K6) 5-volt Supply circuit at the VSS harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K6) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
10	**NOTE: Before continuing, check the PCM harness connectors for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0505-IDLE AIR CONTROL MOTOR CIRCUITS

When Monitored and Set Condition:

P0505-IDLE AIR CONTROL MOTOR CIRCUITS

When Monitored: At power-up and battery voltage greater than 11.5 volts.

Set Condition: The PCM senses a short to ground or battery voltage on any of the four Idle Air Control (IAC) driver circuits for 100 msec while the IAC motor is active.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
IAC #1 CONTROL CIRCUIT SHORTED TO #2, #3, OR #4
IAC #2 CONTROL CIRCUIT SHORTED TO #3 OR #4
IAC #3 CONTROL CIRCUIT SHORTED TO #4
IAC CONTROL CIRCUIT SHORTED TO VOLTAGE
IAC CONTROL CIRCUIT SHORTED TO GROUND
IAC MOTOR OPERATION
IAC MOTOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the IAC Motor harness connector. Disconnect the PCM harness connectors. **NOTE: The following steps are checking for a short between the IAC Control circuits.** Measure the resistance between the IAC #1 Control circuit and #2, #3, #4 Control circuits. Is the resistance below 5.0 ohms on any of the Drivers? Yes → Repair the short between the appropriate IAC Control circuits. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

P0505-IDLE AIR CONTROL MOTOR CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
3	Measure the resistance between the IAC #2 Control circuit and #3, #4 Control circuits. Is the resistance below 5.0 ohms on any of the circuits? Yes → Repair the short between the appropriate IAC Control circuits. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Measure the resistance between the IAC #3 Control circuit and the #4 Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the short between the IAC Control circuits. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Ignition on, engine not running. Measure the voltage on each of the IAC Control circuits. Is the voltage above 1.0 volt at any IAC Control circuit? Yes → Repair the short to voltage in the appropriate IAC Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Repeat each measurement for each IAC Control circuit. Measure the resistance between ground and each IAC Control circuit. Is the resistance below 100 ohms at any IAC Control circuit? Yes → Repair the short to ground in the appropriate IAC Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Connect the PCM harness connectors. Start and idle the engine. Using a test light connected to ground, probe the IAC #1 Control circuit for 10 seconds. Repeat the above test for the remaining IAC Motor Driver circuits. Does the test light turn on and off while probing each IAC Motor Driver circuit? Yes → Replace the Idle Air Control Motor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P0523-OIL PRESSURE VOLTAGE TOO HIGH

When Monitored and Set Condition:

P0523-OIL PRESSURE VOLTAGE TOO HIGH

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: The oil pressure sensor signal at PCM goes above 4.9 volts.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
OIL PRESSURE SWITCH
(G60) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G60) OIL PRESSURE SIGNAL CIRCUIT OPEN
(G60) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Turn the ignition off. Disconnect the Oil Pressure Switch harness connector. Ignition on, engine not running. Connect a jumper wire to the (G60) Oil Pressure Signal circuit in the Sensor harness connector. With the DRBIII® monitor the Oil Pressure Switch state. Touch the other end of the jumper wire to a Ground several times. Did the Oil Pressure Switch state change from High to Low? Yes → Replace the Oil Pressure Switch. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All

P0523-OIL PRESSURE VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (G60) Oil Pressure Signal circuit at the Switch harness connector. Is the voltage above 5.3 volts? Yes → Repair the short to voltage on the (G60) Oil Pressure Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (G60) Oil Pressure Signal circuit from the Oil Pressure Switch harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (G60) Oil Pressure Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Measure the resistance between (G60) Oil Pressure Signal circuit and ground at the Switch connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (G60) Oil Pressure Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	Measure the resistance between Ground and the Ground circuit at the Oil Pressure Switch connector. Is the resistance below 100 ohms? Yes → Go To 7 No → Repair the open in the Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0551-POWER STEERING SWITCH FAILURE

When Monitored and Set Condition:

P0551-POWER STEERING SWITCH FAILURE

When Monitored: With the ignition key on and engine running.

Set Condition: With the vehicle above 40 mph for over 30 seconds, the power steering pressure switch remains open.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
POWER STEERING PRESSURE SWITCH
(K10) P/S PRESSURE SWITCH SIGNAL CIRCUIT OPEN
(K10) P/S PRESSURE SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(Z1) P/S PRESSURE SWITCH GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Turn the ignition off. Disconnect the Power Steering Pressure Switch harness connector. Ignition on, engine not running. Connect a jumper wire to the (K10) P/S Pressure Switch Signal circuit at harness connector. Using the DRBIII®, monitor the Power Steering Pressure Switch. Touch the jumper wire to the (Z1) Ground circuit at the Power Steering Pressure Switch harness connector several times. Did the Power Steering Pressure Switch status change from Hi to Low? Yes → Replace the Power Steering Pressure Switch. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P0551-POWER STEERING SWITCH FAILURE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure resistance of (K10) P/S Pressure Switch Signal circuit from PCM harness connector to P/S Pressure Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the (K10) P/S Pressure Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Measure the resistance between ground and the (K10) P/S Pressure Switch Signal circuit at the Switch harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K10) P/S Pressure Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	With a 12-volt test light connect to 12-volts, probe the (Z1) P/S Pressure Switch ground circuit at the Switch harness connector. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the open in the (Z1) P/S Pressure Switch ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0601-PCM INTERNAL CONTROLLER FAILURE

When Monitored and Set Condition:

P0601-PCM INTERNAL CONTROLLER FAILURE

When Monitored: Ignition key on.

Set Condition: Internal checksum for software failed, does not match calculated value.

POSSIBLE CAUSES
PCM INTERNAL OR SPI

TEST	ACTION	APPLICABILITY
1	The Powertrain Control Module is reporting internal errors, view repair to continue. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
P0622-GENERATOR FIELD NOT SWITCHING PROPERLY

When Monitored and Set Condition:

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY

When Monitored: With the ignition key on and the engine running.

Set Condition: When the PCM tries to regulate the generator field with no result during monitoring.

POSSIBLE CAUSES
GENERATOR FIELD PERFORMANCE
(K125) GEN FIELD SOURCE CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Record all DTCs and the related Freeze Frame data. Check for any related TSBs. Using a 12-volt test light connected to ground, backprobe the (K20) Gen Field Control circuit at the back of the Generator. With the DRBIII®, actuate the Generator Field Driver. Does the test light blink? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 2	All
2	Backprobe the (K125) Generator Field Source circuit at back of Generator with a volt meter. With the DRBIII® actuate the Generator Field Driver. Is the voltage above 10.0 volts? Yes → Go To 3 No → Repair the open in the (K125) Gen Field Source circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Generator Field harness connector. Measure the resistance of the (K20) Generator Field Control circuit from the Generator Field harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the (K20) Gen Field Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
4	Measure the resistance between ground and the (K20) Generator Field Control circuit in the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K20) Gen Field Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	Measure resistance across the Generator Field Terminals at the Generator. Is the resistance between 0.5 of an ohm and 15 ohms? Yes → Go To 6 No → Repair the Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P0645-A/C CLUTCH RELAY CIRCUIT

When Monitored and Set Condition:

P0645-A/C CLUTCH RELAY CIRCUIT

When Monitored: With the ignition key in the run position and battery voltage above 10.4 volts.

Set Condition: An open or shorted condition is detected in the A/C clutch relay control circuit.

POSSIBLE CAUSES
A/C CLUTCH RELAY OPERATION
A/C CLUTCH RELAY
(F12) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, actuate the A/C Clutch Relay. Is the A/C Clutch Relay clicking? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Turn the ignition off. Remove the A/C Clutch Relay from the PDC. Measure the resistance between Terminals 1(85) and 2 (86) of the A/C Clutch Relay. Is the resistance between 50.0 and 90.0 ohms? Yes → Go To 3 No → Replace the A/C Clutch Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P0645-A/C CLUTCH RELAY CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (F12) Fused Ignition Switch Output circuit in the A/C Clutch Relay connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground in the (F12) Fused Ignition Switch Output circuit. Inspect and replace the fuse as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (C13) A/C Clutch Relay Control circuit between the PDC terminal and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (C13) A/C Clutch Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Measure the resistance between ground and the (C13) A/C Clutch Relay Control circuit at the PCM connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (C13) A/C Clutch Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P0700-EATX CONTROLLER DTC PRESENT

When Monitored and Set Condition:

P0700-EATX CONTROLLER DTC PRESENT

When Monitored: With the ignition key on.

Set Condition: This DTC is an indicator that a transmission DTC has previously been set.

POSSIBLE CAUSES
TCM DTC PRESENT SET IN PCM

TEST	ACTION	APPLICABILITY
1	This DTC is an indicator that a Trans DTC has previously been set. A code may not currently be present in the TCM if a Trans repair was made. If after reading transmission DTC's there are no codes in the TCM, this code can be erased from the PCM. Trans DTC present? Continue A DTC was registered in the Transmission Control Module. With the DRB, go to the TCM and read codes. Refer to the appropriate symptom (DTC).	All

Symptom List:
P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR
P1196-2/1 O2 SENSOR SLOW DURING CATALYST MONITOR

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR.

When Monitored and Set Condition:

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR

When Monitored: With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

P1196-2/1 O2 SENSOR SLOW DURING CATALYST MONITOR

When Monitored: With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.

Set Condition: The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
EXHAUST LEAK
RESISTANCE IN THE O2 SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K4) SENSOR GROUND CIRCUIT
O2 SENSOR

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1195-1/1 O2 SENSOR SLOW DURING CATALYST MONITOR — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine. Inspect the exhaust for leaks between the engine and the appropriate O2 Sensor. Are there any exhaust leaks? Yes → Repair or replace the leaking exhaust parts as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Turn the ignition off. Backprobe the O2 Sensor Signal circuit at the O2 Sensor harness connector and PCM harness connector. **NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.** Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 4 No → Repair the excessive resistance on the O2 Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Backprobe the (K4) Sensor ground circuit at the O2 Sensor harness connector and PCM harness connector. **NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.** Start the engine. Allow the engine to idle. Is the voltage below 0.10 of a volt? Yes → Go To 5 No → Repair the excessive resistance on the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. If there are no possible causes remaining, view repair. Repair Replace the O2 Sensor Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1281-ENGINE IS COLD TOO LONG

When Monitored and Set Condition:

P1281-ENGINE IS COLD TOO LONG

When Monitored: The ignition key on, engine running.

Set Condition: The engine does not warm to 176 deg. F while driving for 20 minutes after start.

POSSIBLE CAUSES
ENGINE COOLANT TEMP SENSOR
ENGINE COLD TOO LONG

TEST	ACTION	APPLICABILITY
1	**Note: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.** **Note: Extremely cold outside ambient temperatures may cause this DTC to set.** Verify that the coolant level is at the correct level per service information. Start the engine. With the DRBIII® in Sensors, read the ECT Sensor temperature value. Use a DVOM that has thermal sensing probe to monitor the Coolant temperature at the Thermostat housing. The thermostat housing area should be approximately 192-195°F (89-91°C) when the Thermostat begins to open. Is the DRBIII® reading cooler than the DVOM reading? Yes → Replace the ECT Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	**Note: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.** Start the engine. With the DRBIII®, set the engine RPM to 1500 and allow the engine to warm up for 10-15 minutes. With the DRBIII®, monitor the ENG COOLANT TMP DEG value during the warm up cycle. Make sure the transition of temperature change is smooth. Did the engine temperature reach a minimum of 80° C (176° F)? Yes → Test Complete. No → Refer to the Service Information for cooling system performance diagnosis. The most probable cause is a Thermostat problem. Also, refer to any related TSBs. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT

When Monitored: With the ignition on and battery voltage above 10.4 volts.

Set Condition: An open or shorted condition is detected in the Fuel Pump Relay Control circuit.

POSSIBLE CAUSES
FUEL PUMP RELAY OPERATION
FUEL PUMP RELAY
(A61) FUSED B+ CIRCUIT
(F15) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN
(K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, actuate the Fuel Pump Relay. Is the Fuel Pump Relay clicking? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Turn the ignition off. Remove the Fuel Pump Relay. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between terminals 1 (85) and 2 (86) of the Fuel Pump Relay. Is the resistance between 50 and 90 ohms? Yes → Go To 3 No → Replace the Fuel Pump Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Using a 12-volt test light connected to ground probe the (A61) Fused B+ circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground (A61) Fused B+ circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Ignition on, engine not running. With a 12-volt test light connect to ground, probe the (F15) Fused Ignition Switch output circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 5 No → Repair the open or short to ground in the (F15) Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K31) Fuel Pump Relay control circuit between the PDC and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K31) Fuel Pump Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	Measure the resistance between ground and the (K31) Fuel Pump Relay Control circuit at the PDC. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K31) Fuel Pump Relay control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1294-TARGET IDLE NOT REACHED

When Monitored and Set Condition:

P1294-TARGET IDLE NOT REACHED

When Monitored: With the engine idling and in drive, if automatic. There must not be a MAP sensor trouble code or a throttle position sensor trouble code.

Set Condition: Engine idle is not within 200 rpm above or 100 rpm below target idle for 14 seconds. Three separate failures are required to set a bad trip. Two bad trips are required to set the code.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
VACUUM LEAK
AIR INDUCTION SYSTEM
THROTTLE BODY AND THROTTLE LINKAGE
IAC DRIVER CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. **NOTE: All MAP Sensor, IAC, and/or TPS codes present must be diagnosed first before proceeding.** With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Inspect the Intake Manifold for vacuum leaks. Inspect the Power Brake Booster for any vacuum leaks. Inspect the PCV system for proper operation or any vacuum leaks. Were any problems found? Yes → Repair vacuum leak as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All

P1294-TARGET IDLE NOT REACHED — Continued

TEST	ACTION	APPLICABILITY
3	Inspect the Air Induction System for the following problems. Restrictions: Dirty Air Cleaner, Foreign material in the air intake tube, etc. Leaks: Air Intake tube connection, Air Cleaner housing, etc. Were any problems found? Yes → Repair or replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 4	All
4	Inspect the throttle body plate for carbon build up or other restrictions. Inspect the throttle linkage for binding and smooth operation. Ensure the throttle plate is resting on the stop at idle. Remove IAC, inspect the pintle and its seating surface inside the throttle body. Were any problems found? Yes → Repair the reason for the carbon build up and replace the Throttle Body as needed. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	Turn the ignition off. Disconnect IAC Motor harness connector. Disconnect the PCM harness connectors. Measure the resistance of each of the IAC Driver circuits from the IAC Motor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the appropriate IAC Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1296-NO 5-VOLTS TO MAP SENSOR

When Monitored and Set Condition:

P1296-NO 5-VOLTS TO MAP SENSOR

When Monitored: During power-down and battery voltage greater than 10.4 volts.

Set Condition: The MAP sensor signal voltage goes below 2.35 volts with the key off for 5 seconds.

POSSIBLE CAUSES
MAP SENSOR VOLTS BELOW 2.3 VOLTS
SHORTED SENSOR
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
MAP SENSOR
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: If the P0107 - MAP Sensor Voltage Too Low is also set, diagnose it first before continuing with P1296 - No 5-volts To MAP Sensor.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII® in Sensors, read the MAP Sensor voltage. Is the voltage below 2.35 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the voltage above 4.5 volts? Yes → Go To 3 No → Go To 4	All

P1296-NO 5-VOLTS TO MAP SENSOR — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII® in Sensors, read the MAP Sensor voltage with the Sensor harness connector disconnected. Is the voltage above 4.5 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
4	Measure the voltage on the (K7) 5-volt Supply circuit in the MAP Sensor harness connector while disconnecting the remaining Sensors that share the (K7) 5-volt Supply circuit. Does the voltage return to approximately 5.0 volts with any Sensor disconnected? Yes → Replace the Sensor that pulled the (K7) 5-volt Supply circuit low. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	Turn the ignition off. Disconnect the PCM harness connector. Measure the resistance of the (K7) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the excessive resistance in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Measure the resistance between ground and the (K7) 5-volt Supply circuit in the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1297-NO CHANGE IN MAP FROM START TO RUN

When Monitored and Set Condition:

P1297-NO CHANGE IN MAP FROM START TO RUN

When Monitored: With engine RPM +/- 64 of target idle and the throttle blade at closed throttle.

Set Condition: Too small of a difference is seen between barometric pressure with ignition on (engine running) and manifold vacuum for 8.80 seconds.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
MAP SENSOR VACUUM PORT
MAP SENSOR VOLTAGE BELOW 3.19 VOLTS
(K7) 5-VOLT SUPPLY CIRCUIT OPEN
(K7) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
MAP SENSOR
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: If a MAP high or Low DTC set along with P1297, diagnose the High or Low DTC first before continuing.** Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. Remove the MAP Sensor. Inspect the vacuum port, check for restrictions or any foreign materials. Were any restriction found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3 **NOTE: Reinstall the MAP Sensor before continuing.**	All

P1297-NO CHANGE IN MAP FROM START TO RUN — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, read the MAP Sensor voltage. **NOTE: If a MAP High or Low DTC was set along with P1297, diagnose the High or Low DTC first.** Is the voltage below 3.19 volts? Yes → Go To 4 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Turn the ignition off. Disconnect the MAP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit at the MAP Sensor harness connector. Is the voltage between 4.5 to 5.2 volts? Yes → Go To 5 No → Go To 8	All
5	With the DRBIII®, monitor the MAP Sensor voltage with the Sensor harness connector disconnected. Is the voltage above 1.2 volts? Yes → Replace the MAP Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 6	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K1) MAP Sensor Signal circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Measure the resistance between the (K1) MAP Sensor Signal circuit and the (K4) Sensor ground circuit at the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K1) MAP Sensor Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
8	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K7) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1297-NO CHANGE IN MAP FROM START TO RUN — Continued

TEST	ACTION	APPLICABILITY
9	Measure the resistance between ground and the (K7) 5-volt Supply circuit in the MAP Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
10	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT

When Monitored: With ignition key on and battery voltage above 10.4 volts.

Set Condition: An open or shorted condition is detected in the ASD Relay control circuit.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
ASD RELAY
(F15) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K51) ASD RELAY CONTROL CIRCUIT OPEN
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Turn the ignition off. Remove the ASD Relay. Measure the resistance between terminals 85 and 86 of the ASD Relay. Is the resistance between 50 and 80 ohms? Yes → Go To 3 No → Replace the ASD Relay. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (F15) Fused Ignition Switch Output circuit at the ASD Relay connector in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground in the (F15) Fused Ignition Output. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K51) ASD Relay Control circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K51) ASD Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Measure the resistance between ground and the (K51) ASD Relay Control circuit at the PDC. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K51) ASD Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM

When Monitored and Set Condition:

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM

When Monitored: With ignition key on, battery voltage above 10.4 volts, and engine RPM greater than 400.

Set Condition: No voltage sensed at the PCM when the ASD Relay is energized.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(A142) ASD RELAY OUTPUT CIRCUIT OPEN
(A14) FUSED B+ CIRCUIT OPEN
(A142) ASD OUTPUT CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
2	Attempt to start the engine. Did the engine start? Yes → Go To 3 No → Go To 4	All
3	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connectors. Measure the resistance of the (A142) ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (A142) ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Remove the ASD Relay from the PDC. Disconnect the PCM harness connectors. Measure the resistance of the (A142) ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (A142) ASD Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
5	Turn the ignition off. Remove the ASD Relay from the PDC. Using a 12-volt test light, probe the (A14) Fused B+ circuit at the ASD Relay connector. Does the test light illuminate brightly? Yes → Go To 6 No → Repair the open or short to ground in the (A14) Fused B+ circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1391-INTERMITTENT LOSS OF CMP OR CKP

When Monitored and Set Condition:

P1391-INTERMITTENT LOSS OF CMP OR CKP

When Monitored: Engine running or cranking.

Set Condition: When the failure counter reaches 20 for 2 consecutive trips.

POSSIBLE CAUSES
INTERMITTENT CONDITION
CHECKING INTERMITTENT CMP SIGNAL WITH A LAB SCOPE
CMP WIRE HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
CKP WIRE HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
CHECKING INTERMITTENT CKP SIGNAL WITH A LAB SCOPE
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, erase DTCs. Start the engine and run until operating temp is reached. (Closed Loop) If the DTC does not set right away it may be necessary to test drive the vehicle. Does the DTC reset? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
2	Turn the ignition off. With the DRBIII® lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Are there any irregular or missing signals? Yes → Go To 3 No → Go To 6	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Ensure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) tight. Refer to any TSBs that may apply. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Turn the ignition off. Remove the Camshaft Position Sensor. Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement. Were any problems found? Yes → Repair or replace the Tone Wheel/Pulse Ring as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 5	All
5	If there are no possible causes remaining, view repair. Repair Replace the Camshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the PCM harness connector and in the CMP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Wiggle the related wire harness and gently tap on the Cam Position Sensor. Look for any differences between the Channel 1 and Channel 2 patterns, generated by the CMP Sensor. Does the DRBIII® screen display any missing or irregular patterns? Yes → Replace the Camshaft Position Sensor or repair the wiring/connection concern. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. With the DRBIII® lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Observe the lab scope screen. Are there any irregular or missing signals? Yes → Go To 8 No → Go To 11	All
8	Turn the ignition off. Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Ensure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) tight. Refer to any TSBs that may apply. Were any of the above conditions present? Yes → Repair as necessary Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 9	All
9	Turn the ignition off. Remove the Crankshaft Position Sensor. Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement. Were any problems found? Yes → Repair or replace the Tone Wheel/Flex Plate as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 10	All
10	If there are no possible causes remaining, view repair. Repair Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1391-INTERMITTENT LOSS OF CMP OR CKP — Continued

TEST	ACTION	APPLICABILITY
11	**NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.** Turn the ignition off. With the DRBIII® as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the PCM harness connector and CKP harness connector. Both of the graphs should be identical. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Monitor the DRBIII® lab scope screen, both patterns should be the same. Wiggle the related wire harness and gently tap on the Crank Position Sensor. Look for any differences between Channel 1 and Channel 2 patterns generated by the CKP Sensor. Were any erratic or missing signals noticed? Yes → Replace the Crankshaft Position Sensor or repair the wiring/ connection concern. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:
P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT

When Monitored and Set Condition:

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT

When Monitored: Under closed throttle decel and Fuel Pulse Width equal to zero for 30 seconds.

Set Condition: One of the CKP sensor target windows has more than 2.86% variance from the reference window.

POSSIBLE CAUSES
ADAPTIVE NUMERATOR RELEARN
CMP SENSOR CONNECTOR/WIRING
CKP SENSOR CONNECTOR/WIRING
DAMAGED TONE WHEEL/FLEX PLATE (CRANKSHAFT)
CRANKSHAFT POSITION SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	**Note: Check for any TSB's that may apply to this symptom.** Read and record the Freeze Frame Data. Use this information to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load. Ignition on, engine not running. With the DRBIII® in the miscellaneous menu, choose ″Clear PCM (battery disconnect)″ to reset the PCM. With the DRBIII®, choose the ″Misfire Pretest screen. Road test the vehicle and re-learn the adaptive numerator. The adaptive numerator is learned when the ″Adaptive Numerator Done Learning″ line on the Mis-fire Pre-test screen changes to ″Yes″. Did the adaptive numerator re-learn? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT — Continued

TEST	ACTION	APPLICABILITY
2	**Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Verify the Camshaft Position Sensor is properly installed.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	**Note: Visually inspect the Crankshaft Position Sensor and related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **NOTE: Verify the Crank Position Sensor is properly installed.** Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	Disconnect and remove the Crankshaft Position Sensor. Inspect the tone wheel/flexplate slots for damage, foreign material, or excessive movement. Is the tone wheel/flexplate free from defects? Yes → Go To 5 No → Repair/replace tone wheel/flex plate as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	With the DRBIII® lab scope probe and the Miller special tool #6801, back probe the (K24) CKP Signal circuit in the PCM harness connector. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING..** Start the engine and observe the lab scope screen for any erratic CKP Sensor pulses. Were any erratic Crank Position signals detected? Yes. Replace the Crankshaft Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 5. No. Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND

When Monitored and Set Condition:

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40 deg. F and 90 deg. F and coolant temperature within 10 deg. F of battery/ ambient.

Set Condition: LDP test must pass first. If the PCM suspects a pinched hose it will not set a fault until it runs the evap purge flow monitor. If the purge monitor does not pass then the pinched hose fault will be set.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
EVAP CANISTER OBSTRUCTED
OBSTRUCTION IN HOSE/TUBE BETWEEN EVAP CANISTER AND PURGE SOLENOID
LDP PRESSURE HOSE OBSTRUCTED
LEAK DETECTION PUMP

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
2	Pressurize the EVAP System. On Miller Tool #8404, set the Pressure/Hold switch to Open and set the Vent switch to Closed. Turn the pump timer On and watch the gauge. The flow meter gauge on the EELD reads 0 LPM the EVAP system completely pressurized. Disconnect the LDP Pressure hose at the EVAP Canister. The LDP Pressure hose is the hose that connects the Evap Canister to the Leak Detection Pump. Did the pressure drop when the hose was disconnected? Yes → Go To 3 No → Replace the EVAP Canister. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND — Continued

TEST	ACTION	APPLICABILITY
3	**Note: All previously disconnected hose(s) reconnected.** Re-pressurize the EVAP System. On Miller Tool #8404A, set the Pressure/Hold switch to Open and set the Vent switch to Closed. Turn the pump timer On and watch the gauge. The flow meter gauge on the EELD reads 0 LPM the EVAP system completely pressurized. Disconnect the EVAP hoses at the Purge Solenoid. Did the pressure drop when the hose was disconnected? Yes → Go To 4 No → Repair or replace hose/tube as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
4	Disconnect and remove the LDP pressure hose. The LDP pressure hose is the hose that connects the EVAP Canister to the Leak Detection Pump. Inspect the LDP pressure hose for any obstructions or physical damage. Is the LDP pressure hose free from defects? Yes → Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Repair/replace hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

Symptom:
P1489-HIGH SPEED FAN RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1489-HIGH SPEED FAN RELAY CONTROL CIRCUIT

When Monitored: With the ignition on. Battery voltage greater than 10 volts.

Set Condition: An open or shorted circuit is detected in the high speed radiator fan relay control circuit. One Trip Fault.

POSSIBLE CAUSES
HIGH SPEED RADIATOR FAN RELAY OPERATION
HIGH SPEED RADIATOR FAN RELAY
(F20) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(A16) FUSED B+ CIRCUIT
(C27) HIGH SPEED RAD FAN RELAY CONTROL CIRCUIT OPEN
(C27) HIGH SPEED RAD FAN RELAY CONTROL CIRCUIT SHORT TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the High Speed Radiator Fan Relay. Is the High Speed Radiator Fan Relay operating? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Turn the ignition off. Remove the High Speed Radiator Fan Relay from the PDC. Measure the resistance of the High Speed Radiator Fan Relay between the Fused Ignition Switch Output terminal and the High Speed Rad Fan Relay Control terminal. Is the resistance between 60 to 85 ohms? Yes → Go To 3 No → Replace the High Speed Radiator Fan Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1489-HIGH SPEED FAN RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (F22) Fused Ignition Switch Output circuit at the Relay connector in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground in the (F20) Fused Ignition Output. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Using a 12-volt test light connected to ground probe the (A16) Fused B+ circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 5 No → Repair the open or short to ground (A16) Fused B+ circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (C27) High Speed Rad Fan Relay Control circuit from the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (C27) High Speed Rad Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Measure the resistance between ground and the (C27) High Speed Rad Fan Relay Control circuit in the PDC. Is the resistance below 5.0 ohms? Yes → Repair the short to ground in the (C27) High Speed Rad Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
P1490-LOW SPEED FAN RELAY CONTROL CIRCUIT

When Monitored and Set Condition:

P1490-LOW SPEED FAN RELAY CONTROL CIRCUIT

When Monitored: With the ignition on. Battery voltage greater than 10 volts.

Set Condition: An open or shorted circuit is detected in the low speed radiator fan relay control circuit. One trip Fault.

POSSIBLE CAUSES
LOW SPEED RADIATOR FAN RELAY OPERATION
LOW SPEED RADIATOR FAN RELAY
(F20) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(A16) FUSED B+ CIRCUIT
(C23) LOW SPEED RAD FAN RELAY CONTROL CIRCUIT OPEN
(C23) LOW SPEED RAD FAN RELAY CONTROL CIRCUIT SHORT TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the Low Speed Radiator Fan Relay. Is the Low Speed Radiator Fan Relay operating? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Turn the ignition off. Remove the Low Speed Radiator Fan Relay from the PDC. Measure the resistance of the Low Speed Radiator Fan Relay between the Fused Ignition Switch Output terminal and the Low Speed Rad Fan Relay Control terminal. Is the resistance between 60 to 85 ohms? Yes → Go To 3 No → Replace the Low Speed Radiator Fan Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1490-LOW SPEED FAN RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (F20) Fused Ignition Switch Output circuit at the Relay connector in the PDC. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open or short to ground in the (F20) Fused Ignition Output. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Using a 12-volt test light connected to ground probe the (A16) Fused B+ circuit in the PDC. Does the test light illuminate brightly? Yes → Go To 5 No → Repair the open or short to ground in the (A16) Fused B+ circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (C23) Low Speed Rad Fan Relay Control circuit from the PDC to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (C23) Low Speed Rad Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Measure the resistance between ground and the (C23) Low Speed Rad Fan Control circuit at the PDC. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (C23) Low Speed Rad Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:

P1491-COOLING FAN RELAY CONTROL CIRCUIT

POSSIBLE CAUSES
COOLING FAN RELAY OPERATION
FUSED B+ OUTPUT CIRCUIT
GROUND CIRCUIT
(K173) COOLING FAN RELAY CONTROL CIRCUIT OPEN
(K173) COOLING FAN RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII®, actuate the Cooling Fan Relay. Is the Cooling Fan operating? Yes → Refer to the INTERITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	Turn the ignition off. Remove the Cooling Fan Relay. Using a 12-volt test light connected to ground, probe the Fused B+ circuit of the Cooling Fan Relay connector. Is the voltage above 11.0 volts? Yes → Go To 3 No → Repair the open or short to ground in the Fused B+ circuit. Check and replace any open fuses. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
3	Using a 12-volt test light connected to 12-volts, probe the Ground circuit in the Cooling Fan Relay harness connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open in the Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
4	Disconnect the PCM harness connectors. Measure the resistance of the (K173) Cooling Fan Relay Control circuit between the Cooling Fan Relay connector and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the open in the (K173) Cooling Fan Relay Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All

P1491-COOLING FAN RELAY CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
5	Measure the resistance between ground and the (K173) Cooling Fan Relay Control circuit at Relay connector. Is the resistance below 100 ohms? Yes → Go To 6 No → Repair the short to ground in the (K173) Cooling Fan Relay control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
P1492-BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH

When Monitored and Set Condition:

P1492-BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH

When Monitored: With the ignition key on.

Set Condition: The PCM senses the voltage from the Battery Temperature Sensor above 4.9 volts for 3 seconds.

POSSIBLE CAUSES
BATTERY TEMP SENSOR VOLTS ABOVE 4.8 VOLTS
BATTERY TEMPERATURE SENSOR
(K118) BATT TEMP SIGNAL CIRCUIT OPEN
(K118) BATT TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K4) SENSOR GROUND CIRCUIT OPEN
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Record all DTCs and the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, monitor the Battery Temperature Sensor voltage. Is the voltage above 4.8 volts? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
2	Turn the ignition off. Disconnect the Battery Temp Sensor connector. Ignition on, engine not running. With the DRBIII® in sensors, read the Battery Temperature voltage value. Connect a jumper wire between the (K118) Batt Temp Signal circuit and the (K4) Sensor ground circuit at the Battery Temp Sensor connector. Did the Battery Temp Sensor voltage change from greater than 4.5 volts to less than 1.0 volt? Yes → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3 **NOTE: Remove the jumper wire before continuing.**	All

P1492-BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the PCM harness connectors. Ignition on, engine not running. Measure the voltage on the (K118) Battery Temp Signal circuit at the Sensor harness connector. Is the voltage above 0 volts? Yes → Repair the short to voltage in the (K118) Batt Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 4	All
4	Turn the ignition off. Measure the resistance of the (K118) Battery Temp Signal circuit from the Battery Temp Sensor harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K118) Batt Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
5	Measure the resistance in the (K4) Sensor ground circuit from the PCM harness connector to the Sensor connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K4) Sensor ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P1493-BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW

When Monitored and Set Condition:

P1493-BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW

When Monitored: With the ignition on.

Set Condition: The PCM senses the voltage from the Battery Temperature Sensor to be below 0.5 volt for 3 seconds.

POSSIBLE CAUSES
BATTERY TEMP SENSOR VOLTS BELOW 0.5 OF A VOLT
BATTERY TEMPERATURE SENSOR
(K118) BATT TEMP SIGNAL CIRCUIT SHORTED TO GROUND
(K118) BATT TEMP SIGNAL CIRCUIT SHORTED TO THE (K4) SENSOR GROUND CIRCUIT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. Record all DTCs and the related Freeze Frame data. With DRBIII®, monitor the Ambient/Battery Temperature Sensor voltage. Is the voltage below 0.5 of a volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
2	Ignition on, engine not running. With the DRBIII® in Sensors, read the Battery Temperature voltage value. Disconnect the Battery Temperature Sensor harness connector. Did the Battery Temperature Sensor voltage change from below 1.0 volt to above 4.5 volts? Yes → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance between ground and the (K118) Batt Temp Signal circuit in the Battery Temp Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K118) Batt Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 4	All

P1493-BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance between the (K118) Batt Temp Signal circuit and the (K4) Sensor ground circuit at the Battery Temp Sensor harness connector. Is the resistance below 100 ohms? Yes → Repair the short between the (K4) Sensor ground and the (K118) Batt Temp Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT

When Monitored and Set Condition:

P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT

When Monitored: Immediately after a cold start, with battery/ambient temperature between 40 deg. F and 90 deg. F and coolant temperature within 10 deg. F of battery/ ambient.

Set Condition: The state of the switch does not change when the solenoid is energized.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
LDP VACUUM SUPPLY
LEAK DETECTION PUMP
(K107) LDP SWITCH SIGNAL CIRCUIT OPEN
(K107) LDP SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
2	Turn the ignition off. Disconnect the vacuum supply hose at the Leak Detection Pump. Connect a vacuum gauge to the disconnected vacuum supply hose at the Leak Detection Pump. Start the engine and read the vacuum gauge. Does the vacuum gauge read at least 13″ Hg? Yes → Go To 3 No → Repair leak or obstruction in vacuum hose as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1494-LEAK DETECTION PUMP SW OR MECHANICAL FAULT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Connect the vacuum supply hose at the LDP. Disconnect the Leak Detection Pump electrical harness connector. Start the engine. With the DRBIII® in Inputs/Outputs, read the Leak Detect Pump Switch state. Connect a jumper wire between 12-volts and the (K107) LDP Switch Signal circuit. Did the Leak Detect Pump Sw state change when the jumper was connected? Yes → Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 4 **NOTE: Remove the jumper wire before continuing.**	All
4	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K107) LDP Switch Signal circuit from the PCM harness connector to LDP harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open in the (K107) Leak Detection Pump Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
5	Measure the resistance between ground and the (K107) LDP Switch Signal circuit at the LDP harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K107) LDP Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 6	All
6	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

Symptom:
P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT

When Monitored and Set Condition:

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT

When Monitored: Continuously when the ignition is on and battery voltage is greater than 10.4 volts.

Set Condition: The state of the solenoid circuit does not match the PCM's desired state.

POSSIBLE CAUSES
GOOD TRIP EQUAL TO ZERO
(K125) GENERATOR SOURCE CIRCUIT OPEN
(K106) LDP SOLENOID CONTROL CIRCUIT OPEN
(K106) LDP SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
LEAK DETECTION PUMP
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
2	Turn the ignition off. Disconnect the Leak Detection Pump electrical harness connector. Start the engine. With the DRBIII®, actuate the LDP Solenoid. Using a 12-volt test light connected to ground, check the (K125) Generator Source circuit at the LDP connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the (K125) Generator Source circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Connect a 12-volt test light to a good 12-volt source. Ignition on, engine not running. With the DRBIII®, actuate the LDP Solenoid. Probe the (K106) LDP Solenoid Control circuit with the test light while the Pump is actuating. Does the test light blink? Yes → Go To 4 No → Go To 5	All
4	If there are no possible causes remaining, view repair. Repair Replace the Leak Detection Pump. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
5	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (K106) LDP Solenoid Control circuit from the PCM harness connector to the LDP harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K106) Leak Detection Pump Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All
6	Measure the resistance between ground and the (K106) LDP Solenoid Control circuit at the Solenoid harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K106) LDP Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 6. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 6.	All

Symptom:
P1594-CHARGING SYSTEM VOLTAGE TOO HIGH

When Monitored and Set Condition:

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH

When Monitored: With the ignition key on and the engine speed greater than 0 RPM.

Set Condition: When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not decrease.

POSSIBLE CAUSES
CHARGING SYSTEM OPERATION
(K20) GENERATOR FIELD DRIVER CIRCUIT SHORTED TO GROUND
GENERATOR FIELD COIL SHORTED TO GROUND
BATTERY TEMPERATURE SENSOR
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: Battery must be fully charged and be capable of passing a load test.** **Note: Generator Belt tension and condition must be checked before continuing.** Ignition on, engine not running. With the DRBIII®, read DTCs and the related Freeze Frame data then clear the DTCs. Start the engine. With the DRBIII®, read DTCs. Does the Generator light illuminate and is a DTC set? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Generator Field Harness connector. Carefully inspect the related connectors for corrosion or spread terminals before continuing. Measure the resistance between Ground and the (K20) Gen Field Control circuit at the Generator connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K20) Generator Field Driver circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 3	All

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Measure the resistance between ground and the Generator Field terminals on the Generator. Is the resistance below 100 ohms? Yes → Replace or repair the Generator. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 4	All
4	Connect the PCM harness connectors and the Generator harness connector. Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the Batt Temp Sensor value. Using a thermometer to measure under hood temperature near Battery tray. Is the thermometer temperature within 10 deg of DRBIII® Battery temperature? Yes → Go To 5 No → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
5	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom List:

P1595-SPEED CONTROL SOLENOID CIRCUITS
P1683-SPD CTRL PWR RELAY; OR S/C 12V DRIVER CKT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be P1595-SPEED CONTROL SOLENOID CIRCUITS.

When Monitored and Set Condition:

P1595-SPEED CONTROL SOLENOID CIRCUITS

When Monitored: With the ignition key on, the speed control switched on, the SET switch pressed and the vehicle in drive gear moving above 35 MPH.

Set Condition: The powertrain control module actuates the vacuum and vent solenoids but they do not respond.

P1683-SPD CTRL PWR RELAY; OR S/C 12V DRIVER CKT

When Monitored: With the ignition key on and the speed control switched on.

Set Condition: The speed control power supply circuit is either open or shorted to ground.

POSSIBLE CAUSES
(Z1) GROUND CIRCUIT OPEN
INTERMITTENT CONDITION
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN
BRAKE LAMP SWITCH
(V32) S/C POWER SUPPLY CIRCUIT OPEN
S/C VACUUM SOLENOID
(V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN
(V36) S/C VACUUM SOL CONTROL CIRCUIT SHORTED TO GROUND
S/C VENT SOLENOID
(V35) S/C VENT SOL CONTROL CIRCUIT OPEN
(V35) S/C VENT SOL CONTROL CIRCUIT SHORTED TO GROUND
PCM

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. **NOTE: In the below step you will need to actuate both S/C solenoids separately. Note the operation of the each solenoid when actuated.** With the DRBIII®, actuate the Speed Control Vacuum Solenoid and note operation. With the DRBIII®, actuate the Speed Control Vent Solenoid and note operation. Choose the conclusion that best matches the solenoids operation. Vacuum Solenoid not operating Go To 2 Vent Solenoid not operating Go To 5 Both S/C Solenoids not operating Go To 8 Both S/C Solenoids operating Go To 13	All
2	Turn the ignition off. Disconnect the Speed Control Servo harness connector. Ignition on, engine not running. With the DRBIII®, actuate the Speed Control Vacuum Solenoid. Using a 12-volt test light connected to 12-volts, probe the (V36) S/C Vacuum Sol Control circuit at the S/C Servo harness connector. Does the test light illuminate brightly and flash? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 3	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (V36) S/C Vacuum Sol Control circuit between the PCM harness connector and Speed Control Servo harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the (V36) S/C Vacuum Sol Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
4	Measure the resistance between ground and the (V36) S/C Vacuum Sol Control circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (V36) S/C Vacuum Sol Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 12	All

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the Speed Control Servo harness connector. Ignition on, engine not running. With the DRBIII®, actuate the S/C Vent Solenoid. Using a 12-volt test light connected to 12-volts, probe the (V35) S/C Vent Sol Control circuit in the Speed Control Servo harness connector. Does the test light illuminate brightly and flash? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 6	All
6	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (V35) S/C Vent Sol Control circuit between the PCM harness connector and S/C Servo harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open in the (V35) S/C Vent Solenoid Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
7	Measure the resistance between ground and the (V35) S/C Vent Sol Control circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (V35) S/C Vent Sol Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 12	All
8	Turn the ignition off. Disconnect the S/C Servo harness connector. Ignition on, engine not running. Turn the Cruise Control on. Using a 12-volt test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the S/C Servo harness connector. Does the test light illuminate brightly? Yes → Replace the Speed Control Servo. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 9	All
9	Turn the ignition off. Measure the resistance of the (V30) S/C Brake Switch Output circuit from the S/C Servo harness connector to the Brake Lamp Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the (V30) S/C Brake Switch Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1595-SPEED CONTROL SOLENOID CIRCUITS — Continued

TEST	ACTION	APPLICABILITY
10	Disconnect the Brake Lamp Switch harness connector. Ignition on, engine not running. Turn the Cruise Control on, it may be necessary to hold the On button down while checking the following circuit. Using a 12-volt test light connected to ground, probe the (V32) S/C Power Supply circuit in the Brake Lamp Switch harness connector. Does the test light illuminate brightly? Yes → Replace the Brake Lamp Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 11	All
11	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the (V32) S/C Power Supply circuit between the PCM harness connector and the Brake Lamp Switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the open in the (V32) S/C Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
12	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If the there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
13	Turn the ignition off. Disconnect the S/C Servo harness connector. Using a 12-volt test light connected to 12-volts, probe the (Z1) Ground circuit in the S/C Servo harness connector. Does the test light illuminate brightly? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Repair the open in the (Z1) Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
P1596-SPEED CONTROL SWITCH ALWAYS HIGH

When Monitored and Set Condition:

P1596-SPEED CONTROL SWITCH ALWAYS HIGH

When Monitored: With the ignition key on.

Set Condition: An open circuit is detected in the speed control on/off switch circuit. The circuit must be above 4.8 volts for more than 2 minutes to set the DTC.

POSSIBLE CAUSES
SPEED CONTROL ON/OFF SWITCH OPERATION
S/C ON/OFF SWITCH
CLOCKSPRING
(V37) S/C SWITCH SIGNAL CIRCUIT SHORTED TO VOLTAGE
(V37) S/C SWITCH SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCK SPRING
(K4) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(V37) S/C SWITCH SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
(K4) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
PCM

TEST	ACTION	APPLICABILITY
1	Engine Running. With the DRBIII®, read DTCs and record the related Freeze Frame data. With the DRBIII® in Sensors, read the Speed Control inputs state. While monitoring the DRBIII®, push the Speed Control On/Off Switch several times, then leave it on. Did the DRBIII® show Speed Control Switching off and on? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 2	All
2	Turn the ignition off. Disconnect the S/C On/Off Switch 2-way harness connector only. Measure the resistance across the S/C On/Off Switch. Is the resistance between 20.3K and 20.7K ohms? Yes → Go To 3 No → Replace the On/Off Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1596-SPEED CONTROL SWITCH ALWAYS HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Disconnect the upper and lower 6-way clockspring harness connectors per Service Information. Measure the resistance of the (K4) Sensor ground circuit between the upper and lower 6-way clockspring harness connectors. Measure the resistance of the (V37) S/C Switch Signal circuit between the upper and lower 6-way clockspring harness connectors. Was the resistance above 5.0 ohms for either circuit? Yes → Replace the clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 4	All
4	Connect the Clockspring harness connectors per Service Information. Disconnect the Speed Control On/Off Switch 2-way harness connector only. Ignition on, engine not running. Measure the voltage on the (V37) S/C Switch Signal circuit in the On/Off Switch 2-way connector. Is the voltage above 5.2 volts? Yes → Repair the short to voltage in the (V37) S/C Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 5	All
5	Turn the ignition off. Disconnect the lower Clockspring 6-way harness connector per Service Information. Disconnect the PCM harness connectors. Measure the resistance of the (V37) S/C Switch Signal circuit from the PCM harness connector to the lower Clockspring harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (V37) S/C Switch Signal circuit between the PCM and Clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
6	Measure the resistance of the (K4) Sensor ground circuit from the PCM harness connector to the lower Clockspring harness connector. Is the resistance below 5.0 ohms? Yes → Go To 7 No → Repair the open (K4) Sensor ground circuit between the PCM and Clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
7	Disconnect the upper clockspring harness connector per Service Information. Measure the resistance of the (V37) S/C Switch Signal circuit from the upper Clockspring harness connector to the On/Off switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open in the (V37) S/C Switch Signal circuit, Clockspring to S/C Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

P1596-SPEED CONTROL SWITCH ALWAYS HIGH — Continued

TEST	ACTION	APPLICABILITY
8	Measure the resistance of the (K4) Sensor ground circuit from the On/Off Switch 2-way harness connector to the upper Clockspring harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the (K4) Sensor ground circuit between the Clockspring and S/C Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
9	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
P1597-SPEED CONTROL SWITCH ALWAYS LOW

When Monitored and Set Condition:

P1597-SPEED CONTROL SWITCH ALWAYS LOW

When Monitored: With the ignition key on and battery voltage above 10.4 volts.

Set Condition: When switch voltage is less than 0.39 of a volt for 2 minutes.

POSSIBLE CAUSES
S/C SWITCH VOLTAGE BELOW 1.0 VOLT
S/C ON/OFF SWITCH
S/C RESUME/ACCEL SWITCH
CLOCKSPRING SHORTED TO GROUND
(V37) S/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(V37) S/C SWITCH SIGNAL CIRCUIT SHORTED TO (K4) SENSOR GROUND
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs and record the related Freeze Frame data. Check for any related TSBs. With the DRBIII®, read the S/C Switch volts status. Is the S/C Switch voltage below 1.0 volt? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
2	Turn the ignition off. Disconnect the S/C ON/OFF Switch harness connector. Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch volts. Did the S/C Switch volts change to 5.0 volts? Yes → Replace the S/C ON/OFF Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 3	All

P1597-SPEED CONTROL SWITCH ALWAYS LOW — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the S/C RESUME/ACCEL Switch harness connector. Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch volts. Did the S/C Switch volts go above 4.0 volts? Yes → Replace the Resume/Accel Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 4	All
4	Turn the ignition off. Disconnect the lower clockspring 6-way harness connector per Service Information. Ignition on, engine not running. With the DRBIII® in Sensors, read the S/C Switch voltage. Did the S/C Switch volts change to 5.0 volts? Yes → Replace the Clockspring. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 5	All
5	Turn the ignition off. Connect the Clockspring harness connector per Service Information. Disconnect the PCM harness connectors. Measure the resistance between a known good ground and the (V37) S/C Switch Signal circuit at S/C ON/OFF Switch harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (V37) S/C Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 6	All
6	Measure the resistance between the (V37) S/C Signal circuit and the (K4) Sensor ground circuit at the ON/OFF Switch harness connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the (K4) Sensor ground and the (V37) S/C Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 7	All
7	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
P1682-CHARGING SYSTEM VOLTAGE TOO LOW

When Monitored and Set Condition:

P1682-CHARGING SYSTEM VOLTAGE TOO LOW

When Monitored: With the ignition key on and the engine running over 1500 RPM after 25 seconds.

Set Condition: When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not increase.

POSSIBLE CAUSES
CHARGING VOLTAGE BELOW 15.1 VOLTS
BATTERY TEMPERATURE SENSOR
RESISTANCE IN THE BATTERY POSITIVE CIRCUIT
RESISTANCE IN THE GENERATOR GROUND
(K125) GEN FIELD SOURCE CIRCUIT OPEN
(K125) GEN FIELD SOURCE CIRCUIT SHORTED TO GROUND
(K20) GEN FIELD CONTROL CIRCUIT OPEN
GENERATOR FIELD COIL HIGH RESISTANCE
PCM

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **NOTE: Battery must be fully charged and capable of passing a battery load test.** **NOTE: Generator Belt tension and condition must be checked before continuing.** **NOTE: Inspect the vehicle for any aftermarket accessories that may exceed the maximum Generator output.** **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Start the engine. Record all DTCs and the related Freeze Frame data. With the DRBIII®, read the target charging voltage. Is the target charging voltage above 15.1 volts? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 2	All

P1682-CHARGING SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine. Allow the engine to reach normal operating temperature. With the DRBIII® in sensors, read the Battery Temp Sensor value. Using a Thermometer, measure under hood temperature. Is the temperature within 10° F of Battery temperature? Yes → Go To 3 No → Replace the Battery Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
3	Ignition on, engine not running. Measure the voltage between the Generator B+ Terminal and the Battery Positive Post. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** **CAUTION: Ensure all wires are clear of the engine's moving parts.** Start the engine. Is the voltage above 0.4 of a volt? Yes → Repair the excessive resistance in the Battery Positive circuit between the Generator and Battery. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 4	All
4	Start the engine. **WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.** Warm the engine to operating temperature. **Caution: Ensure all wires are clear of the engine's moving parts.** Measure the voltage between the Generator case and Battery Negative Post. Is the voltage above 0.1 of a volt? Yes → Repair the excessive resistance in the Generator Ground circuit between the Generator Case and Battery Negative side. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 5	All
5	Ignition on, engine not running. Carefully inspect all connectors for corrosion or spread terminals before continuing. With the DRBIII® actuate the Generator Field Driver. While backprobing, measure the voltage on the (K125) Gen Field Source circuit at back of Generator. Is the voltage above 10.0 volts? Yes → Go To 6 No → Repair the open in the (K125) Gen Field Source circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

P1682-CHARGING SYSTEM VOLTAGE TOO LOW — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Disconnect the Generator Field harness connector at back of the Generator. Measure resistance across the Generator Field Terminals at the Generator. Is the resistance above 15 ohms? Yes → Replace or repair the Generator as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 7	All
7	Measure the resistance between ground and the (K125) Gen Field Source circuit in the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K125) Gen Field Source circuit and replace the PCM. Perform POWERTRAIN VERIFICATION TEST VER - 3. No → Go To 8	All
8	Measure the resistance of the (K20) Gen Field Control circuit from the Generator harness connector to the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the (K20) Gen Field Control circuit. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All
9	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 3.	All

Symptom:
P1685 WRONG OR INVALID KEY MSG RECEIVED FROM SKIM

POSSIBLE CAUSES
NO COMMUNICATION WITH SKIM
SKIM TROUBLE CODES SET
NO VIN PROGRAMMED IN THE PCM
INCORRECT VIN IN PCM
INVALID SKIM KEY NOT PRESENT
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read the PCM DTCs and record the related Freeze Frame data. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Go To 7	All
2	With the DRBIII®, attempt to communicate with the SKIM. Can the DRB III® communicate with the SKIM? Yes → Go To 3 No → Refer to symptom BUS +/- SIGNAL OPEN FROM SKIM in the COMMUNICATION category. Perform SKIS VERIFICATION.	All
3	With the DRB III®, check for SKIM DTCs. Are any DTCs present in the SKIM? Yes → Repair all SKIM DTCs. Perform SKIS VERIFICATION. No → Go To 4	All
4	With the DRB III®, display the VIN that is programmed in the PCM. Has a VIN been programmed into the PCM? Yes → Go To 5 No → Program the correct VIN into the PCM and retest. Perform SKIS VERIFICATION.	All
5	With the DRB III®, display the VIN that is programmed in the PCM. Was the correct VIN programmed into the PCM? Yes → Go To 6 No → Go to SKIM and perform the PCM replaced function to write in the correct VIN. Perform SKIS VERIFICATION.	All

P1685 WRONG OR INVALID KEY MSG RECEIVED FROM SKIM — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off. Replace and program the Sentry Key Immobilizer Module per with the Service Information. Ignition on, engine not running. With the DRB III®, erase all SKIM and PCM DTCs. Attempt to start and idle the engine. With the DRB III®, read the PCM DTCs. Does the DRB III® display this code? Yes → Go to SKIM and perform function to write in correct VIN. Perform SKIS VERIFICATION. No → Test Complete.	All
7	**NOTE: This DTC could have been set if the SKIM harness connector was disconnected, or if the SKIM was replaced recently.** **NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.** **NOTE: Ensure the customer is not attempting to use a non-SKIM duplicate key.** Ignition on, engine not running. Verify the correct VIN is programmed into the PCM and SKIM. Turn the ignition off. With the next customer key turn the ignition key on and crank the engine to start. With the DRB III®, read the PCM DTCs. Look for P1685 Does the DTC return? Yes → Replace the Ignition Key. Perform SKIS VERIFICATION. No → Test Complete. **NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.**	All

Symptom:
P1686 NO SKIM BUS MESSAGE RECEIVED

POSSIBLE CAUSES
NO SKIM BUS MESSAGES
LOSS OF SKIM COMMUNICATION
PCI BUS CIRCUIT OPEN FROM PCM TO SKIM
SKIM/PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read the PCM DTCs and record the related Freeze Frame data. Check for any related TSBs. Is the Good Trip Counter displayed and equal to zero? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform SKIS VERIFICATION.	All
2	With the DRBIII®, attempt to communicate with the SKIM. **NOTE: This test will indicate if the Bus is operational from the DLC to the SKIM.** Was the DRBIII® able to communicate with the SKIM? Yes → Go To 3 No → Refer to symptom BUS +/- SIGNAL OPEN FROM SKIM in the COMMUNICATION category. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the SKIM harness connector. Measure the resistance of the PCI Bus circuit between the PCM harness connector and the SKIM harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PCI Bus circuit between the PCM and the SKIM for an open. Perform SKIS VERIFICATION.	All
4	Replace the Sentry Key Immobilizer Module per Service Information. Ignition on, engine not running. Display and erase all PCM and SKIM DTCs. Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle. With the DRBIII®, display PCM DTCs. Does the DRBIII® display the same DTC? Yes → Replace and program the Powertrain Control Module per Service Information. Perform SKIS VERIFICATION. No → Test Complete.	All

Symptom:
P1687-NO CLUSTER BUS MESSAGE

When Monitored and Set Condition:

P1687-NO CLUSTER BUS MESSAGE

When Monitored: Ignition key on.

Set Condition: No messages received from the MIC (Instrument Cluster) for 20 seconds.

POSSIBLE CAUSES
NO CLUSTER BUS MESSAGE
COMMUNICATE WITH CLUSTER
INSTRUMENT CLUSTER OPERATION
PCM

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, erase DTCs. Cycle the ignition key on for 20 seconds then turn off. Perform this several times. With the DRBIII®, read DTC's. Does the DTC reset? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	With the DRBIII®, attempt to communicate with the Instrument cluster. Can communication be established with the Instrument Cluster? Yes → Go To 3 No → Refer to the Communication Category and perform the appropriate symptom (Diagnostic test) related to no communication with cluster. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Start the engine Allow the engine to idle. Is the correct engine speed display in the instrument cluster (Tach)? Yes → Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Refer to the Instrument Cluster Category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
P1692-CLUSTER SOFTWARE MISMATCH

When Monitored and Set Condition:

P1692-CLUSTER SOFTWARE MISMATCH

When Monitored: Ignition on.

Set Condition: When the PCM is initialized, it sends out a request to the cluster for Tire Size, Axle Ratio and T-case data. The PCM does this 3 times, once every 1.87 seconds. If the Cluster does not respond with the correct information after the third time, this fault will set in the PCM. The PCM will only request this data upon a NAVRAM reset, initial module power-up, battery disconnect/reconnect cycle, or manual reset of the module performed with a diagnostic tool.

POSSIBLE CAUSES
INCORRECT CLUSTER INSTALLED
INCORRECT AXLE RATIO,TIRE SIZE, OR T/CASE INFO

TEST	ACTION	APPLICABILITY
1	If the cluster was previously replace with the wrong part number this fault will set. Was the cluster previously replaced? Yes → Install correct Rubicon Cluster. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Verify that the proper transfer case, tire size, and axle ratio are programmed in the PCM. Was the proper information programmed in the PCM? Yes → Set the correct axle ratio, tire size, or transfer case information in the PCM. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Test Complete.	All

Symptom:

P1696-PCM FAILURE EEPROM WRITE DENIED

POSSIBLE CAUSES
PCM FAILURE

Repair Instructions:

PCM FAILURE

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 5.

Symptom:
P1698-NO BUS MESSAGE FROM TRANS CONTROL MODULE

POSSIBLE CAUSES
NO BUS MESSAGE FROM TRANS INTERMITTENT
PCM PCI BUS CIRCUIT OPEN
NO BUS MESSAGE FROM TRANS

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, erase DTCs. Cycle the ignition key on and off several times. With the DRBIII®, read DTCs. Does the DTC reset? Yes → Go To 2 No → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 1. **NOTE: This DTC could have been set when the TCM was disconnected during transmission Diagnostics.**	All
2	Ignition on, engine not running. Connect the DRBIII® and access Powertrain Control Module. **Note: This test checks for other PCI BUS codes. That indicates different circuits in the BUS.** With the DRBIII®, read DTCs. Is a DTC also set for NO SKIM BUS MESSAGE and/or No MIC BUS MESSAGE? Yes → Go To 3 No → Refer to the Communication Category and perform the appropriate symptom related to the no communication with TCM. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

P1698-NO BUS MESSAGE FROM TRANS CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, read DTCs. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRBIII® will not read PCM DTC's, follow the ″NO RESPONSE TO PCM (SCI only)″ symptom path, if vehicle will start. For NO START Conditions follow symptom ″NO RESPONSE″ in Starting category .** Turn the ignition off. Disconnect the PCM harness connector(s). Connect the DRBIII® to the Data Link connector Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Select DRBIII® Standalone. Select lab scope. Select Live. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCM PCI Bus circuit Ignition on, engine not running. Observe the voltage displayed on the DRBIII® Lab Scope. What is the voltage displayed on the scope? Pulse from 0 to approximately 7.5 volts Test Complete. Steady 0 volts Repair the open PCI Bus circuit to PCM. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
P1899-P/N SWITCH PERFORMANCE

POSSIBLE CAUSES
DRBIII® DISPLAYS P/N & D/R NOT IN CORRECT POSITION
TRS T41 SENSE (P/N SENSE) CIRCUIT SHORTED TO GROUND
TRS T41 (P/N SENSE) CIRCUIT OPEN
TRS (P/N SWITCH)
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII®, read the PNP switch input state. While moving the gear selector through all gear positions Park to 1st and back to Park, watch the DRBIII® display. Did the DRBIII® display P/N and D/R in the correct gear positions? Yes → Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the TRS P/N switch harness connector. **Check connectors - Clean/repair as necessary** Measure the resistance between ground and the TRS T41 (P/N Sense) circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the TRS T41 Sense (P/N Sense) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All
3	Measure the resistance of the TRS T41 (P/N Sense) circuit between the PCM C1 harness connector and the TRS harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the open in the TRS T41 (P/N Sense) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

P1899-P/N SWITCH PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Connect the TRS (P/N) harness connector. Move the gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through the gear positions, measure the resistance between ground and the TRS T41 (P/N) Sense circuit in the PCM C1 harness connector. **NOTE: The circuit is grounded in Park and Neutral and open in the other positions.** Did the display change from above 100 kohms (open) to below 10.0 ohms (grounded)? Yes → Go To 5 No → Replace the TRS Assembly (P/N Switch) per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRBIII®

POSSIBLE CAUSES
DRBIII® DOES NOT SHOW BRAKE SW PRESSED OR RELEASED
(F32) FUSED B+ CIRCUIT OPEN
(Z1) GROUND CIRCUIT OPEN
(K29) BRAKE LAMP SWITCH SIGNAL CIRCUIT
(K29) BRAKE LAMP SWITCH SIGNAL CIRCUIT OPEN
(K29) BRAKE LAMP SWITCH SIGNAL CIRCUIT SHORT TO GROUND
(K29) BRAKE LAMP SWITCH SIGNAL LESS THAN 10.0 VOLTS
(V32) S/C POWER SUPPLY CIRCUIT BELOW 10 VOLTS AT BRAKE SWITCH CONN
PCM

TEST	ACTION	APPLICABILITY
1	Check for any related TSBs. Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the Brake Switch state. Press and release the brake pedal several times. Does the DRBIII® display Brake Switch PRESSED and RELEASED? Yes → The Brake Lamp Switch is operating properly at this time. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 2	All
2	Turn the ignition off. Disconnect the Brake Lamp Switch harness connector. Using a 12-volt test light connected to ground, probe the (F32) Fused B+ circuit at the Brake Lamp Switch harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the excessive resistance or short to ground in the (F32) Fused B+ circuit. Inspect the related fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
3	Using a 12-volt test light connect to 12-volts, probe the Brake Lamp Switch ground circuit. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the open in the (Z1) Brake Lamp Switch Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRBIII® — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance across the Brake Lamp Switch Signal terminal and the Ground terminal (measurement taken across the switch). Apply and release the Brake Pedal while monitoring the ohmmeter. Does the resistance change from below 5.0 ohms to open circuit? Yes → Go To 5 No → Replace the Brake Lamp Switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
5	Disconnect the PCM harness connectors. Measure the resistance of the (K29) Brake Lamp Switch Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the open in the (K29) Brake Lamp Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
6	Disconnect the CAB harness connector. Measure the resistance between ground and the (K29) Brake Lamp Switch Signal circuit. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K29) Brake Lamp Switch Signal circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4. No → Go To 7	All
7	Turn the ignition off. Connect the PCM harness connectors. Connect the CAB harness connector. Connect the Brake Lamp Switch harness connector. Brake pedal must be depressed in the next step. Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (K29) Brake Lamp Switch Signal circuit at the Brake Lamp Switch harness connector. Is the test light illuminated and bright? Yes → Go To 8 No → Replace or adjust the brake switch. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All
8	Turn the ignition off. Disconnect the Brake Switch harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the DRBIII®, actuate the S/C Vacuum Solenoid. Using a 12-volt test light connected to ground, backprobe the S/C Power Supply Circuit in the Brake Switch harness connector. Did the test light illuminate brightly? Yes → Go To 9 No → Repair the excesssive resistance in the (V32) S/C Power Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON DRBIII® — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 4.	All

Symptom:
*CHECKING A/C SYSTEM OPERATION WITH NO DTCS

POSSIBLE CAUSES
A/C CLUTCH RELAY DTC PRESENT
REFRIGERATION SYSTEM NOT PROPERLY CHARGED
HIGH PRESS CUT-OFF SWITCH
LOW PRESSURE SWITCH
A/C REQUEST CIRCUIT OPEN
A/C SELECT CIRCUIT OPEN
A/C CLUTCH COIL
A/C COMPRESSOR CLUTCH GROUND CIRCUIT OPEN
(C3) A/C CLUTCH RELAY OUTPUT CIRCUIT OPEN
(A17) FUSED B+ CIRCUIT
A/C CLUTCH RELAY

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read DTCs. Is there an A/C Clutch Relay DTC present? Yes → Diagnose the related DTC(s) before continuing. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Turn the ignition off. Verify that the Refrigerant System is properly charged per Service Procedure. Is the Refrigerant System properly charged? Yes → Go To 3 No → Properly charge the Refrigerant System per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
3	Verify the High Pressure Cut-Off Switch operation per Service Information. Is the High Pressure Cut-Off Switch OK? Yes → Go To 4 No → Replace the High Pressure Cut-Off Switch. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
4	Verify the Low Pressure Switch operation per Service Information. Is the Low Pressure Switch OK? Yes → Go To 5 No → Replace the Low Pressure Switch. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
5	Engine Running. Turn the A/C system on and the fan on high. With the DRBIII® in Inputs/Outputs, read the A/C request state. Does the A/C request state change? Yes → Go To 6 No → Repair the open in the A/C Request circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	With the DRBIII®, read the A/C Select status. Turn the A/C Switch on and off a few times. Does the A/C Select state change? Yes → Go To 7 No → Repair the open in the A/C Select circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
7	Ignition on, engine not running. Disconnect the A/C Compressor Clutch harness connector. Connect a test light between the ground circuit and the A/C Clutch Relay Output circuit. With the DRBIII®, actuate the A/C Clutch Relay. Does the test light illuminate brightly on and off with the relay actuation? Yes → Replace the A/C Clutch Coil. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 8	All
8	Turn the ignition off. Disconnect the A/C Clutch harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the A/C Compressor Clutch Ground Circuit. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the A/C compressor clutch ground circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
9	Remove the A/C Clutch Relay. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the A/C Clutch Relay Output circuit between the Relay and the A/C Clutch Coil connector. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the open in the (C3) A/C Clutch Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
10	Measure the voltage on the (A17) Fused B+ circuit in the A/C Clutch Relay connector. Is the voltage above 11.0 volts? Yes → Go To 11 No → Repair the open or short to ground in the (A17) Fused B+ circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
11	If there are no possible causes remaining, view repair. Repair Replace the A/C Clutch Relay. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
*CHECKING EVAPORATIVE EMISSION OPERATION WITH NO DTCS

POSSIBLE CAUSES
FUEL TANK VENT
WIRE HARNESS INSPECTION
VACUUM HARNESS INSPECTION
PURGE SYSTEM CONTAMINATED

TEST	ACTION	APPLICABILITY
1	Start the engine. Allow the engine to reach normal operating temperature. **Note: Engine must be in closed loop.** With the DRBIII®, go to Purge Vapors Test. Press 3 to flow. **Note: Short Term Adaptive should change.** Did Short Term Adaptive change? Yes → Test Complete. No → Go To 2	All
2	Turn the ignition off. Remove the Purge Solenoid. Inspect the line from rollover valve to the solenoid. Is liquid fuel in the line? Yes → Replace the Fuel Tank Vent. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 3	All
3	**Note: Use the Freeze Frame Data to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.** **NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: Refer to any technical service bulletins that may apply.** Perform a wiggle test of the Evap Purge Solenoid wiring while the circuit is actuated with the DRBIII®. Listen for the solenoid to quit actuating. Also watch for the Good Trip Counter to change to 0. Were any problems found? Yes → Repair wire harness/connectors as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4	All

*CHECKING EVAPORATIVE EMISSION OPERATION WITH NO DTCS — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Visually inspect the Evap Purge Solenoid and vacuum harness. Look for any chafed, pierced, pinched, or partially broken hoses.** **Note: Refer to any technical service bulletins that may apply.** Were any problems found? Yes → Repair vacuum harness/connections as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn the ignition off. Remove the Purge solenoid and tap the ports against a clean solid surface. Did any foreign material fall out? Yes → Replace the purge solenoid and clean or replace the vacuum and purge lines and Evap canister. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Test Complete.	All

Symptom:

*CHECKING HARD TO FILL WITH FUEL

POSSIBLE CAUSES
NVLD FILTER PLUGGED

Repair Instructions:

NVLD FILTER PLUGGED

Replace the NVLD filter and clean out the Hoses.

Perform POWERTRAIN VERIFICATION TEST VER - 2.

Symptom:
*CHECKING THE PCM POWER AND GROUNDS

POSSIBLE CAUSES
PCM FUSED B+ CIRCUIT
PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
PCM GROUND CIRCUITS

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the PCM harness connectors. Using a 12-volt test light connected to ground, probe the PCM Fused B+ circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the open in the Fused B+ circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the Ignition Switch Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Turn the ignition off. Using a 12-volt test light connected to battery voltage, probe the PCM ground circuits in the PCM harness connector. Does the test light illuminate brightly? Yes → Test Complete. No → Repair the open in the PCM ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*CHECKING FUEL DELIVERY

POSSIBLE CAUSES
FUEL PUMP RELAY
FUEL PRESSURE OUT OF SPECIFICATION
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP
(A61) FUSED B+ CIRCUIT
(A141) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN
(Z1) FUEL PUMP GROUND CIRCUIT EXCESSIVE RESISTANCE
FUEL PUMP MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test. **Note: It may be necessary to use a mechanics stethoscope in the next step.** Listen for fuel pump operation at the fuel tank. Does the Fuel Pump operate? Yes → Go To 2 No → Go To 5 **Caution: Stop All Actuations.**	All
2	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install a fuel pressure gauge to the fuel rail test port. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Choose a conclusion that best matches your fuel pressure reading. Below Specification Go To 3 Within Specification Test Complete. Above Specification Replace the fuel filter/fuel pressure regulator. Perform POWERTRAIN VERIFICATION TEST VER - 1. **Caution: Stop All Actuations.**	All

*CHECKING FUEL DELIVERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module. Install special 5/16″ fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module. Attach a fuel pressure test gauge to the ″T″ fitting on tool #6539. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Is the fuel pressure within specification now? Yes → Repair/replace fuel supply line as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4 **Caution: Stop All Actuations.**	All
4	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose,fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
5	Turn the ignition off. Disconnect the fuel pump module harness connector. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test. Using a 12-volt test light connected to ground, probe the (A141) Fuel Pump Relay Output circuit at the Fuel Pump Module harness connector. Does the test light illuminate brightly? Yes → Go To 6 No → Go To 8 **Caution: Stop All Actuations.**	All
6	Turn the ignition off. Disconnect the Fuel Pump Module harness connector. Using a test light connected to 12-volts, backprobe the (Z1) Fuel Pump ground circuit at the Fuel Pump Module harness connector. Does the test light illuminate brightly? Yes → Go To 7 No → Repair the excessive resistance in the (Z1) Fuel Pump Ground circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*CHECKING FUEL DELIVERY — Continued

TEST	ACTION	APPLICABILITY
7	If there are no possible causes remaining, view repair. Repair Replace the Fuel Pump Module. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
8	Turn the ignition off. Remove the Fuel Pump Relay from the PDC. Using a 12-volt test light connected to ground, backprobe the Fuel Pump Relay Fused B+ circuit at the PDC. Does the test light illuminate? Yes → Go To 9 No → Repair the open or short to ground in the (A61) Fuel Pump Realy Fused B+ circuit. Inspect the fuse and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
9	Disconnect the Fuel Pump Module harness connector. Measure the resistance of the (A141) Fuel Pump Relay Output circuit from the relay connector to the Fuel Pump Module connector. Is the resistance below 5.0 ohms? Yes → Replace the Fuel Pump Relay. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the open in the (A141) Fuel Pump Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*CHECKING HARD START (FUEL DELIVERY SYSTEM)

POSSIBLE CAUSES
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PUMP INLET STRAINER PLUGGED
FAULTY FUEL PUMP MODULE
FUEL INJECTORS
FUEL CONTAMINATION

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install the fuel pressure gauge at the engine. Refer to the Service Information FUEL DELIVERY Section. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Choose a conclusion that best matches your fuel pressure reading. Below Specification Go To 2 Within Specification Go To 4	All
2	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Raise vehicle on hoist, and disconnect the fuel supply line at the fuel pump module. Install special tool #6539 (5/16″) fuel line adapter fuel pressure gauge between the fuel supply line and the fuel pump module. Ignition on, engine not running. With the DRBIII®, actuate the ASD Fuel System test and observe the fuel pressure gauge. **NOTE: Fuel pressure specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Is the fuel pressure within specification? Yes → Visually and physically inspect the fuel supply lines between the fuel tank and the fuel rail. Repair/replace as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 3	All

*CHECKING HARD START (FUEL DELIVERY SYSTEM) — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose,fitting or line, the fuel system pressure must be released.** Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer. Is the Fuel Inlet Strainer plugged? Yes → Replace the Fuel Pump Inlet Strainer. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All
4	**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.** Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install special tool #6539 (5/16″) fuel line adapter. Install the fuel pressure gauge. Start the engine and allow the fuel system to reach maximum pressure. Turn the ignition off. **NOTE: Fuel specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine. Monitor the fuel pressure gauge for a minimum of 5 minutes. **NOTE: The pressure should not fall below 241 KPa (35 psi)** Does the fuel pressure drop? Yes → Replace fuel pump module. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 5	All
5	**WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Remove special tool #C4390. Start the engine and allow the fuel system to reach maximum pressure. Turn the ignition off. **NOTE: Fuel specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Install special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the fuel pump module. Monitor the fuel pressure gauge for a minimum of 5 minutes. **NOTE: The pressure should not fall below 241 KPa (35 psi)** Does the fuel pressure drop? Yes → Replace leaking fuel injectors. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Check the fuel for contaminants. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*ENGINE CRANKS DOES NOT START

POSSIBLE CAUSES
NO START PRE-TEST
POWERTRAIN FUSES OPEN
SECONDARY INDICATORS PRESENT
NO CKP SENSOR SIGNAL WHEN CRANKING ENGINE
NO CMP SENSOR SIGNAL WHEN CRANKING ENGINE
ENGINE MECHANICAL PROBLEM
(A142) ASD RELAY OUTPUT CIRCUIT OPEN
FUEL CONTAMINATION

TEST	ACTION	APPLICABILITY
1	**Note: The following list of items must be checked before continuing with any no start tests.** The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times. This will allow any DTCs to set that may have been erased due to a dead battery. Try to communicate with PCM, if not able to communicate check fuses. Make sure the Powers and Ground to the PCM are ok. Make sure the PCM communicates with the DRBIII® and that there are no DTCs stored in the PCM memory. If the PCM reports a No Response condition, refer to the Communication category for the proper tests. Read the PCM DTCs with the DRBIII®. If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Symptom list for the related P-code that is reported by the PCM. Make sure that the PCI bus is functional. Attempt to communicate with the Instrument Cluster and VTSS. If you are unable to establish communicate refer to the Communication category for the proper symptoms. The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the DRBIII® and check for DTCs that may be stored in the Sentry Key Immobilizer Module (SKIM). Repair the DTC(s) before continuing. If no DTCs are found, using the DRBIII®, select Clear PCM (BATT Disconnect). Crank the engine several times. Using the DRBIII®, read DTCs. If a DTC is present perform the DTC diagnostics before continuing. Were any problems found? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 2	All
2	Check for any open fuses in the PDC or Junction Block that may be related to the No Start condition. Are any of the fuses open? Yes → Replace the open fuse and check the related circuit(s) for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 3	All

*ENGINE CRANKS DOES NOT START — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, under DTCs & Related Functions, read the Secondary Indicators while cranking the engine. Are there any Secondary Indicators present while cranking the engine? Yes → Refer to symptom list and perform tests related to the secondary indicator that is reported by the DRBIII®. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 4	All
4	With the DRBIII® in Sensors, check the Current CKP Count while cranking the engine. Does the CKP Counter change while cranking the engine? Yes → Go To 5 No → Refer to Driveability Symptom P0320-NO CRANK REFERENCE SIGNAL AT PCM. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
5	With the DRBIII® in Sensors, check the Current CMP Count while cranking the engine. Does the Current CMP Count change while cranking the engine? Yes → Go To 6 No → Refer to Driveability Symptom P0340-NO CAM SIGNAL AT PCM Perform POWERTRAIN VERIFICATION TEST VER - 5.	All
6	Check for any of the following conditions/mechanical problems. ENGINE VALVE TIMING - must be within specifications ENGINE COMPRESSION - must be within specifications ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks. FUEL - must be free of contamination FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector Are there any engine mechanical problems? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 5. No → Go To 7	All
7	Turn the ignition off. Remove the ASD relay from the PDC. Disconnect the PCM harness connectors. Verify the ASD Relay is getting Fused B+ voltage before continuing. Measure the resistance of the (A142) ASD Relay output circuit from the ASD Relay connector to the PCM harness connector, Ignition coil, and the fuel injectors. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open ASD Relay output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

*ENGINE CRANKS DOES NOT START — Continued

TEST	ACTION	APPLICABILITY
8	Verify that the Fuel tank is not empty before continuing. Follow the diagnostics for Checking Fuel Delivery under the Driveability section of this manual. Was the No Start condition solved after following the above diagnostic procedure? Yes → Test Complete. No → Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual. Perform POWERTRAIN VERIFICATION TEST VER - 5.	All

Symptom:
*FUEL PRESSURE LEAK DOWN

POSSIBLE CAUSES
CHECKING FUEL LEAK DOWN
FUEL INJECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair /replace as necessary.** Turn the ignition off. **WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Install special tool #6539 (5/16″) fuel line adapter. Install the fuel pressure gauge. Start the engine and allow the fuel system to reach maximum pressure. Turn the ignition off. **NOTE: Fuel specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine. Monitor the fuel pressure gauge for a minimum of 5 minutes. **NOTE: The pressure should not fall below 241 KPa (35 psi).** Does the fuel pressure drop? Yes → Replace the fuel pump module. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Go To 2	All
2	**WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.** Remove special tool #C4390. Start the engine and allow the fuel system to reach maximum pressure. Turn the ignition off. **NOTE: Fuel specification is 400 KPa +/- 34 KPa (58 psi +/- 5 psi).** Install special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the fuel pump module. Monitor the fuel pressure gauge for a minimum of 5 minutes. **NOTE: The pressure should not fall below 241 KPa (35 psi)** Does the fuel pressure drop? Yes → Replace leaking fuel injectors. Perform POWERTRAIN VERIFICATION TEST VER - 2. No → Test Complete.	All

Symptom:
*NO CRANK CONDITION

POSSIBLE CAUSES
MECHANICAL CONDITION
TRANSMISSION RANGE SENSOR
BATTERY CIRCUIT RESISTANCE TOO HIGH
CLUTCH PEDAL POSITION SWITCH
(T141) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
TRS T41 SENSE (P/N SENSE) CIRCUIT OPEN
(T40) STARTER RELAY OUTPUT CIRCUIT OPEN
(A2) FUSED B+ CIRCUIT OPEN
STARTER
STARTER RELAY

TEST	ACTION	APPLICABILITY
1	**NOTE: Check all fuses and verify the battery is fully charged and capable of passing a load test before continuing.** **WARNING: MAKE SURE THE BATTERY IS DISCONNECTED, THEN WAIT TWO MINUTES BEFORE PROCEEDING.** Turn the engine over by hand to ensure the engine is not seized. Is the engine able to turn over? Yes → Go To 2 No → Repair the mechanical condition preventing the starter motor from cranking. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Move the Gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through each gear, measure the resistance between ground and the TRS T41 Sense (P/N Sense) circuit. Did the resistance change from above 10.0 ohms to below 10.0 ohms? Yes → Go To 3 No → Replace the Transmission Range Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Check the Battery Cables for high resistance using the service information procedure. Did either Battery Cable have a voltage drop greater than 0.2 of a volt? Yes → Repair the Battery circuit for high resistance. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 4	All

*NO CRANK CONDITION — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the Clutch Pedal Position Switch. If this vehicle is not equipped with a manual transmission answer NO to this test and continue. Connect a jumper wire between the two terminals of the Clutch Pedal Position Switch and attempt to start the engine. Does the engine crank? Yes → Replace the Clutch Pedal Position Switch. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 5	All
5	Turn ignition off. Remove the Starter Relay from PDC. **WARNING: The Parking Brake must be on and the Transmission must be in park for a vehicle equipped with an automatic transmission or Neutral on a Manual transmission.** **WARNING: The engine may be cranked in the next step. Keep away from moving engine parts.** Briefly connect a jumper wire between Starter Relay B+ circuit and the (T40) Starter Relay Output circuits. Did the Starter Motor crank the engine? Yes → Go To 6 No → Go To 8 **NOTE: Remove the jumper wire before continuing.**	All
6	Ignition on, engine not running. Using a 12-volt test light connected to ground, probe the (T141) Fused Ignition Switch Output circuit in the Starter Relay connector. While observing 12-volt test light, hold ignition key in the start position. Does the test light illuminate brightly? Yes → Go To 7 No → Repair the open or high resistance in the (T141) Fused Ignition Switch Output circuit. Inspect related fuses and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
7	Turn the ignition off. Disconnect the PCM harness connectors. Measure the resistance of the Starter Relay Control circuit between the Relay terminal and the PCM harness connector. Is the resistance below 5.0 ohms? Yes → Replace the Starter Motor Relay. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the open in the TRS T41 Sense (P/N Sense) circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO CRANK CONDITION — Continued

TEST	ACTION	APPLICABILITY
8	Disconnect the Starter Relay Output connector from the Starter Solenoid. Measure the resistance of the (T40) Starter Relay Output circuit between the Relay and the Solenoid harness connector. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the open in the (T40) Starter Relay Output circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
9	Using a 12-volt test light connected to ground, backprobe the (A2) Fused B+ circuit at the Starter Relay terminal. Does the test light illuminate brightly? Yes → Go To 10 No → Repair the open or high resistance in the (A2) Fused B+ circuit. Inspect related fuses and repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	If there are no other possible causes remaining, review repair. Repair Replace the Starter. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM PCM WITH A NO START CONDITION

POSSIBLE CAUSES
PCM FUSED B+ CIRCUIT
PCM NO RESPONCE
PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
PCM GROUND CIRCUITS
TP SENSOR
5-VOLT SENSOR OPEN OR SHORTED
(K7) 5-VOLT SUPPLY CKT SHORT TO GROUND
(K6) 5-VOLT CIRCUIT SUPPLY SHORTED TO GROUND
PCM

TEST	ACTION	APPLICABILITY
1	**NOTE: The DRBIII® and cable must be operating properly for the results of this test to be valid.** **NOTE: Ensure the ignition switch was on while trying to communicate with the PCM.** Turn the ignition off. Disconnect the PCM harness connectors. Using a 12-volt test light connected to ground, backprobe the PCM Fused B+ circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the open in the Fused B+ circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Ignition on, engine not running. Using a 12-volt test light connected to ground, backprobe the PCM Fused Ignition Switch Output circuit in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 3 No → Repair the open in the Ignition Switch Output circuit. Inspect and replace fuses as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
3	Turn the ignition off. Using a 12-volt test light connected to 12-volts, backprobe the PCM ground circuits in the PCM harness connector. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the opens in the PCM ground circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM WITH A NO START CONDITION — Continued

TEST	ACTION	APPLICABILITY
4	Connect the PCM harness connectors. Disconnect the TP Sensor harness connector. Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit. Is the voltage between 4.5 and 5.2 volts? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Disconnect the MAP Sensor harness connector. **NOTE: Connect the TP Sensor harness connector.** Ignition on, engine not running. Measure the voltage on the (K7) 5-volt Supply circuit in the MAP Sensor harness connector. Is the voltage between 4.5 and 5.2 volts? Yes → If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module in accordance with Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
6	Measure the voltage on the (K7) 5-volt Supply circuit. Disconnect all the sensors that use a 5-volt Supply circuit. Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors. Yes → Replace the sensor that is pulling down the 5-volt supply. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect PCM harness connectors. Measure the resistance between ground and the (K7) 5-volt Supply circuit with all the Sensor harness connectors disconnected. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K7) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All
8	Disconnect all sensors that use the (K6) 5-volt Supply. Measure the resistance between ground and the (K6) 5-volt Supply circuit at the PCM harness connector. Is the resistance below 100 ohms? Yes → Repair the short to ground in the (K6) 5-volt Supply circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 9	All

*NO RESPONSE FROM PCM WITH A NO START CONDITION — Continued

TEST	ACTION	APPLICABILITY
9	**NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.** Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits. If there is no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*START AND STALL CONDITION

POSSIBLE CAUSES
CHECKING DTCS
CHECKING SKIM DTCS
TP SENSOR SWEEP
TP SENSOR VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
ECT SENSOR OPERATION
OTHER POSSIBLE CAUSES FOR START & STALL
FUEL CONTAMINATION

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. With the DRBIII®, read engine DTCs. Are any DTCs present? Yes → Refer to the Driveability Category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 2	All
2	**NOTE: If you are unable to communicate with the SKIM, refer to the Communication Category and perform the appropriate symptom.** With the DRBIII®, read the SKIM codes. Are there any SKIM DTCs? Yes → Refer to the Vehicle Theft category and perform the appropriate symptom. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 3	All
3	With the DRBIII®, read TP Sensor voltage. While monitoring the DRBIII®, slowly open and close the Throttle. Is the voltage change smooth? Yes → Go To 4 No → Replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
4	With the DRBIII®, read TP Sensor voltage. Throttle must be against stop. Is the voltage 0.92 or less with the Throttle closed? Yes → Go To 5 No → Check for a binding throttle condition. If OK, replace the Throttle Position Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*START AND STALL CONDITION — Continued

TEST	ACTION	APPLICABILITY
5	**Note: For this test to be valid, the thermostat must be operating correctly.** **Note: This test works best if performed on a cold engine (cold soaked).** **NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.** Ignition on, engine not running. With the DRBIII®, read the ECT value. **Note: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.** Start the engine. During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F). Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)? Yes → Go To 6 No → Replace the Engine Coolant Temperature Sensor. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
6	The following additional items should be checked as a possible cause for a start and stall condition. Refer to any Technical Service Bulletins (TSB's) that may apply to the symptom. The exhaust system must be free of any restrictions. The engine compression must be within specifications. The engine valve timing must be within specifications. The engine must be free from vacuum leaks. The throttle body must be free of carbon buildup and dirt. Do any of the above conditions exist? Yes → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Verify that the Fuel tank is not empty before continuing. Follow the diagnostics for Checking Fuel Delivery under the Driveability section of this manual. Was the Start and Stall condition solved after following the above diagnostic test? Yes → Test Complete. No → Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Verification Tests

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. **2. NOTE: If the SKIM or PCM was replaced, refer to the service information for proper programming procedures.** **3. NOTE: If the MIC was replaced, configure new cluster with Tire Size, Axle, T-Case Type, and EQ Setting.** 4. Ensure all accessories are turned off and the battery is fully charged. 5. With the DRBIII®, record and erase all DTC's from ALL modules. Start and run the engine for 2 minutes. Operate all functions of the system that caused the original concern. 6. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII®, read DTC's from ALL modules. Are any DTCs present or is the original condition still present? Yes → Repair is not complete, refer to the appropriate symptom. No → Repair is complete.	All

POWERTRAIN VERIFICATION TEST VER - 1	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Inspect the engine oil for contamination. If oil contamination is suspected, change the oil and filter. 3. If the PCM was not replaced skip steps 4 through 6 and continue with the verification. 4. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Attempt to start the engine. 8. If the conditions cannot be duplicated, erase all DTCs. Is the vehicle still unable to start and/or are there any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a NO TROUBLE CODE repair, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes or the symptom no longer exists, the repair was successful and testing is complete. 4. If the initial or another symptom exists, the repair is not complete. Check all technical service bulletins or flash updates and return to Symptoms if necessary. 5. If this verification procedure is being performed after a DTC repair, perform steps 6 through 13. 6. Connect the DRBIII® to the data link connector. Using the DRBIII® erase any diagnostic trouble codes and reset all values. 7. If the PCM was not replaced, skip steps 8 through 10, then proceed with the verification. 8. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer System (SKIS), Secret Key data must be updated to enable start. 9. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 10. For SKIS theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, and Misc. Place SKIM in secured access mode by using the correct PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. 11. Road test the vehicle. If the test is for an A/C DTC, ensure it is operating during the following test. 12. Drive the vehicle for at least 5 minutes at 64 Km/h (40 mph). Ensure the transmission shifts properly through all gears. At some point stop the vehicle and turn off the engine for at least 10 seconds. 13. With the DRBIII®, read DTCs. Are any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

POWERTRAIN VERIFICATION TEST VER - 3	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Connect the DRBIII® to the Data Link Connector and erase the DTCs. 3. If the PCM was not replaced skip steps 4 through 6 then continue the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Perform the generator output test per service manual information. 8. Start the engine and set the engine speed to 2000 rpm for at least 30 seconds. 9. Allow the engine to return to idle. 10. Cycle the ignition key off then on. 11. With the DRBIII®, read DTCs. Are any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 4	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. With the DRBIII®, erase DTCs. 3. If the PCM was not replaced, skip steps 4 through 6, then continue with the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air bag modules. In addition, if the vehicle is equipped with entry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Turn the speed control ON (if equipped, cruise light will be on). 8. Depress and release the SET Switch when the vehicle speed is greater than 35 MPH. The speed control should engage and maintain the selected speed. 9. Depress and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 mph. 10. Press and hold the COAST switch. The vehicle speed should decrease. 11. Using caution, depress and release the brake pedal. The speed control should disengage. 12. Bring the vehicle speed back up to 35 MPH. 13. Depress the RESUME/ACCEL switch. The speed control should resume the previously set speed. 14. Hold down the SET switch. The vehicle should decelerate. 15. Ensure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed. 16. Depress and release the CANCEL switch. The speed control should disengage. 17. Bring the vehicle speed back up above 35 mph and engage speed control. 18. Depress the OFF switch to turn OFF, (Cruise light will be off). The speed control should disengage. 19. NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET. 20. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h). 21. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed. 22. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. 23. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly. 24. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop. 25. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating). 26. Then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. 27. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition. Did the Speed Control pass the above test? Yes → Repair is complete. No → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure).	All

Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 5	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If any existing diagnostic trouble codes have not been repaired, go to the appropriate Symptom List and follow path specified. 3. Connect the DRBIII® to the data link connector. 4. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories. 5. If the PCM was not replaced skip steps 6 through 8 and continue the verification. 6. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with entry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 7. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 8. For SKIM theft alarm: Connect DRBIII® to data link connectorto Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. 9. If the Catalyst was replaced, with the DRBIII® go to the miscellaneous Menu Option ″Catalyst Replaced″ and press enter. 10. If a Comprehensive Component DTC was repaired, perform steps 11 and 13. If a Major OBD II Monitor DTC was repaired skip step 11 and continue verification. 11. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes. 12. With the DRBIII®, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running). 13. If the conditions cannot be duplicated, erase all DTC with the DRBIII®. Did the OBD II monitor run successfully and has the Good Trip Counter changed to one or more? Yes → Repair is complete. No → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure).	All

Verification Tests — Continued

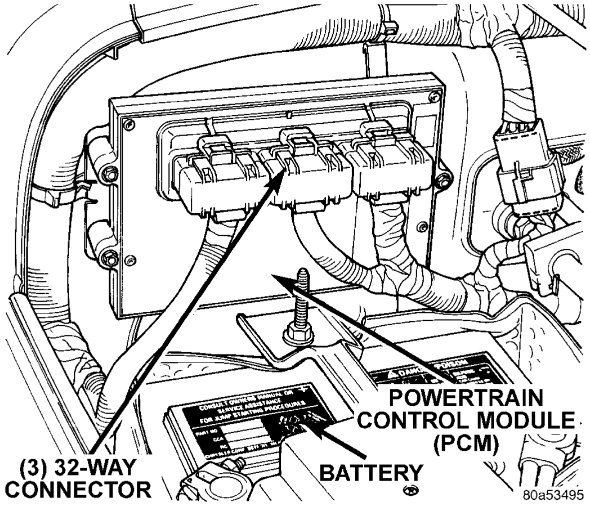
POWERTRAIN VERIFICATION TEST VER - 6	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If all DTCs have not been repaired, go to the symptom list and follow the path specified. After all DTCs have been repaired, return to TEST VER-6 and, with the DRBIII® in System Tests, perform the LDP Monitor Test. 3. If the PCM was not replaced, skip steps 4 through 6 then continue with the verification. 4. If the PCM was replaced, the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Airbag Systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Airbag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. The LDP Monitor Test is a useful way to run a total LDP system performance test. Use this test to verify any type of LDP system repair. 8. Connect the DRBIII® to the data link connector. Engine running, turn off all accessories. With the DRBIII® in System Tests, perform the LDP Monitor Test. 9. Note: While test is being performed, PCM must see RPM, minimum MAP, No Vehicle speed and minimum Throttle Position sensor (At idle, in park.) Did the LDP Monitor Test fail and/or have any DTCs set? Yes → Check for any related Technical Service Bulletins and/or refer to the apopropriate Symptom list (Diagnostic Procedure) No → Repair is complete.	All

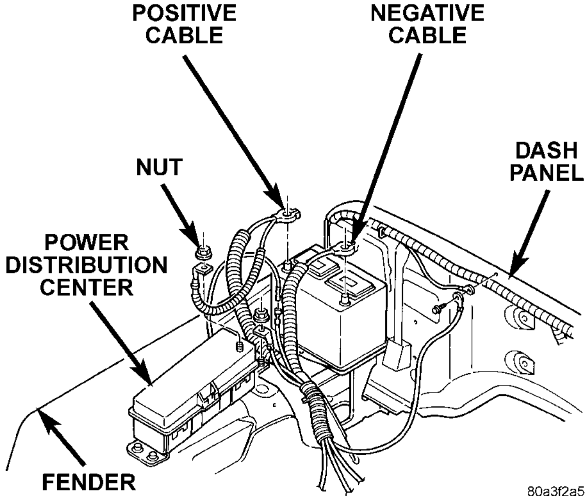
SKIS VERIFICATION	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKIM. This number can be obtained from the vehicle's invoice or Chrysler's Customer Center (1-800-992-1997). **3. NOTE: When entering the PIN, care should be taken because the SKIM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PINs are entered, the SKIM will Lock Out the DRB for 1 hour.** 4. To exit Lock Out mode, the ignition key must remain in the Run position continually for 1 hour. Turn off all accessories and connect a battery charger if necessary. 5. With the DRB, select Theft Alarm, SKIM and Miscellaneous. Then, select the desired procedure and follow the steps that will be displayed. 6. If the SKIM has been replaced, ensure all of the vehicle ignition keys are programmed to the new SKIM. **7. NOTE: Prior to returning vehicle to the customer, perform a module scan to be sure that all DTCs are erased. Erase any DTCs that are found.** 8. With the DRB, erase all DTCs. Perform 5 ignition key cycles leaving the key on for at least 90 seconds per cycle. 9. With the DRB, read the SKIM DTCs. Are there any SKIM DTCs? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

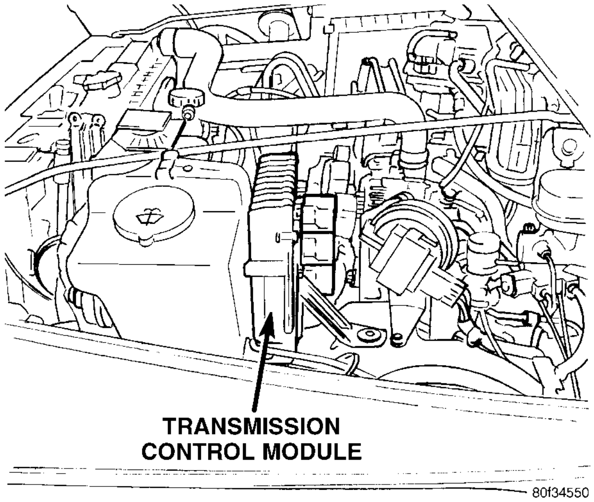
NOTES

8.0 COMPONENT LOCATIONS

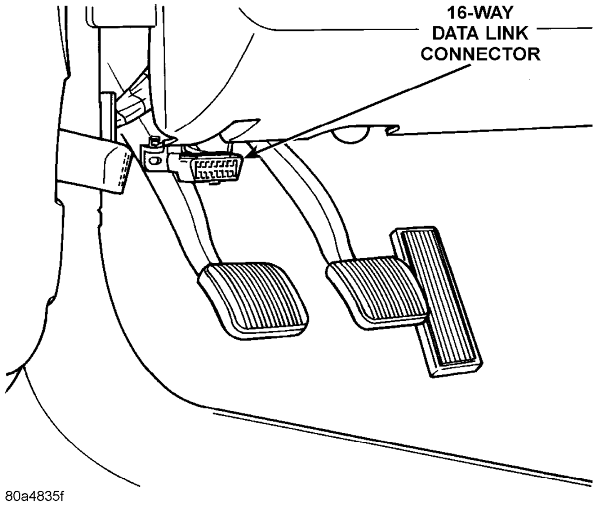
8.1 CONTROL MODULES AND PDC



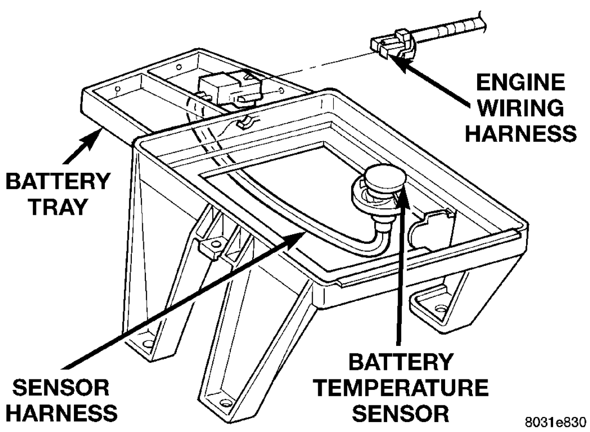




8.2 DATA LINK CONNECTOR



8.3 SENSORS AND SOLENOIDS



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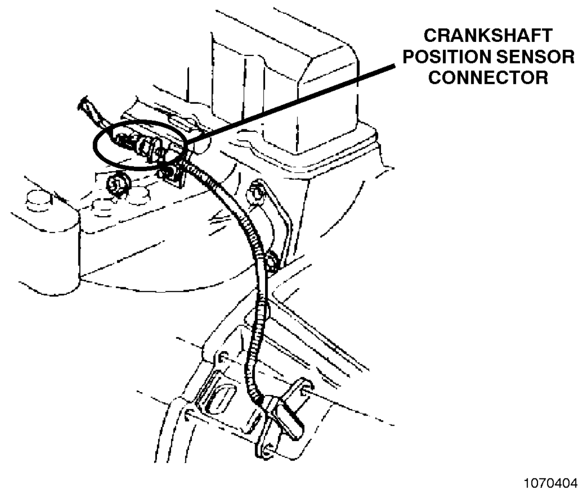

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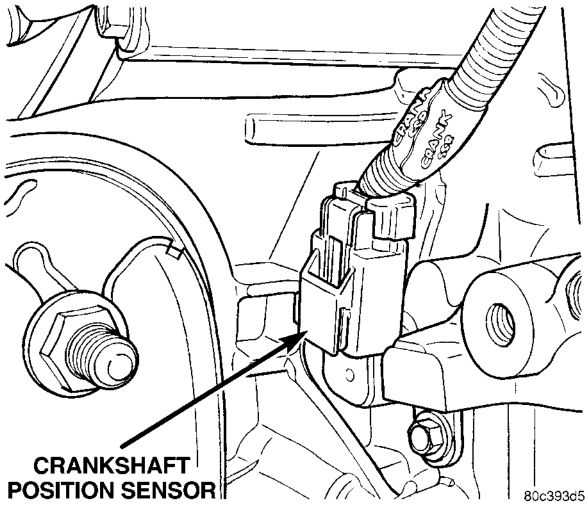

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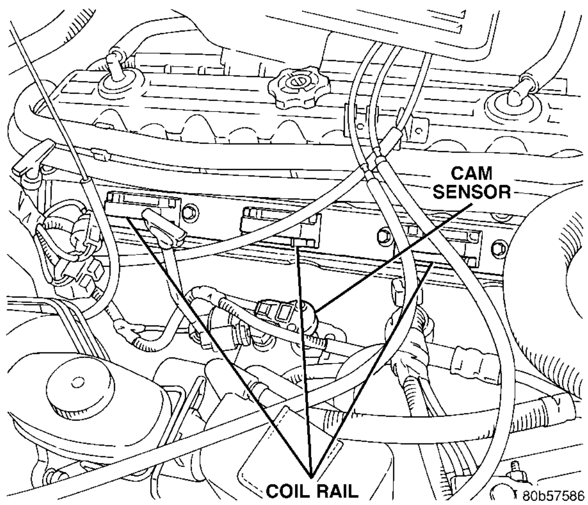

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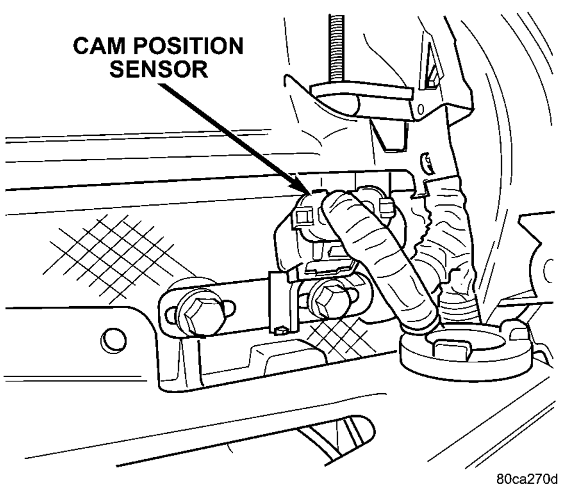

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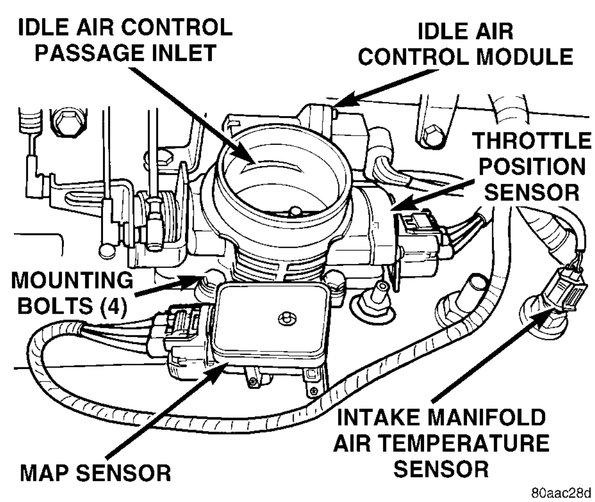

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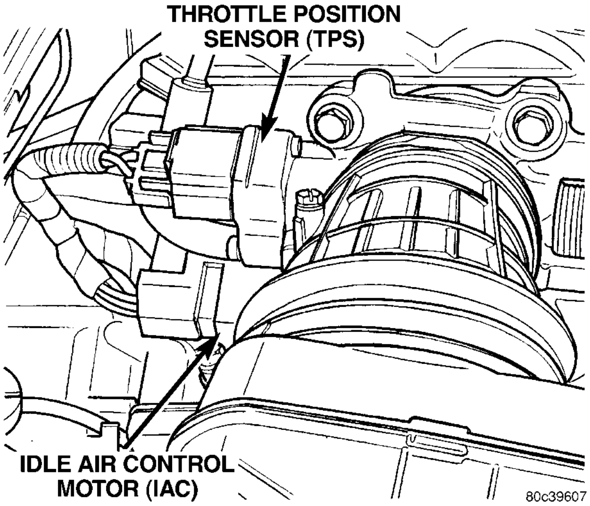

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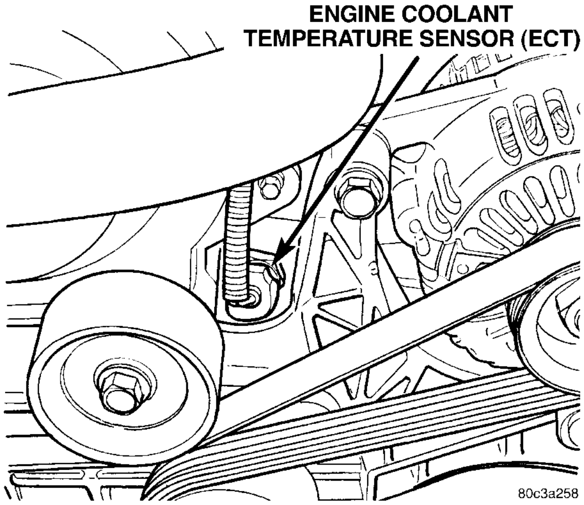

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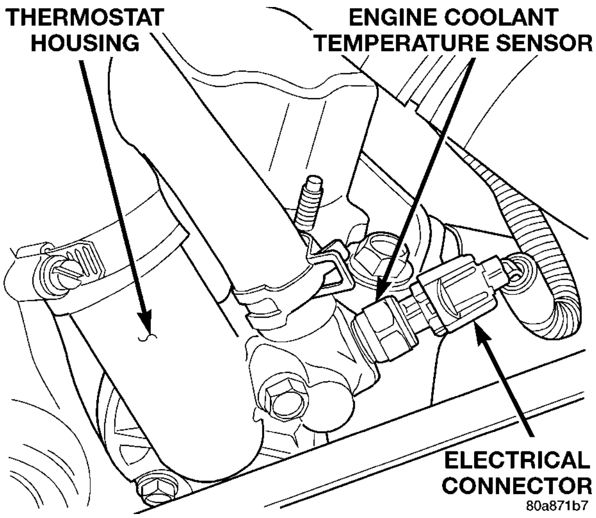

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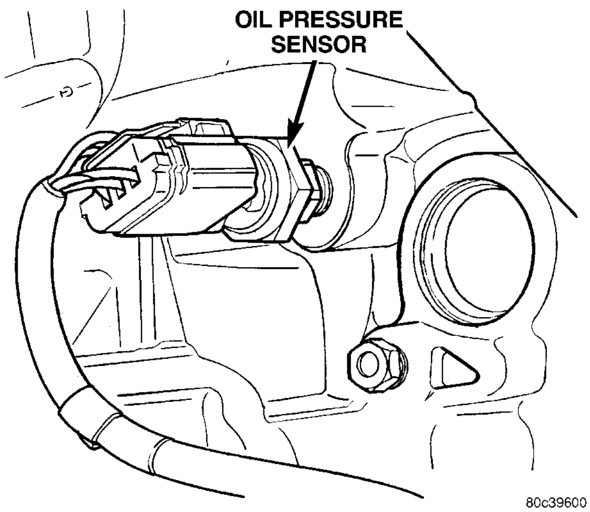

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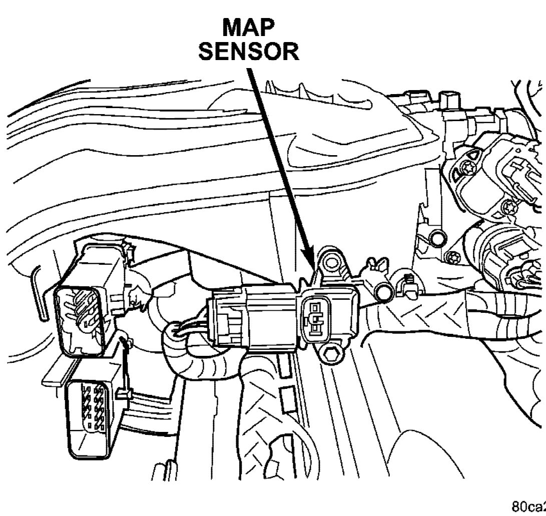

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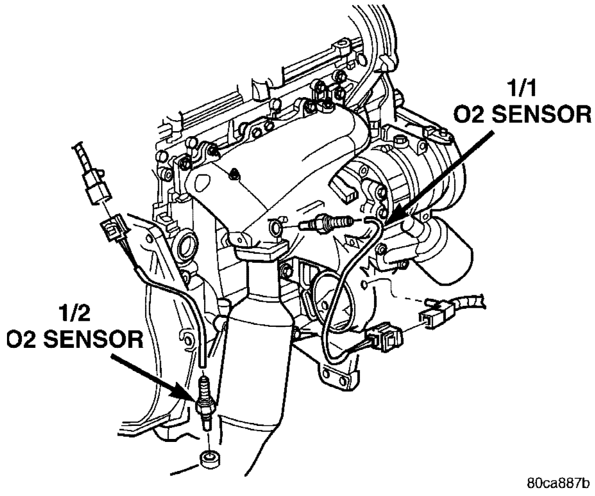

8.3 SENSORS AND SOLENOIDS (Continued)

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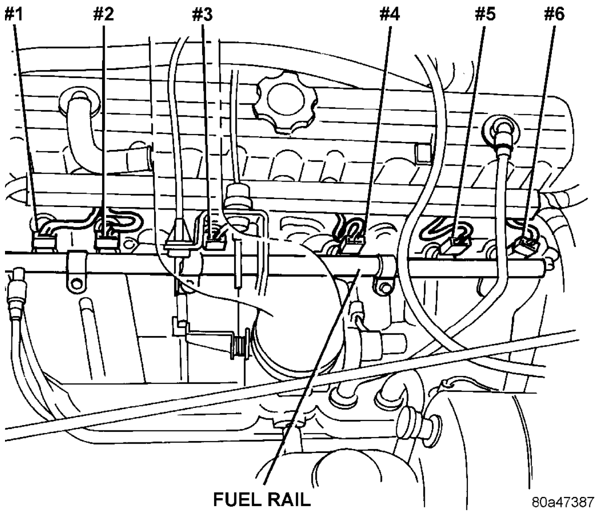

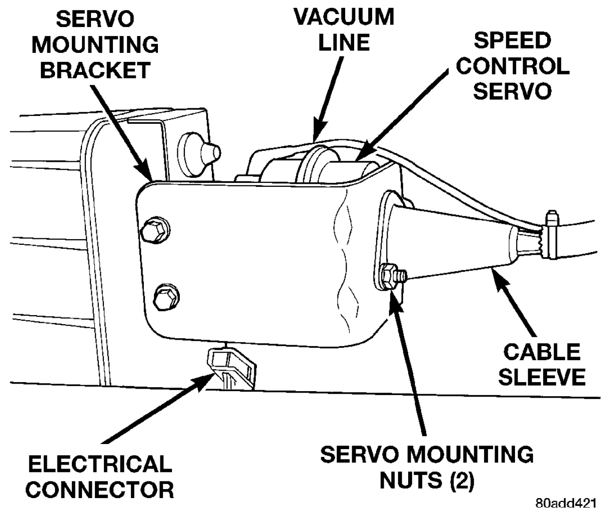

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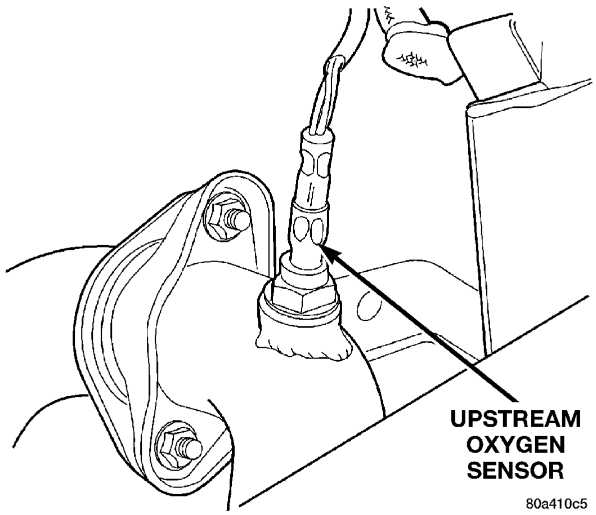

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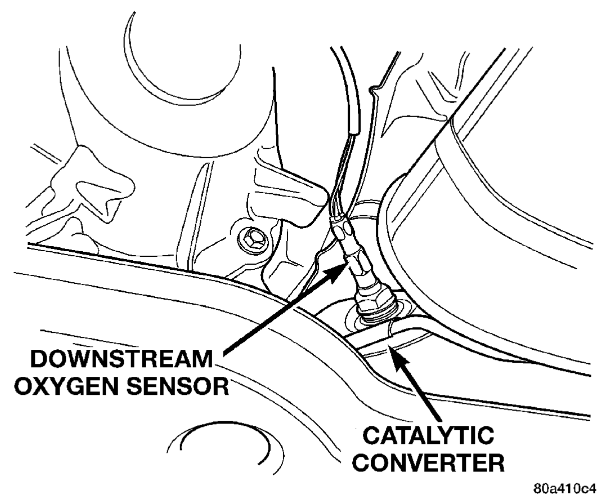
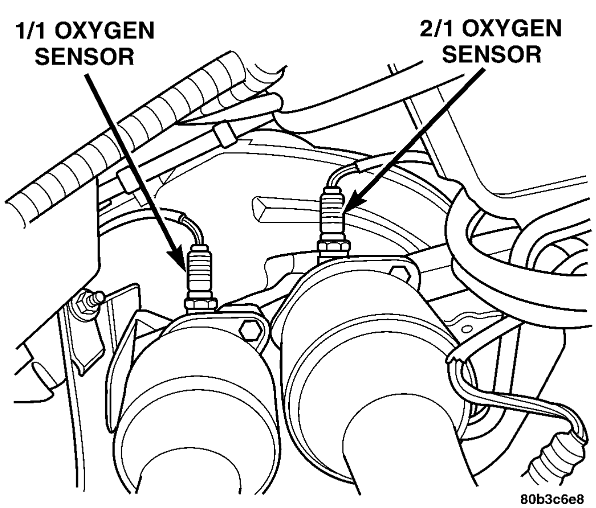


1/1 and 2/1 Calif & EURO III



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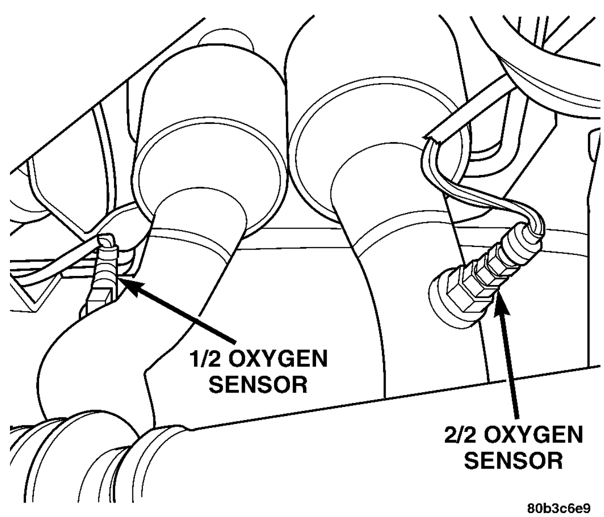

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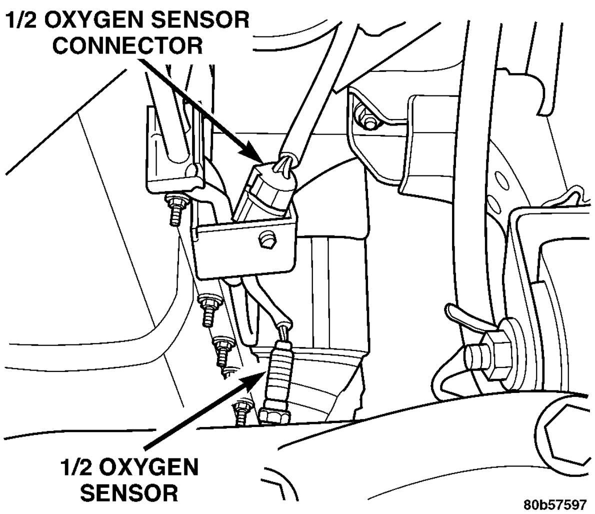
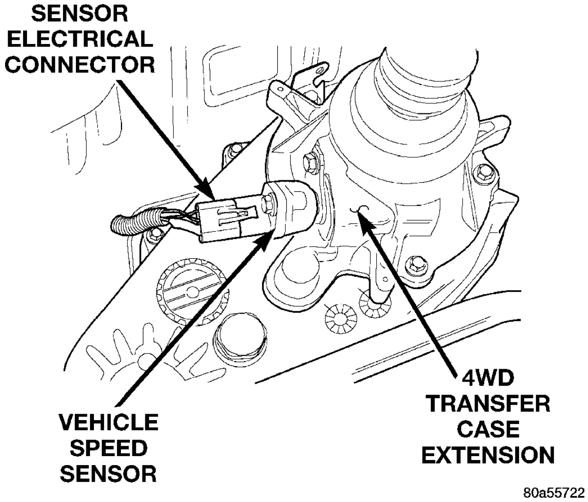
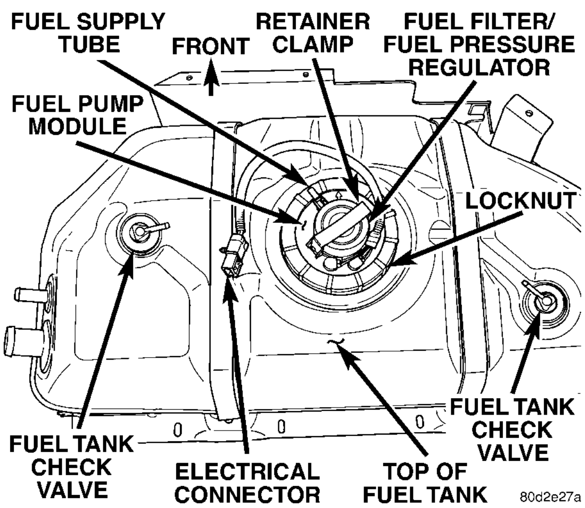
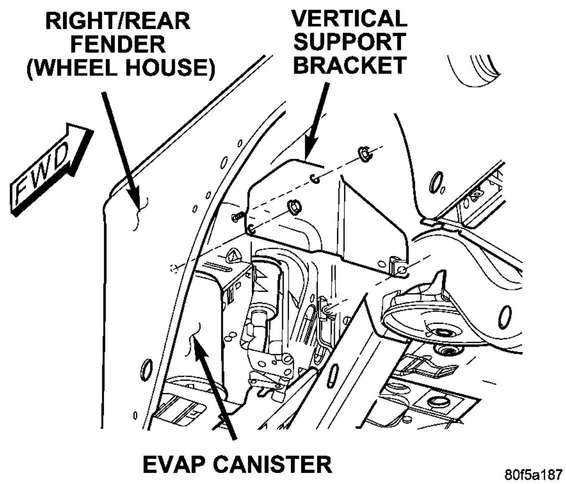
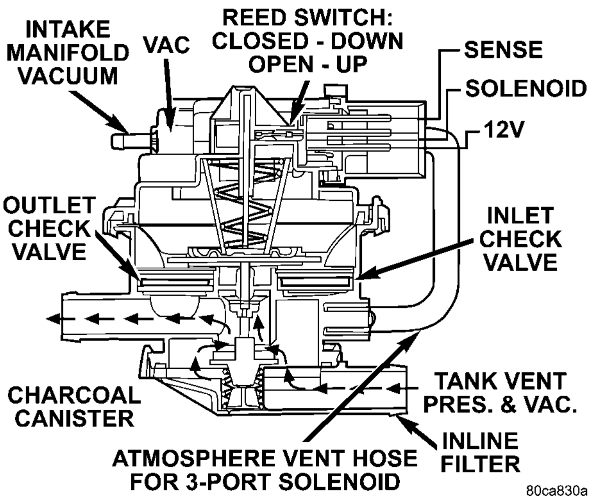


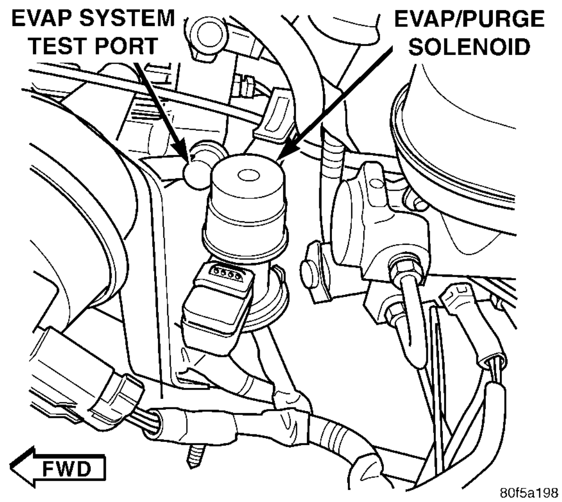


8.4 FUEL SYSTEM

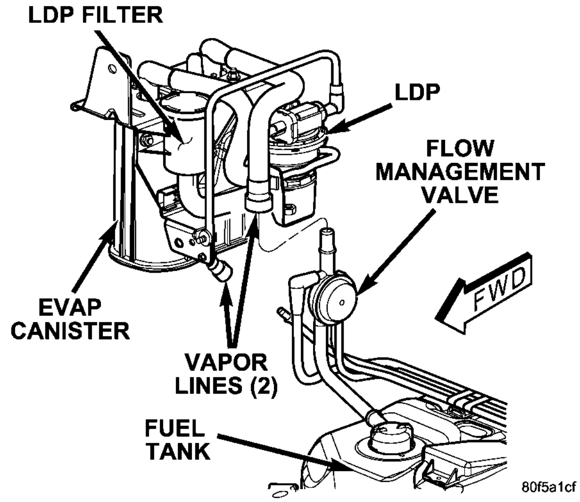




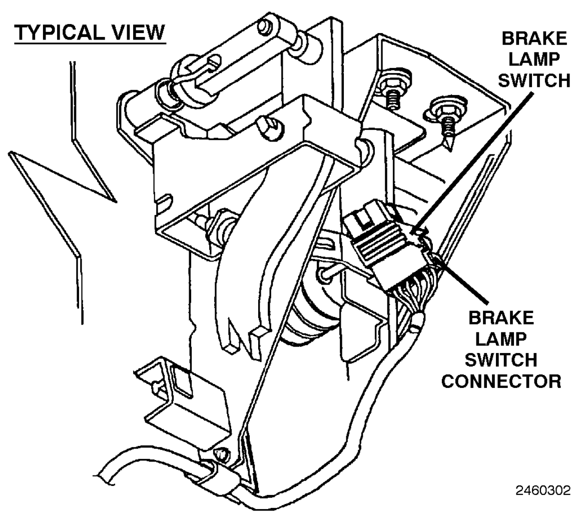


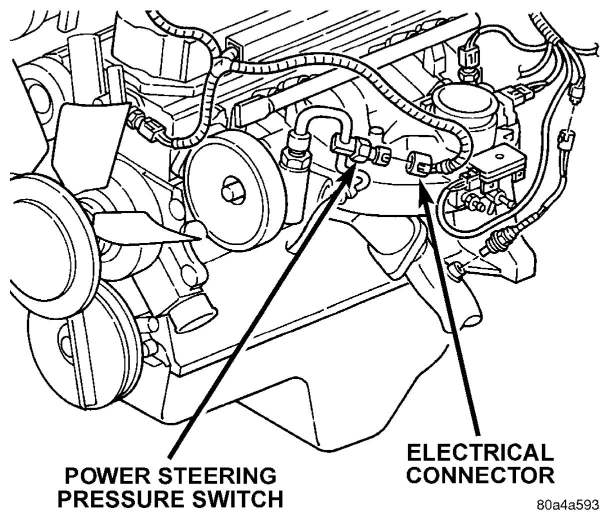


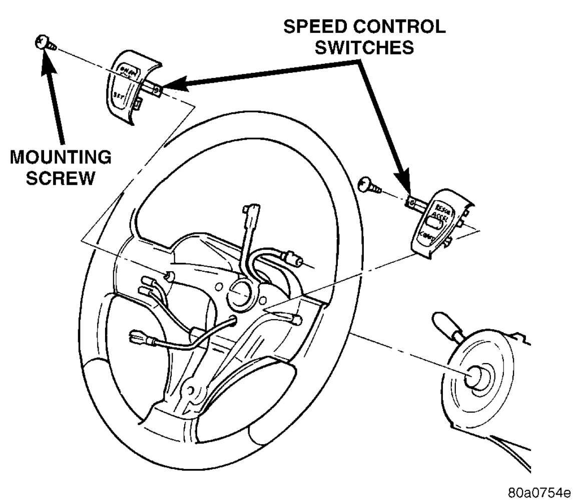
8.4 FUEL SYSTEM (Continued)



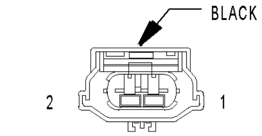
8.5 SWITCHES







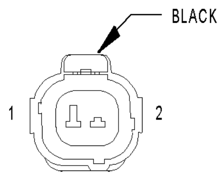
9.0 CONNECTOR PINOUTS



A/C COMPRESSOR CLUTCH

A/C COMPRESSOR CLUTCH - BLACK 2 WAY

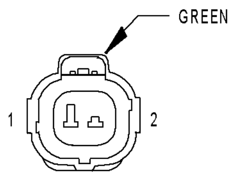
CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK (2.4L)	A/C CLUTCH RELAY OUTPUT
1	C3 20DB/BK (4.0L)	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z246 18BK/OR (2.4L)	GROUND
2	Z1 20BK (4.0L)	GROUND



A/C HIGH PRESSURE SWITCH (4.0L)

A/C HIGH PRESSURE SWITCH (4.0L) - BLACK 2 WAY

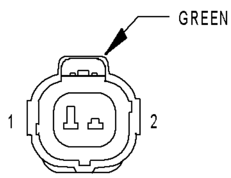
CAV	CIRCUIT	FUNCTION
1	C90 20LG	A/C SELECT SIGNAL
2	C22 20DB/WT	A/C SWITCH SIGNAL



A/C LOW PRESSURE SWITCH (2.4L)

A/C LOW PRESSURE SWITCH (2.4L) - GREEN 2 WAY

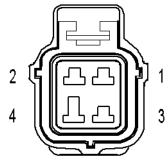
CAV	CIRCUIT	FUNCTION
1	C21 18DB/OR	A/C REQUEST SIGNAL
2	C90 20LG	A/C SELECT SIGNAL



A/C LOW PRESSURE SWITCH (4.0L)

A/C LOW PRESSURE SWITCH (4.0L) - GREEN 2 WAY

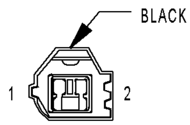
CAV	CIRCUIT	FUNCTION
1	C21 20DB/OR	A/C REQUEST SIGNAL
2	C22 20DB/WT	A/C SWITCH SIGNAL



A/C PRESSURE TRANSDUCER (2.4L)

A/C PRESSURE TRANSDUCER (2.4L) - 4 WAY

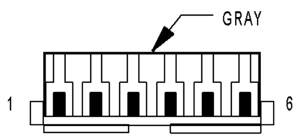
CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND 1
2	K6 20VT/WT	5 VOLT SUPPLY
3	C18 18DB	A/C PRESSURE SIGNAL
4	-	-



BATTERY TEMPERATURE SENSOR

BATTERY TEMPERATURE SENSOR - BLACK 2 WAY

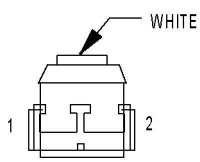
CAV	CIRCUIT	FUNCTION
1	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

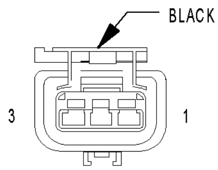
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	Z1 20BK/WT	GROUND
3	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
5	F32 18PK/DB	FUSED B(+)
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID

BRAKE TRANSMISSION SHIFT INTERLOCK SOLENOID - WHITE 2 WAY

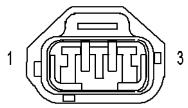
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)



CAMSHAFT POSITION SENSOR (2.4L)

CAMSHAFT POSITION SENSOR (2.4L) - BLACK 3 WAY

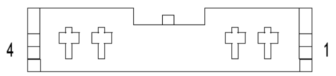
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND 1
3	K44 18TN/YL	CMP SIGNAL



CAMSHAFT POSITION SENSOR (4.0L)

CAMSHAFT POSITION SENSOR (4.0L) - 3 WAY

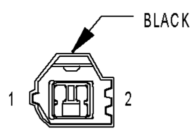
CAV	CIRCUIT	FUNCTION
1	K44 18TN/YL	CMP SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5V SUPPLY



CLOCKSPRING C1

CLOCKSPRING C1 - 4 WAY

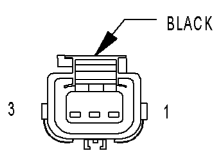
CAV	CIRCUIT	FUNCTION
1	X3 20RD/YL	HORN RELAY CONTROL
2	V37 20RD/LG (EXCEPT RHD HARDTOP SUB-WOOFER)	SPEED CONTROL SWITCH SIGNAL
2	V37 20RD/LB (RHD HARD-TOP SUBWOOFER)	SPEED CONTROL SWITCH SIGNAL
3	K4 20BK/LB	SENSOR GROUND 1
4	-	-



CLUTCH PEDAL POSITION SWITCH (M/T)

CLUTCH PEDAL POSITION SWITCH (M/T) - BLACK 2 WAY

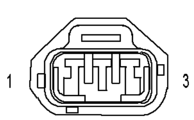
CAV	CIRCUIT	FUNCTION
1	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
2	A41 18YL	FUSED IGNITION SWITCH OUTPUT (START)



CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T)

CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T) - BLACK 3 WAY

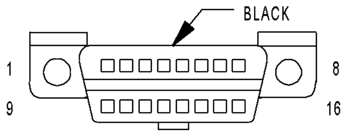
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK (2.4L)	CRANKSHAFT POSITION SENSOR SIGNAL
1	K7 20OR (4.0L)	5V SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
2	K4 18BK/LB (2.4L)	SENSOR GROUND 1
3	K7 18OR (2.4L)	5V SUPPLY
3	K24 18GY/BK (4.0L)	CRANKSHAFT POSITION SENSOR SIGNAL



CRANKSHAFT POSITION SENSOR (4.0L M/T)

CRANKSHAFT POSITION SENSOR (4.0L M/T) - 3 WAY

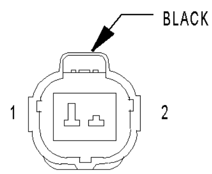
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5 VOLT SUPPLY



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

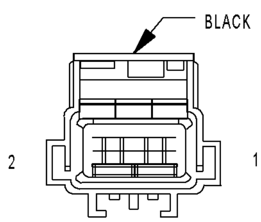
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D23 20WT/BR	FLASH PROGRAM ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



ENGINE COOLANT TEMPERATURE SENSOR

ENGINE COOLANT TEMPERATURE SENSOR - BLACK 2 WAY

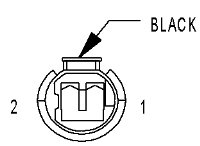
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (2.4L)	SENSOR GROUND 1
1	K4 20BK/LB (4.0L)	SENSOR GROUND 1
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



ENGINE OIL PRESSURE SWITCH

ENGINE OIL PRESSURE SWITCH - BLACK 2 WAY

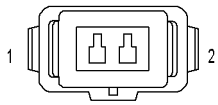
CAV	CIRCUIT	FUNCTION
1	G60 18GY/YL	OIL PRESSURE SIGNAL
2	-	-



EVAP/PURGE SOLENOID

EVAP/PURGE SOLENOID - BLACK 2 WAY

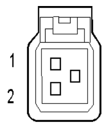
CAV	CIRCUIT	FUNCTION
1	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
2	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)



FUEL INJECTOR NO. 1
(2.4L)

FUEL INJECTOR NO. 1 (2.4L) - 2 WAY

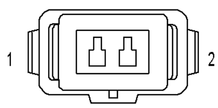
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER



FUEL INJECTOR NO. 1
(4.0L)

FUEL INJECTOR NO. 1 (4.0L) - 2 WAY

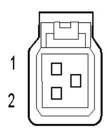
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER



FUEL INJECTOR NO. 2
(2.4L)

FUEL INJECTOR NO. 2 (2.4L) - 2 WAY

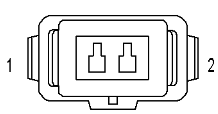
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	FUEL INJECTOR NO. 2 DRIVER



FUEL INJECTOR NO. 2
(4.0L)

FUEL INJECTOR NO. 2 (4.0L) - 2 WAY

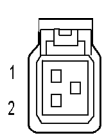
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	FUEL INJECTOR NO. 2 DRIVER



FUEL INJECTOR NO. 3
(2.4L)

FUEL INJECTOR NO. 3 (2.4L) - 2 WAY

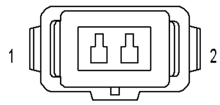
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER



FUEL INJECTOR NO. 3
(4.0L)

FUEL INJECTOR NO. 3 (4.0L) - 2 WAY

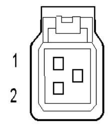
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER



FUEL INJECTOR NO. 4 (2.4L)

FUEL INJECTOR NO. 4 (2.4L) - 2 WAY

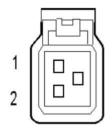
CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER



FUEL INJECTOR NO. 4 (4.0L)

FUEL INJECTOR NO. 4 (4.0L) - 2 WAY

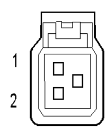
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER



FUEL INJECTOR NO. 5 (4.0L)

FUEL INJECTOR NO. 5 (4.0L) - 2 WAY

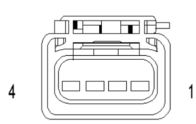
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K38 18GY	FUEL INJECTOR NO. 5 DRIVER



FUEL INJECTOR NO. 6 (4.0L)

FUEL INJECTOR NO. 6 (4.0L) - 2 WAY

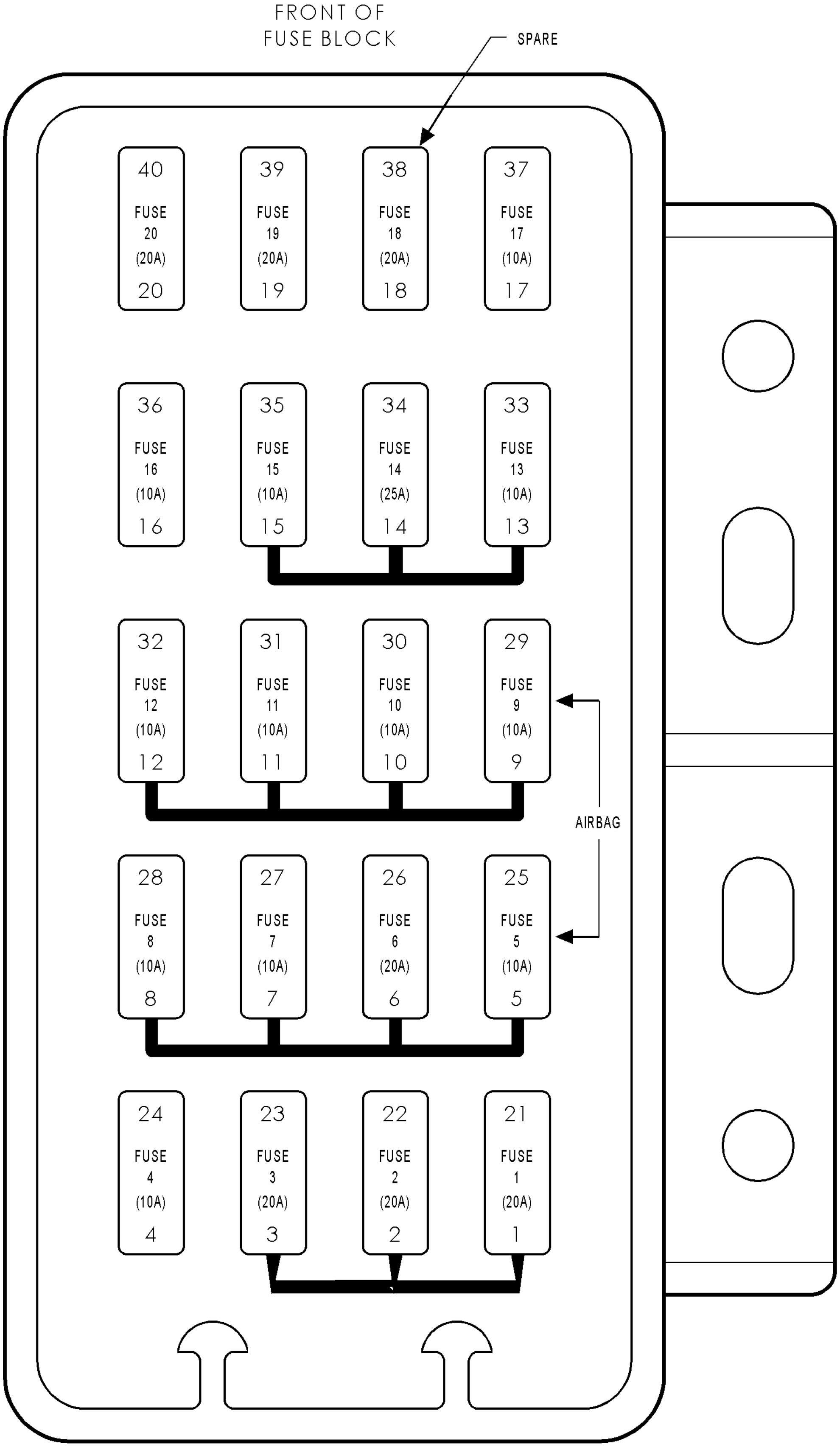
CAV	CIRCUIT	FUNCTION
1	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER



FUEL PUMP MODULE

FUEL PUMP MODULE - 4 WAY

CAV	CIRCUIT	FUNCTION
1	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
2	K226 20DB/LG	FUEL LEVEL SENSOR SIGNAL
3	K4 20BK/LB	SENSOR GROUND 1
4	Z1 18BK	GROUND


FRONT OF
FUSE BLOCK
SPARE
40
FUSE
20
(20A)
20
39
FUSE
19
(20A)
19
38
FUSE
18
(20A)
18
37
FUSE
17
(10A)
17
36
FUSE
16
(10A)
16
35
FUSE
15
(10A)
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34
FUSE
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33
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(10A)
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32
FUSE
12
(10A)
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31
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11
(10A)
11
30
FUSE
10
(10A)
10
29
FUSE
9
(10A)
9
AIRBAG
28
FUSE
8
(10A)
8
27
FUSE
7
(10A)
7
26
FUSE
6
(20A)
6
25
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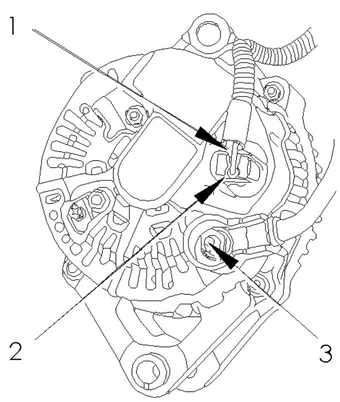
5
(10A)
5
24
FUSE
4
(10A)
4
23
FUSE
3
(20A)
3
22
FUSE
2
(20A)
2
21
FUSE
1
(20A)
1

FUSES (FUSE/RELAY BLOCK)

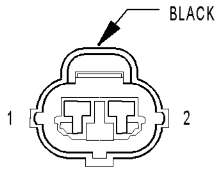
FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	20A	F33 18PK/RD	FUSED B(+)
1	20A	F33 20PK/RD	FUSED B(+)
2	20A	F32 18PK/DB	FUSED B(+)
3	20A	X13 16BK/RD (SUBWOOFER)	FUSED B(+)
4	10A	Z1 20BK	DOOR AJAR SWITCH OUTPUT
5	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
6	20A	V23 18BR/PK (HARD TOP)	FUSED IGNITION SWITCH OUTPUT (RUN)
7	10A	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
8	10A	F24 20RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
9	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
9	10A	F14 18LG/YL (PAD)	FUSED IGNITION SWITCH OUTPUT (RUN)
10	10A	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
10	10A	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
11	10A	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	10A	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	10A	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	10A	L5 20BK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
14	10A	X12 20PK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
15	10A	F81 20DB/RD (HARD TOP)	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	10A	L22 20LG/DG (EXPORT)	DIMMER SWITCH LOW BEAM OUTPUT
16	10A	L22 20LG/DG (EXPORT)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
17	25A	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
17	25A	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
18	20A	F38 16LB/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
19	20A	-	-
20	20A	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
20	20A	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)



GENERATOR

GENERATOR - 3 WAY

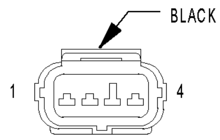
CAV	CIRCUIT	FUNCTION
1	-	FIELD WIRES
2	-	FIELD WIRE CONNECTOR
3	-	B(+) (OUTPUT TERMINAL)



GENERATOR

GENERATOR - BLACK 2 WAY

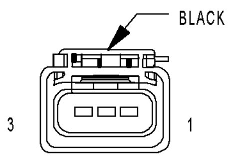
CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD



IDLE AIR CONTROL MOTOR

IDLE AIR CONTROL MOTOR - BLACK 4 WAY

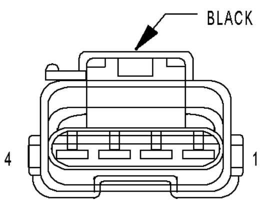
CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
4	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER



IGNITION COIL PACK (2.4L)

IGNITION COIL PACK (2.4L) - BLACK 3 WAY

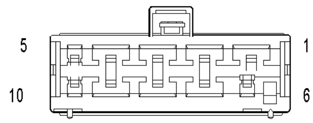
CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K19 18GY	IGNITION COIL NO. 1 DRIVER



IGNITION COIL PACK (4.0L)

IGNITION COIL PACK (4.0L) - BLACK 4 WAY

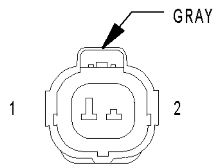
CAV	CIRCUIT	FUNCTION
1	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
4	K18 18RD/YL	IGNITION COIL NO. 3 DRIVER



IGNITION SWITCH

IGNITION SWITCH - 10 WAY

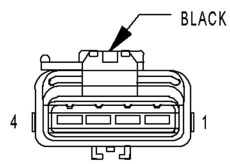
CAV	CIRCUIT	FUNCTION
1	A1 18RD	FUSED B(+)
2	A21 18DB	IGNITION SWITCH OUTPUT (RUN-START)
3	F22 12WT/PK	IGNITION SWITCH OUTPUT (RUN-ACC)
4	F30 12RD/PK	FUSED B(+)
5	G26 20LB	KEY-IN IGNITION SWITCH SENSE
6	A41 18YL	IGNITION SWITCH OUTPUT (START)
7	A31 18BK/DG	IGNITION SWITCH OUTPUT (RUN-ACC)
8	A22 14BK/OR	IGNITION SWITCH OUTPUT (RUN)
9	A2 14PK/BK	FUSED B(+)
10	Z1 16BK	GROUND



INTAKE AIR TEMPERATURE SENSOR

INTAKE AIR TEMPERATURE SENSOR - GRAY 2 WAY

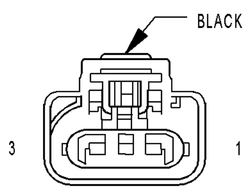
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB (2.4L)	SENSOR GROUND 1
1	K4 20BK/LB (4.0L)	SENSOR GROUND 1
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL



LEAK DETECTION PUMP

LEAK DETECTION PUMP - BLACK 4 WAY

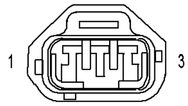
CAV	CIRCUIT	FUNCTION
1	-	-
2	K125 18WT/DB	GENERATOR SOURCE
3	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE



MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (2.4L) - BLACK 3 WAY

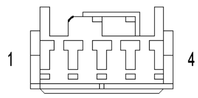
CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SIGNAL
2	K4 18BK/LB	SENSOR GROUND 1
3	K7 18OR	5 VOLT SUPPLY



MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L)

MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L) - 3 WAY

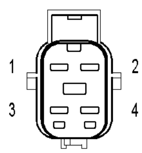
CAV	CIRCUIT	FUNCTION
1	K1 18DG/RD	MAP SIGNAL
2	K4 20BK/LB	SENSOR GROUND 1
3	K7 20OR	5V SUPPLY



OVERDRIVE OFF SWITCH

OVERDRIVE OFF SWITCH - 4 WAY

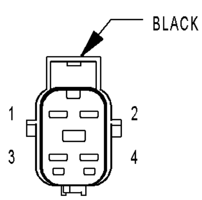
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
3	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
4	E2 20OR	PANEL LAMPS FEED



OXYGEN SENSOR 1/1 UPSTREAM

OXYGEN SENSOR 1/1 UPSTREAM - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
3	K4 20BK/LB	SENSOR GROUND 1
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



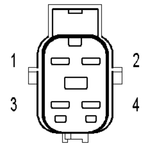
OXYGEN SENSOR 1/2 DOWNSTREAM

OXYGEN SENSOR 1/2 DOWNSTREAM - BLACK 4 WAY

0

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
1	A242 18VT/OR (EXPORT/ JAPAN LOW EMISSIONS VEHICLE)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	K299 18BR/WT (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 1/2 HEATER CONTROL
2	Z1 18BK (EXPORT/JAPAN LOW EMISSIONS VEHI- CLE)	GROUND
3	K4 20BK/LB	SENSOR GROUND 1
4	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL

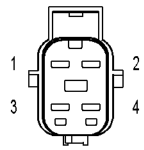
CONNECTOR PINOUTS



OXYGEN SENSOR
2/1 UPSTREAM
(EXCEPT EXPORT/
JAPAN LOW EMISSION VEHICLE)

OXYGEN SENSOR 2/1 UPSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE) - 4 WAY

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTO SHUT DOWN RELAY OUTPUT
2	K299 18BR/WT	O2 SENSOR 2/1 HEATER CONTROL
3	K4 20BK/LB	SENSOR GROUND 1
4	K241 18LG/RD	OXYGEN SENSOR 2/1 SIGNAL

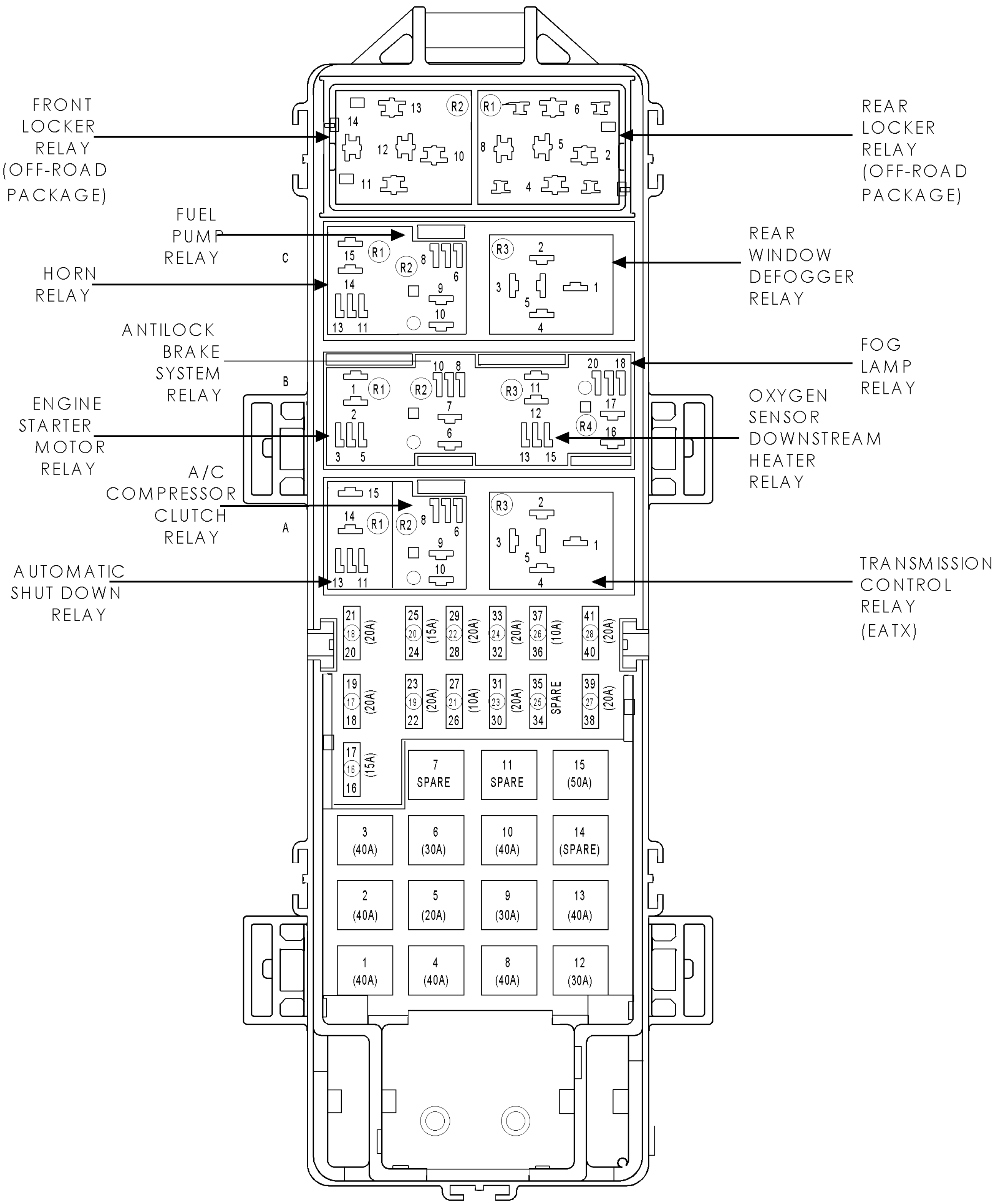


OXYGEN SENSOR
2/2 DOWNSTREAM
(EXCEPT EXPORT/
JAPAN LOW EMISSION VEHICLE)

OXYGEN SENSOR 2/2 DOWNSTREAM (EXCEPT EXPORT/JAPAN LOW EMISSION VEHICLE) - 4 WAY

CAV	CIRCUIT	FUNCTION
1	A242 18VT/OR	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 20BK/LB	SENSOR GROUND 1
4	K341 18TN/WT	OXYGEN SENSOR 2/2 SIGNAL

POWER DISTRIBUTION CENTER



C O N N E C T O R P I N O U T S

FUSES (PDC)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	A111 12RD/LB	FUSED B(+)
2	40A	A4 12BK/PK	FUSED B(+)
3	40A	A6 12RD/BK	FUSED B(+)
4	40A	A16 12GY (2.4L)	FUSED B(+)
5	20A	A30 16RD/WT (A/T)	FUSED B(+)
6	30A	A2 14PK/BK	FUSED B(+)
7	-	-	-
8	40A	A10 12RD/DG (ABS)	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
10	40A	A3 12RD/WT	FUSED B(+)
11	-	-	-
12	30A	A20 12RD/DB (ABS)	FUSED B(+)
13	40A	F30 12RD/PK	FUSED B(+)
14	-	-	-
15	50A	M1 16PK/WT	FUSED B(+)
15	50A	M1 20PK/WT (ABS)	FUSED B(+)
16	15A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	AUTOMATIC SHUT DOWN RELAY OUTPUT
17	20A	F70 16PK/BK	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
19	20A	F39 16PK/LG (FRONT FOG LAMPS)	FUSED B(+)
20	15A	F60 16RD/WT	FUSED B(+)
21	10A	A17 20RD/GY	FUSED B(+)
22	20A	A1 18RD	FUSED B(+)
23	20A	A61 18DG/BK	FUSED B(+)
24	20A	A88 18RD/DB (OFF-ROAD PACKAGE)	FUSED B(+)
25	-	-	-
26	10A	M1 20PK/WT	FUSED B(+)
27	20A	L9 18BK/WT	FUSED B(+)
28	20A	F42 18DG/LG	AUTOMATIC SHUT DOWN RELAY OUTPUT
28	20A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT

A/C COMPRESSOR CLUTCH RELAY (IN PDC)

CAV	CIRCUIT	FUNCTION
A6	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
A7	-	-
A8	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
A9	C3 20DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
A10	A17 20RD/GY	FUSED B(+)

AUTOMATIC SHUT DOWN RELAY (IN PDC)

CAV	CIRCUIT	FUNCTION
A11	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
A12	-	-
A13	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
A13	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
A14	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
A15	A14 14RD/WT	FUSED B(+)

ENGINE STARTER MOTOR RELAY (IN PDC)

CAV	CIRCUIT	FUNCTION
B1	A2 14PK/BK	FUSED B(+)
B2	T40 12BR (ABS)	ENGINE STARTER MOTOR RELAY OUTPUT
B2	T40 14BR (EXCEPT ABS)	ENGINE STARTER MOTOR RELAY OUTPUT
B3	T41 20BR/LB	PARK/NEUTRAL POSITION SWITCH SENSE
B4	-	-
B5	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)

FUEL PUMP RELAY (IN PDC)

CAV	CIRCUIT	FUNCTION
C6	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
C6	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
C7	-	-
C8	K31 18BR	FUEL PUMP RELAY CONTROL
C9	A141 18DG/WT	FUEL PUMP RELAY OUTPUT
C10	A61 18DG/BK	FUSED B(+)

HIGH SPEED RADIATOR FAN RELAY (2.4L)

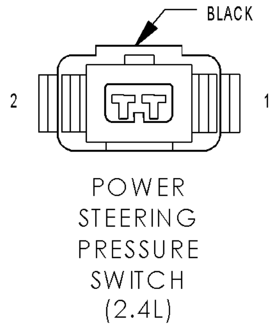
CAV	CIRCUIT	FUNCTION
D10	A16 12GY	FUSED B(+)
D11	C27 18DB	HIGH SPEED RADIATOR FAN RELAY CONTROL
D13	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
D14	C25 12YL	HIGH SPEED RADIATOR FAN RELAY OUTPUT

LOW SPEED RADIATOR FAN RELAY (2.4L)

CAV	CIRCUIT	FUNCTION
D2	A16 12GY	FUSED B(+)
D4	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
D4	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
D6	C24 18DB/PK	LOW SPEED RADIATOR FAN RELAY CONTROL
D8	C23 12DG	LOW SPEED RADIATOR FAN RELAY OUTPUT

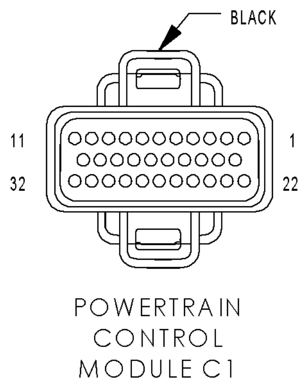
OXYGEN SENSOR DOWNSTREAM HEATER RELAY

CAV	CIRCUIT	FUNCTION
B11	F142 18OR/DG	FUSED ASD RELAY OUTPUT
B11	F142 18OR/DG	FUSED ASD RELAY OUTPUT
B12	A242 18VT/OR	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
B13	F142 18OR/DG	FUSED ASD RELAY OUTPUT
B13	F142 18OR/DG	FUSED ASD RELAY OUTPUT
B14	-	-
B15	K512 18RD/YL	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT



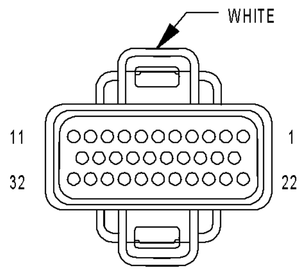
POWER STEERING PRESSURE SWITCH (2.4L) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
1	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE
2	Z1 20BK	GROUND



POWERTRAIN CONTROL MODULE C1 - BLACK 32 WAY

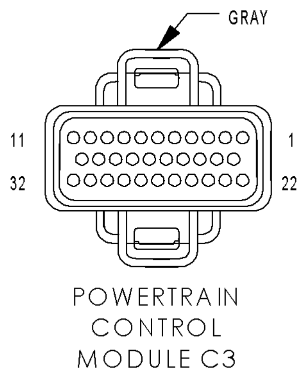
CAV	CIRCUIT	FUNCTION
1	K18 18RD/YL (4.0L)	IGNITION COIL NO. 3 DRIVER
2	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	-	-
4	K4 18BK/LB	SENSOR GROUND 1
5	-	-
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	-	-
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR (2.4L)	POWER STEERING PRESSURE SWITCH SENSE
13	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
14	-	-
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5V SUPPLY
18	K44 18TN/YL	CMP SIGNAL
19	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	-	-
22	A14 14RD/WT	FUSED B(+)
23	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2

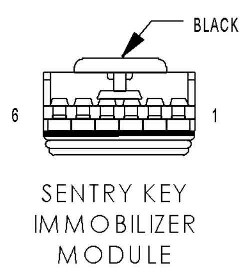
POWERTRAIN CONTROL MODULE C2 - WHITE 32 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY (4.0L)	FUEL INJECTOR NO. 5 DRIVER
7	-	-
8	-	-
9	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
10	K20 18DG	GENERATOR FIELD
11	-	-
12	K58 18BR/DB (4.0L)	FUEL INJECTOR NO. 6 DRIVER
13	-	-
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	-	-
18	-	-
19	C18 18DB (2.4L)	A/C PRESSURE SIGNAL
20	-	-
21	-	-
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SIGNAL
24	-	-
25	-	-
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	K6 18VT/WT	5V SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3 - GRAY 32 WAY

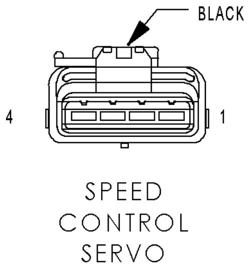
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR (A/C)	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	C24 18DB/PK (2.4L)	LOW SPEED RADIATOR FAN RELAY CONTROL
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD (SPEED CONTROL)	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD (SPEED CONTROL)	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.0L)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
10	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18YL/RD (SPEED CONTROL)	SPEED CONTROL ON/OFF SWITCH SENSE
12	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (A/T)	TORQUE MANAGEMENT REQUEST SENSE
14	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE
15	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR HEATER CONTROL
17	-	-
18	-	-
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
21	C27 18DB (2.4L)	HIGH SPEED RADIATOR FAN RELAY CONTROL
22	C21 18DB/OR (A/C)	A/C SWITCH SENSE
23	C90 18LG (A/C)	A/C SELECT INPUT
24	K29 18WT/PK	BRAKE LAMP SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18DB/LG (4.0L)	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/WT	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LB (SPEED CONTROL)	SPEED CONTROL SWITCH SIGNAL



SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

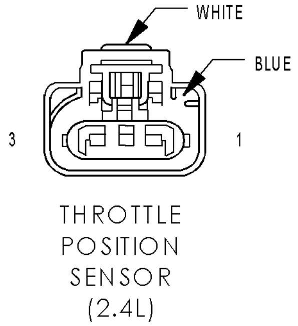
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	Z1 20BK	GROUND
6	F33 20PK/RD	FUSED B(+)

CONNECTOR PINOUTS



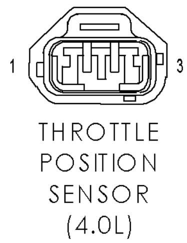
SPEED CONTROL SERVO - BLACK 4 WAY

CAV	CIRCUIT	FUNCTION
1	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
4	Z1 18BK	GROUND



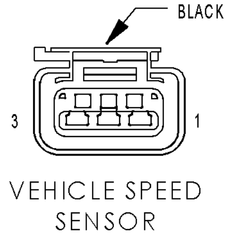
THROTTLE POSITION SENSOR (2.4L) - WHITE/BLUE 3 WAY

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO.1 SIGNAL



THROTTLE POSITION SENSOR (4.0L) - 3 WAY

CAV	CIRCUIT	FUNCTION
1	K7 20OR	5-VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO.1 SIGNAL

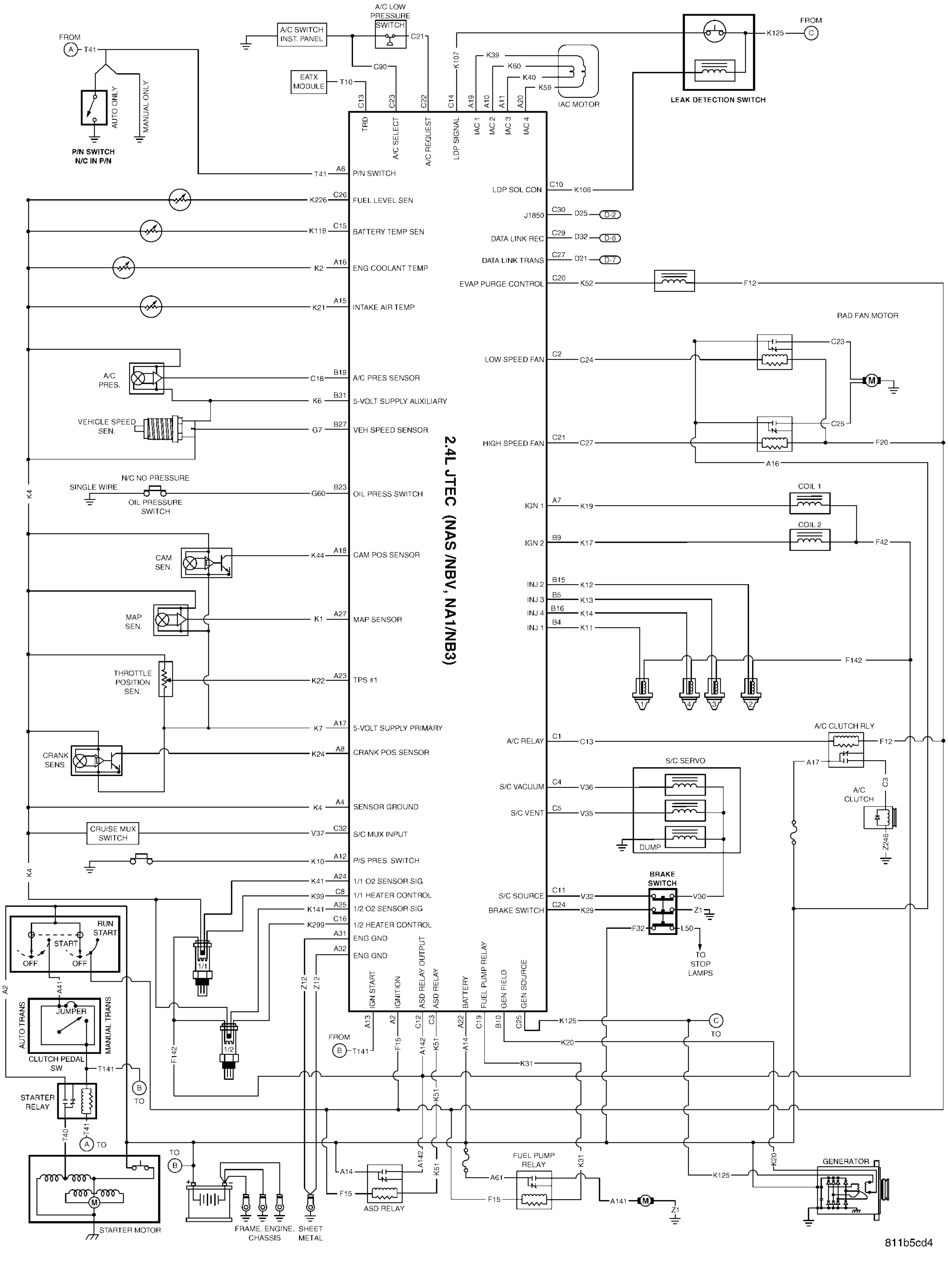


VEHICLE SPEED SENSOR - BLACK 3 WAY

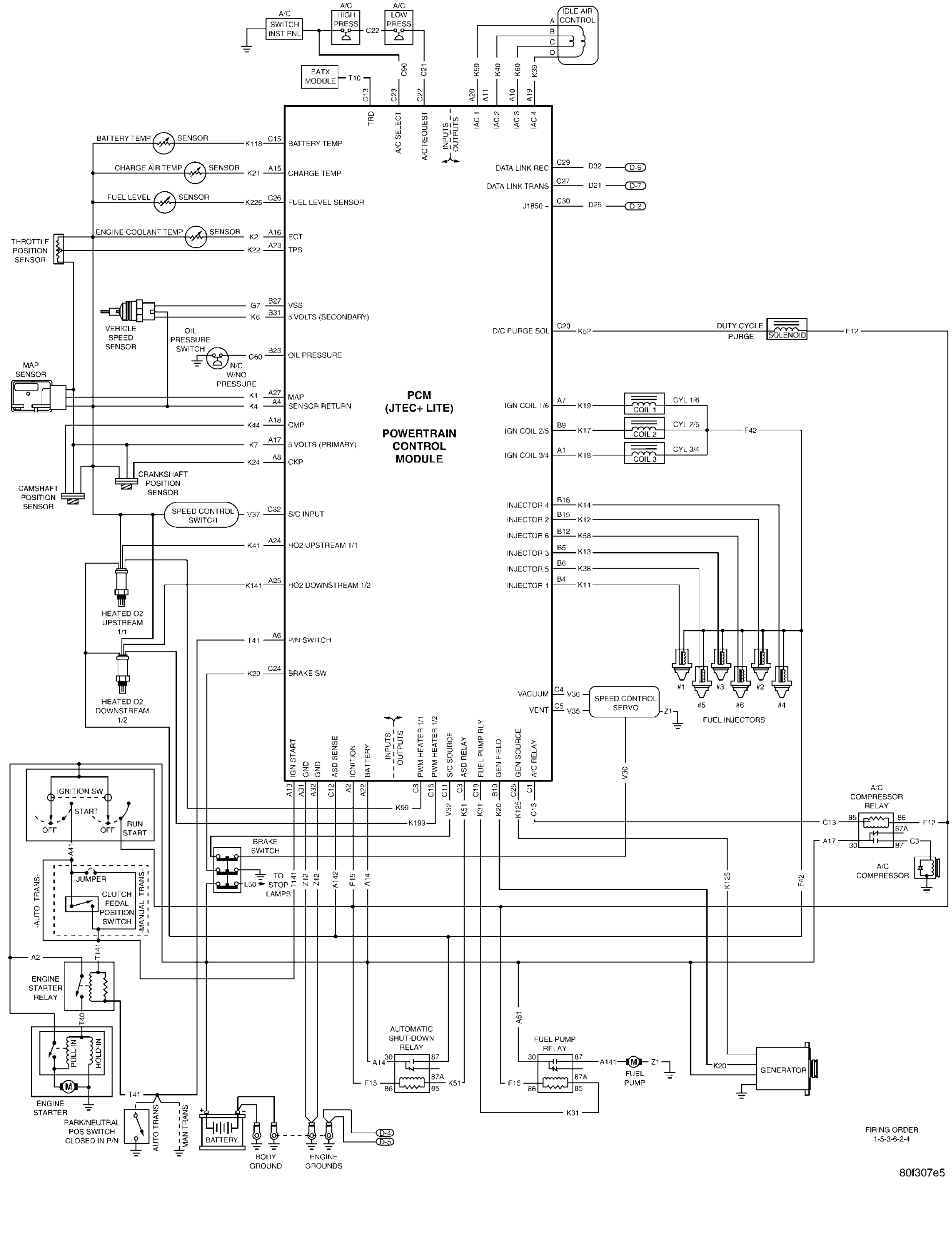
CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	5V SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL

NOTES

10.0 SCHEMATIC DIAGRAMS

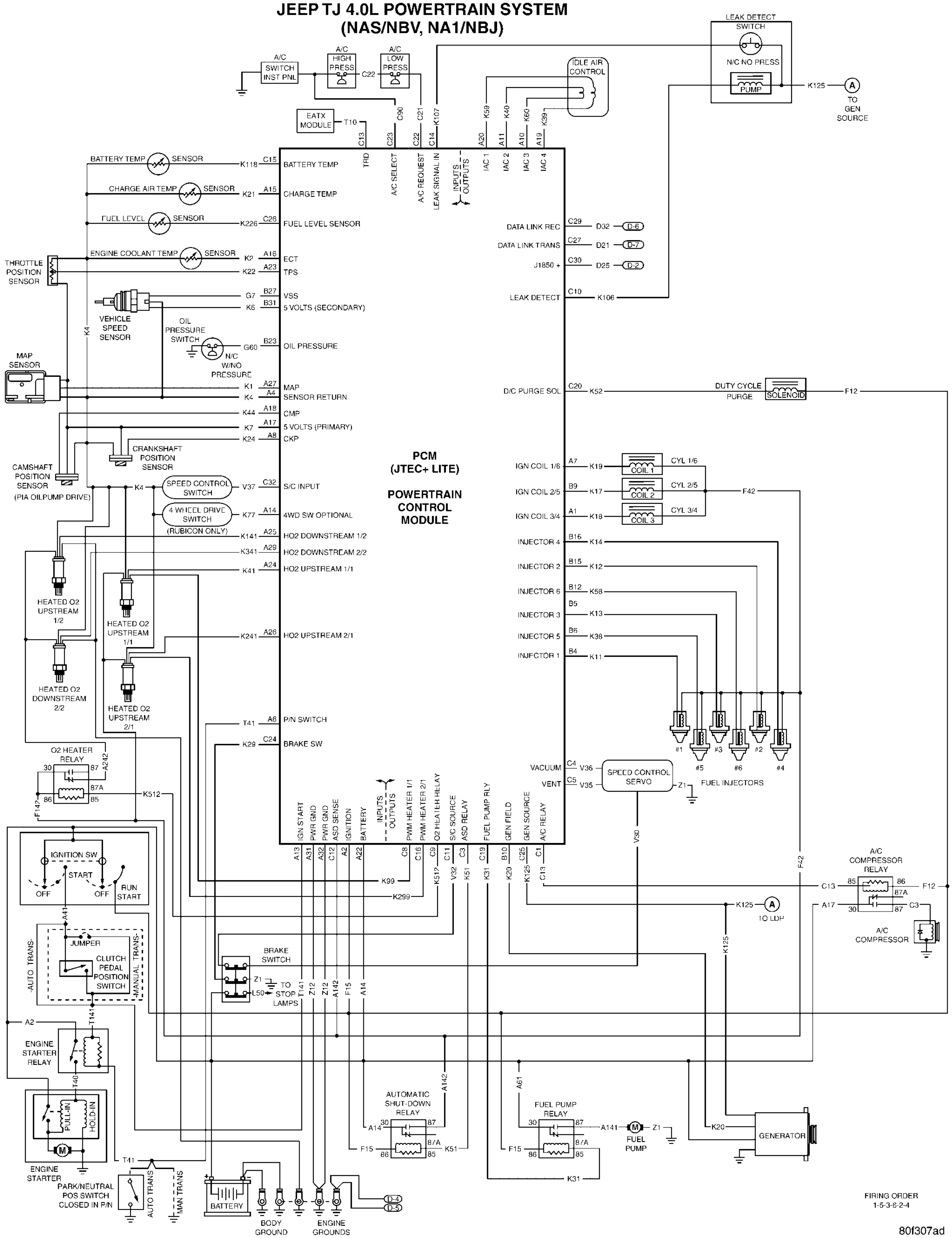


JEEP TJ 4.0L POWERTRAIN SYSTEM (NA1/NB3)



SCHEMATIC DIAGRAMS

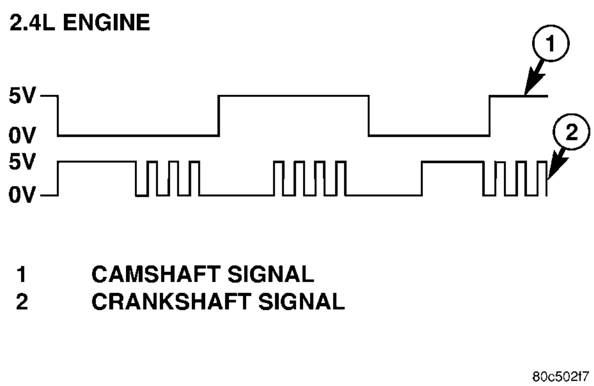
JEEP TJ 4.0L POWERTRAIN SYSTEM (NAS/NBV, NA1/NBJ)



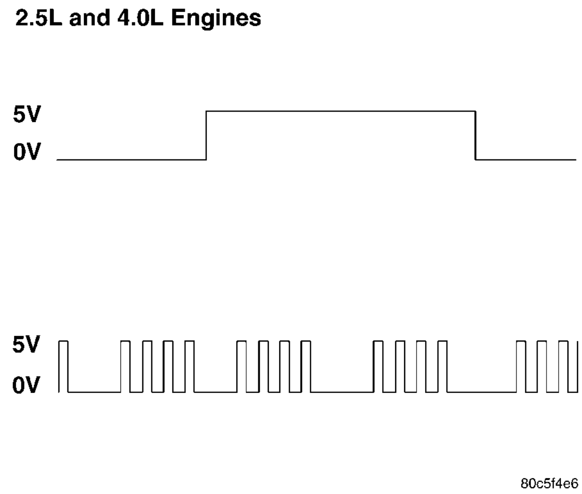
NOTES

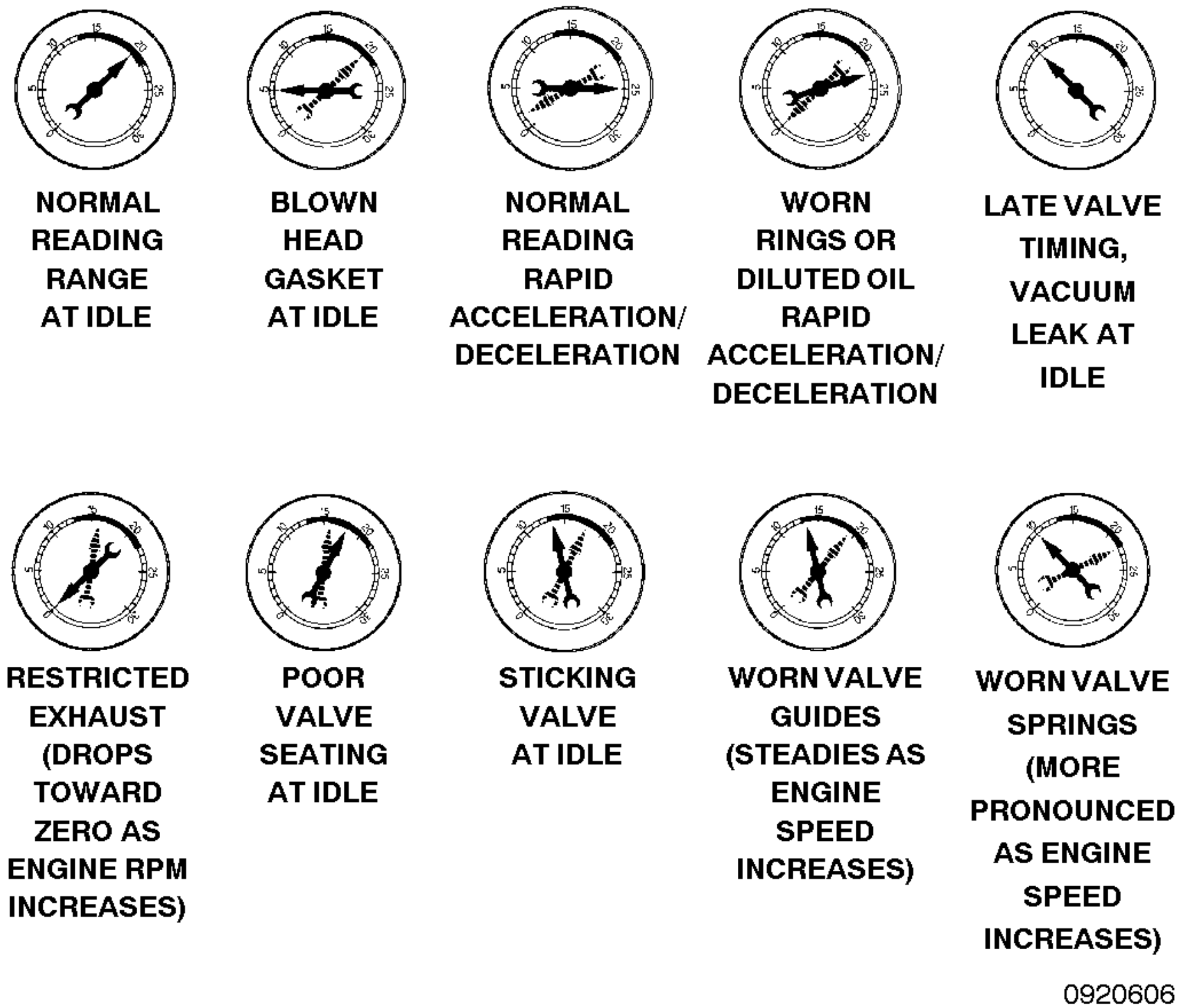
11.0 CHARTS AND GRAPHS

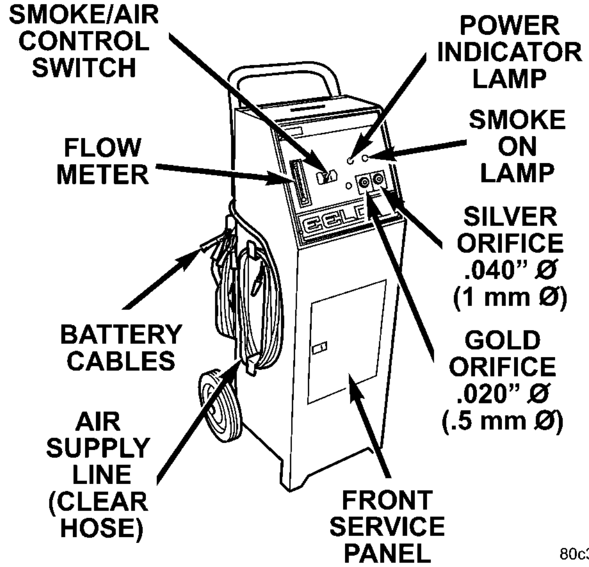
2.4L



4.0L







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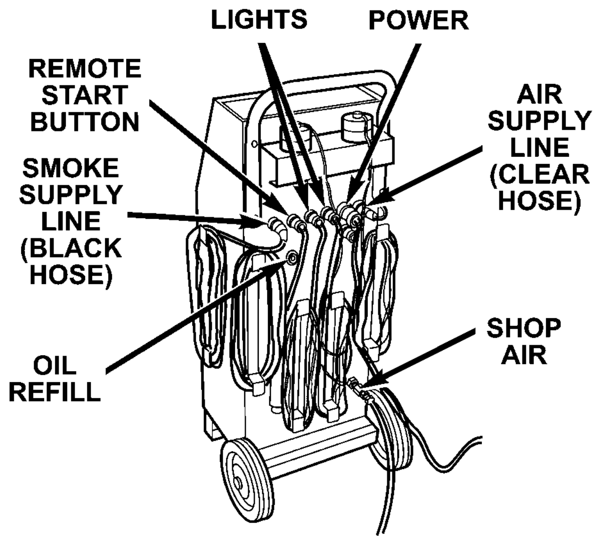

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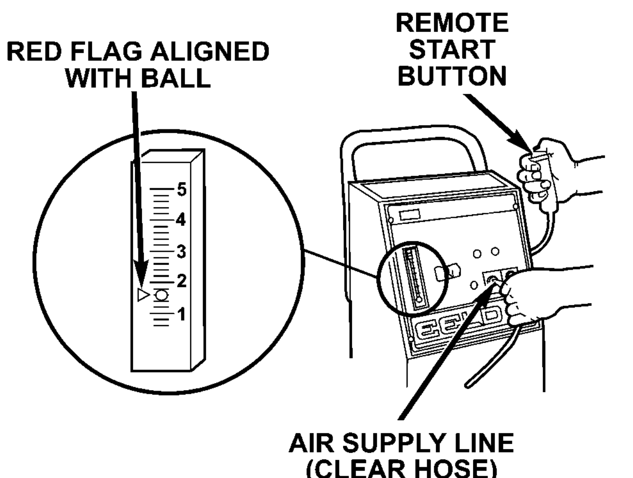
EELD CALIBRATION



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CHARTS AND GRAPHS

O2 SENSOR CONFIGURATION

AB 3.9L	1/1	UPSTREAM
AB 3.9L	1/2	DOWNSTREAM
AB 5.2L	1/1	LEFT BANK UPSTREAM
AB 5.2L	1/2	LEFT BANK DOWNSTREAM
AB 5.2L	2/1	RIGHT BANK UPSTREAM
AB 5.2L	2/2	RIGHT BANK DOWNSTREAM
AB 5.9L	1/1	UPSTREAM
AB 5.9L	1/2	DOWNSTREAM
AN 2.5L	1/1	UPSTREAM
AN 2.5L	1/2	DOWNSTREAM
AN 3.9L	1/1	UPSTREAM
AN 3.9L	1/2	DOWNSTREAM
AN 4.7L	1/1	LEFT BANK UPSTREAM
AN 4.7L	1/2	LEFT BANK DOWNSTREAM
AN 4.7L	2/1	RIGHT BANK UPSTREAM
AN 4.7L	2/2	RIGHT BANK DOWNSTREAM
AN 5.9L 2WD	1/1	LEFT BANK UPSTREAM
AN 5.9L 2WD	1/2	PRE CATALYST
AN 5.9L 2WD	1/3	POST CATALYST
AN 5.9L 2WD	2/1	RIGHT BANK UPSTREAM
AN 5.9L 4WD	1/1	UPSTREAM
AN 5.9L 4WD	1/2	DOWNSTREAM
DN 3.9L	1/1	UPSTREAM
DN 3.9L	1/2	DOWNSTREAM
DN 4.7L	1/1	LEFT BANK UPSTREAM
DN 4.7L	1/2	LEFT BANK DOWNSTREAM
DN 4.7L	2/1	RIGHT BANK UPSTREAM
DN 4.7L	2/2	RIGHT BANK DOWNSTREAM
DN 5.9L	1/1	UPSTREAM
DN 5.9L	1/2	DOWNSTREAM
DR 3.7L	1/1	UPSTREAM
DR 3.7L	1/2	DOWNSTREAM
DR 4.7L	1/1	LEFT BANK UPSTREAM
DR 4.7L	1/2	LEFT BANK DOWNSTREAM
DR 4.7L	2/1	RIGHT BANK UPSTREAM
DR 4.7L	2/2	RIGHT BANK DOWNSTREAM
DR 5.7L	1/1	LEFT BANK UPSTREAM
DR 5.7L	1/2	LEFT BANK DOWNSTREAM
DR 5.7L	2/1	RIGHT BANK UPSTREAM
DR 5.7L	2/2	RIGHT BANK DOWNSTREAM
DR 5.9L	1/1	UPSTREAM
DR 5.9L	1/2	DOWNSTREAM
DR 8.0L	1/1	LEFT BANK UPSTREAM
DR 8.0L	1/2	PRE CATALYST
DR 8.0L	1/3	POST CATALYST
DR 8.0L	2/1	RIGHT BANK UPSTREAM
KJ 2.4L	1/1	UPSTREAM
KJ 2.4L	1/2	DOWNSTREAM
KJ 3.7L	1/1	LEFT BANK UPSTREAM
KJ 3.7L	1/2	LEFT BANK DOWNSTREAM
KJ 3.7L	2/1	RIGHT BANK UPSTREAM
KJ 3.7L	2/2	RIGHT BANK DOWNSTREAM
TJ 2.4L	1/1	UPSTREAM
TJ 2.4L	1/2	DOWNSTREAM
TJ 4.0L	1/1	FRONT UPSTREAM
TJ 4.0L	1/2	FRONT DOWNSTREAM
TJ 4.0L	2/1	REAR UPSTREAM
TJ 4.0L	2/2	REAR DOWNSTREAM
WJ 4.0L	1/1	FRONT UPSTREAM
WJ 4.0L	1/2	FRONT DOWNSTREAM
WJ 4.0L	2/1	REAR UPSTREAM
WJ 4.0L	2/2	REAR DOWNSTREAM
WJ 4.7L	1/1	LEFT BANK UPSTREAM
WJ 4.7L	1/2	LEFT BANK DOWNSTREAM
WJ 4.7L	2/1	RIGHT BANK UPSTREAM
WJ 4.7L	2/2	RIGHT BANK DOWNSTREAM
WJ 5.9L	1/1	UPSTREAM
WJ 5.9L	1/2	DOWNSTREAM
ZB 8.3L	1/1	LEFT BANK UPSTREAM
ZB 8.3L	1/2	LEFT BANK DOWNSTREAM
ZB 8.3L	2/1	RIGHT BANK UPSTREAM
ZB 8.3L	2/2	RIGHT BANK DOWNSTREAM

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NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all the specifications, instructions, and graphics needed to diagnose body system problems. The diagnostics in this manual are based on the failure condition or symptom being present at time of diagnosis.

Please follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the appropriate modules: i.e., if the DRBIII® displays a ″No Response″ condition, you must diagnose that first.
2. Read DTC's (diagnostic trouble codes) with the DRBIII®.
3. If no DTC's are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All schematics are in Section 10.0.

An asterisk (*) placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added: carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DIAGNOSTIC TROUBLE CODE. It is recommended that you review the entire manual to become familiar with all the new and changed diagnostic procedures.

This book reflects many suggested changes from readers of past issues. After using this book, if you have any comments or suggestion, please fill out the form in the back of the book, and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all 2004 Jeep® Wrangler (TJ) vehicles.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the body system is performed in six basic steps:

1. verification of complaint
2. verification of any related symptoms
3. symptom analysis
4. problem isolation
5. repair of isolated problem
6. verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

The vehicle systems that are part of the ″body″ system are:

- airbag system
- audio
- chime
- electrically heated systems
- instrument cluster
- vehicle communications

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

The body system on the 2004 Jeep® Wrangler (TJ) consists of a combination of modules that communicate over the PCI bus (Programmable Communication Interface multiplex system). Through the PCI bus, information about the operation of vehicle components and circuits is relayed quickly to the appropriate module(s). All modules receive all the information transmitted on the bus even though a module may not require all information to perform its function. It will only respond to messages ″addressed″ to it through a binary coding process. This method of data transmission significantly reduces the complexity of the wiring in the vehicle and the size of wiring harnesses. All of the information about the functioning of all the systems is organized, controlled, and communicated by the PCI bus, which is described in the Vehicle Communication Section of the general information.

3.1 AIRBAG SYSTEM

The Airbag system is designed to provide increased driver and passenger protection if the vehicle is involved in a front-end collision. The airbag system is designed to be used in conjunction with the seat belt system.

Whenever the ignition switch is turned to the Run or Start position, the ACM performs a warning indicator bulb-check via a PCI bus request to the instrument cluster to illuminate the Airbag Warning Indicator. The indicator remains illuminated for 6 to 8 seconds, and then turns off. If the indicator remains off, the ACM has checked the system and found it to be free of discernable malfunctions.

The ACM monitors critical input and output circuits within the airbag system, ensuring the circuits are operating properly. Some circuits are tested continuously; other circuits are tested only under certain circumstances. The ACM provides diagnostic information about the airbag system to the technician through the DRBIII® via the PCI bus.

The deceleration of g-forces resulting from the impact of a front-end collision causes the electronic sensor inside of the ACM to be triggered. This causes the inflators to be actuated, thus deploying the airbag(s). The total time between determining to deploy and deflation of the air bag is 1/10th of one second (100ms).

The 2004 Jeep Wrangler (TJ) may be equipped with a Passenger Airbag (PAB) On - Off Switch. This switch has an ACM-controlled light that will illuminate when the switch is in the Off position.

Use the test procedures in this manual to diagnose the cause of any customer complaint regarding the Airbag Warning Indicator (located in the instrument cluster), such as:

- Airbag warning indicator does not illuminate at any time
- Airbag warning indicator is illuminated at all times

3.1.1 PASSENGER AIRBAG ON-OFF SWITCH

Vehicles without rear seats will be equipped with a Passenger Airbag (PAB) On - Off Switch. The PAB On - Off Switch allows the vehicle operator to turn the passenger airbag function On or Off.

The Off indicator in the PAB On - Off Switch will be illuminated for 2 seconds whenever the ignition is transitioned to the Run position as a bulb check. The Off indicator will remain illuminated when the PAB On - Off Switch is turned to the Off position.

The PAB On - Off Switch assembly is mounted in the center of the instrument panel below the radio, this allows the Off indicator to be visible to both front seat occupants.

WARNING: TO AVOID PERSONAL INJURY OR DEATH, ALWAYS CHECK THE PASSENGER AIRBAG ON - OFF SWITCH POSITION BEFORE DRIVING THE VEHICLE. A SWITCH IN THE WRONG POSITION INCREASES THE RISK OF SERIOUS INJURY OR DEATH IN A COLLISION.

To operate the Passenger Airbag On - Off Switch, insert the ignition key into the PAB On - Off Switch keyway, push the key in to release the internal plunger, and rotate switch to the desired position. The spring-loaded locking plunger prevents the user from leaving the key in the switch. The key will be automatically ejected from the switch when inward force is not applied. The ignition key is the only key or object that should ever be inserted into the PAB On - Off Switch.

NOTE: Do not turn the Passenger Airbag On - Off Switch while the ignition is in the Run position.

The ACM continuously monitors the resistance of the Passenger Airbag On - Off Switch circuits to identify the switch position and to provide switch circuit diagnostics.

- ON Position: Passenger Airbag On - Off Switch resistance = 175 to 190 ohms
- OFF Position: Passenger Airbag On - Off Switch resistance = 820 to 870 ohms

If the ACM detects that the PAB On - Off Switch circuits are open, shorted to ground, or shorted to battery voltage, it will set Active and Stored DTC's. When a DTC is detected by the ACM, it will transmit a PCI bus message to the Instrument Cluster to illuminate the Airbag warning indicator. Whenever the Airbag warning indicator is illuminated, the ACM should be the first module to be interrogated.

If after replacing the ACM, any of the following codes are active, the ACM must be re-configured to match the vehicle equipment:

- MODULE NOT CONFIGURED FOR PAB OFF SWITCH
- PASSENGER AIRBAG ON - OFF SWTCH CIRCUIT OPEN
- PASSENGER AIRBAG ON - OFF SWTCH INDICATOR CIRCUIT OPEN

To properly configure the ACM, using the DRBIII®, select Miscellaneous from the Airbag system menu and follow instructions.

WARNING: IGNORING THE AIRBAG WARNING INDICATOR IN THE INSTRUMENT CLUSTER COULD MEAN THE PASSENGER AIRBAG ON - OFF SWITCH IS NOT FUNCTIONAL AND THE PASSENGER AIRBAG MAY DEPLOY IF AN IMPACT OCCURS. IF THE AIRBAG WARNING INDICATOR ILLUMINATES, WHILE DRIVING, THE AIRBAG ON - OFF SWITCH WILL REMAIN FUNCTIONAL FOR THAT KEY CYCLE. IF THE AIRBAG WARNING INDICATOR ILLUMINATES AGAIN AT THE NEXT IGNITION ON AND STAYS ILLUMINATED FOR MORE THAN 6 - 8 SECONDS, THE ACM WILL DEFAULT TO PASSENGER AIRBAG ON. IF THE AIRBAG WARNING INDICATOR BULB TEST OR IF THE OFF INDICATOR DOES NOT ILLUMINATE WITH THE SWITCH IN THE OFF POSITION THE PASSENGER AIRBAG MAY DEPLOY IF AN IMPACT OCCURS. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.

3.1.2 SPECIAL TOOLS

Some airbag diagnostic tests use special tools, the 8310 and 8443 airbag load tools for testing squib circuits. The load tools contain fixed resistive loads, jumpers, and adapters. The fixed loads are connected to cables and are mounted in a storage case.

The cables can be directly connected to some airbag system connectors. Jumpers are used to convert the load tool cable connectors to other airbag system connectors. The adapters are connected to the module harness connector to open shorting clips and to protect the connector terminal during testing.

When using the load tool, follow all of the safety procedures in the service information for disconnecting airbag system components. Inspect the wiring, connector, and terminals for damage or misalignment.

Substitute the airbag load tool in place of a Driver or Passenger airbag, curtain airbag, clockspring, or seat belt tensioner, (use a jumper if needed). Then follow all of the safety procedures in the service information for connecting airbag system components.

Read the module active DTC's. If the module reports NO ACTIVE DTC'S, the defective component has been removed from the system and should be replaced. If the DTC is still active, continue this process until all of the components in the circuit have been tested.

Then disconnect the module connector and connect the matching adapter to the module connector. With all airbags disconnected and adapter installed, the squib circuits can be tested for open and shorted conditions.

3.1.3 DIAGNOSTIC TROUBLE CODES

Airbag diagnostic trouble codes (DTC) consist of active and stored codes. If more than one DTC exists, diagnostic priority should be given to the active code(s). Each DTC is diagnosed by following a specific testing procedure. The diagnostic test procedures contain step-by-step instructions for determining the cause of the DTC. It is not necessary to perform all of the tests in this manual to diagnose an individual DTC.

Always begin by reading the DTC's using the DRBIII®. If more than one code exists, diagnostic priority should be given to active code(s).

Active DTC's for the airbag system are not permanent and will change the moment the cause of the code is corrected. In certain test procedures within this manual, DTC's are used as a diagnostic tool.

3.1.3.1 ACTIVE CODES

An active trouble code indicates an on-going malfunction. This indicates that the defect is currently active every time the ACM checks the particular circuit or function. It is impossible to erase an active code; active codes automatically erase themselves when the cause for the code has been corrected.

With the exception of the warning indicator trouble codes or malfunctions, when a malfunction has been detected by the ACM, the Airbag warning indicator is illuminated for a minimum of 12 seconds, or as long as the malfunction is present.

3.1.3.2 STORED CODES

Airbag codes are automatically stored in the ACM memory as soon as the malfunction is detected, with the exception of the Loss Of Ignition Run-Only code, which is an active code only. A stored code indicates that there was an active code present at some time. However, the code currently may not be present as an active code, although another active code may be.

When a trouble code occurs, the Airbag warning indicator illuminates for 12 seconds minimum, (even if the condition existed for less than 12 seconds). Stored codes display the time in minutes that the code was active, and the number of times that the ignition has been cycled since the active code was last detected.

The minimum time shown for any code will be one minute, even if the code was actually present for less than one minute. Thus, the time shown for a code that was present for two minutes 13 seconds, for example, would be three minutes.

If a malfunction is not active while performing a diagnostic test, the active code diagnostic test will not locate the source or the condition. In this case, the stored code can indicate an area to inspect. The following procedure may uncover a malfunction that is difficult to locate:

WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING INSPECTION:

If no obvious problems are found:

- Erase the stored codes
- Place the ignition in the Run position
- Wiggle the wire harness and connectors
- Rotate the steering wheel from stop to stop
- Recheck for active codes periodically as you work through the system.

3.2 AUDIO SYSTEM

Some radio systems available on the 2004 TJ communicate on the PCI Bus. They use the bus for three reasons. The first is to communicate trouble codes, second is to receive dimming information, and the third is to receive cabin equalization information. The audio system is available in a 4 speaker base system and a 7 speaker system with an external subwoofer.

When troubleshooting output shorts or "output" error messages, the following applies:

On radios without an external amplifier, the term output refers to the path between the radio and the speaker. This type of circuit can be monitored all the way through the speaker connections by the radio assembly. When the radio displays a shorted output DTC with this type of system, the speaker, radio, or wiring could be at fault.

On radios with an external amplifier, the term "output" refers to the circuit between the radio connector and the amplifier. The radio is capable of monitoring only this portion and can tell nothing about the circuit between the amplifier and the speakers. Consequently, a shorted output DTC on this type of system would only refer to this circuit. A faulty speaker could not cause this DTC.

3.3 ELECTROCHROMIC COMPASS/TEMPERATURE MIRROR WITH LIGHTS

DESCRIPTION

The optional self-dimming Electrochromic Compass/Temperature Mirror has a vacuum fluorescent (VF) display that is integrated into the rear view mirror. The Compass/Temp Mirror includes the compass/temperature display and two map/reading lamps. This display provides the outside temperature and one of eight compass headings to indicate the direction the vehicle is facing. The Compass/Temp Mirror displays the compass heading and the outside temperature at the same time. The Ambient Temperature Sensor monitors the outside temperature and is hardwired to the Compass/Temp Mirror.

BUTTON OPERATION

The Compass/Temp Mirror incorporates 3 (mode/lamp) buttons to access and control various functions.

Left Button

- Press and Release
  > Toggles Left Map Light On/Off
- Press w/ Right Switch for more than 5 seconds and Release
  > Toggles Electrochromic Status On/Off -automatic On with each ignition cycle
  > On mode is indicated by green status LED next to right button

Center Button

- Press for more than 3 seconds and Release
  > Cycle through display status
  – Compass / Temperature (Fahrenheit) - °F mode stored to memory
  – Compass / Temperature (Celsius) - °C mode stored to memory
  – Display Off - off mode stored to memory
- Press and Hold for 3-6 seconds
  > Activate zone variance mode (adjust compass for true north)
  – ″Z″ and the currently programmed zone (1-15) will flash in display window
  – Each press of the center button will increment to the next zone
  – When proper zone is selected, wait 5 seconds and mirror display returns to comp/temp (see variance zone map for proper zone number setting)
- Press and Hold for more than 6 seconds
  > Activate compass calibration
  – ″CAL″ shows in display window until compass is calibrated (verify correct variance zone prior to initial or re-calibration)
  – Drive vehicle in a slow circle for 1.5 revolutions to recalibrate compass

Right Button

- Press and Release
  > Toggles Right Map Light On/Off

ELECTROCHROMIC (EC) OPERATION (auto dimming feature)

The automatic dimming feature detects forward and rear light conditions and adjusts the reflectance level of the mirror to eliminate unwanted glare by the use 2 photoelectric sensors. The feature can be disabled by depressing the Left and Right buttons together for more than 5 seconds. The disable command will only remain in effect until the ignition is turned off. The EC function will automatically return to ON with each ignition cycle.

When the forward sensor detects daytime conditions, the rear sensor is inactive and the mirror remains in a high reflectance state.

When nighttime conditions are sensed by the forward sensor, the rear facing sensor is active and detects glare from rearward approaching vehicles or other glare producing light sources. The mirror will automatically adjust to a low reflectance state to remove the unwanted glare from the inside rear view mirror. The mirror will automatically return to a high reflectance state whenever the vehicle is placed in REVERSE to ensure a clear view when backing up.

NOTE: Do not allow the forward or rear sensors to be obstructed since this may impair proper performance.

ELECTROCHROMIC (EC) DIAGNOSTICS

Ensure that both the forward and rear sensors are not obstructed by hang items, tape, stickers, window decals, etc.

1. With the ignition in the ON position:
   Use a flashlight or other light source, to illuminate the forward facing sensor. The mirror should remain/adjust to a high reflectance state. This simulates daytime conditions.
   Cover the forward facing sensor with a finger or dark material. Using a flashlight or other light source, illuminate the rear-facing sensor. The mirror should dim to a low reflectance state. This simulates nighttime glare conditions.
   Cover the forward and rear facing sensors with fingers or dark material. The mirror should remain/adjust to a high reflectance state. This simulates nighttime non-glare conditions.
2. With the ignition in the ON position, the BRAKE applied and the vehicle in REVERSE:
   Cover the forward facing sensor with a finger or dark material. Using a flashlight or other light source, illuminate the rear-facing sensor. The mirror should remain in a high reflectance state. This simulates nighttime driving conditions, providing a clear view while backing up.
   If the EC Comp/Temp Mirror does not respond as indicated, replace the EC Comp/Temp Mirror in accordance with the Service Information.

COMPASS OPERATION

The compass is capable of distinguishing 8 primary directions: N, NE, E, SE, S, SW, W, NW. This electronic compass is designed to display readings relative to True North. All compasses measure readings relative to Magnetic North. The difference between Magnetic North and True North varies from place to place across the surface of the earth. Therefore, the compass must be told approximately where it is on the earth's surface so that the Magnetic North reading can be properly converted into a True North Display. This is done by separating different parts of the earth into numbered ″Zone Variances″ (see zone variance map). The Zone Variance in which the compass is to function must be entered into the compass.

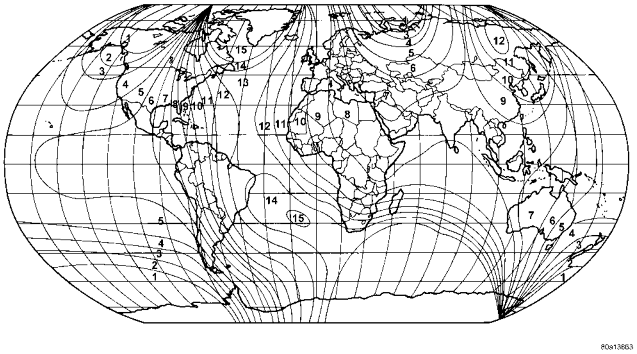
FIRST TIME / MANUAL CALIBRATION

Set or confirm the Zone Variance, refer to COMPASS ZONE VARIANCE. During first time or manual calibration, the compass may already be calibrated (CAL is not displayed). It is recommended that the CAL mode be invoked under all situations. With the ignition in the ON position, pressing and holding the CENTER button for more than 6 seconds will toggle the display to CAL. Releasing the button after the 6 second duration will enter the compass into the calibration mode. CAL will remain illuminated until the calibration is complete. Move the vehicle to an area away from large metallic objects or overhead power lines. While CAL is illuminated in the display the vehicle must be driven in at least 1 complete 360° circle at less than 5 MPH (8 KPH). Up to 3 complete 360° circles may be required. The compass will calibrate; CAL will turn off, and the compass will resume normal operation.

COMPASS ZONE VARIANCE (adjust compass for true north)

The compass has a default zone of 8. Refer to the Zone Variance Map to determine the correct zone number. The correct compass Zone selection is critical to proper compass operation. With the ignition in the ON position, pressing the CENTER button for 3-6 seconds and then releasing while ″Z″ is illuminated enters the compass into the Zone display mode. In the Zone display mode, ″Z″ will be illuminated instead of the temperature. The current Zone number, 1 through 15 will be displayed. While ″Z″ is illuminated; momentarily pressing the CENTER button advances the zone to the next higher zone. When the desired zone number is displayed, do not press the button again. After 5 seconds, the Zone Variance number will be stored in the module memory.

On long trips, a vehicle may leave its original zone and enter one or more new zones. Generally, if no more that 3 or 4 zones are temporarily traversed, there is now reason to reset the Zone Variance. Only a permanent relocation of the vehicle to a new zone is reason enough to reset the Zone Variance. Each zone is magnetically about 4.2° wide. Until a total nearing 22.5° is accumulated by traversing zones, the typical driver will not notice any difference on the display. Beyond 22.5°, a reading may be off by one or more primary directions.



CONTINUOUS CALIBRATION

During normal operation, the EC Comp/Temp Mirror will continuously update the compass calibration to adjust for gradual changes in the vehicle's magnetic remnant field. If the vehicle is subjected to high magnetic influences, the compass may appear to indicate false headings, locked or appear unable to be calibrated. If this occurs, refer to MANUAL CALIBRATION.

COMPASS DIAGNOSTICS

If at any time the compass continually displays the incorrect direction, the reading is erratic or locked, verify the correct zone variance per COMPASS ZONE VARIANCE and manually recalibrate per MANUAL CALIBRATION. The electronic compass, although highly protected from changes in magnetic field, can be susceptible to large changes in magnetic field. Examples include, but not limited to: high tension power lines, large steel buildings, automatic car washes, large quantities of scrap metal, etc. While occurrence of this phenomenon is infrequent, it is possible.

OUTSIDE TEMPERATURE OPERATION

The EC Comp/Temp Mirror utilizes internal module memory temperature data to accurately display the outside temperature and to avoid ″hot soak″ condition readings. The displayed outside temperature information is stored within the memory of the EC Comp/Temp Mirror. The temperature memory only sets after the EC Comp/Temp Mirror has been on for 5 continuous minutes. When the EC Comp/Temp Mirror is first powered up, it retrieves the temperature data from the module memory. With the memory set when the EC Comp/Temp Mirror is powered up, the last temperature stored will be displayed and the module enters the Slow Update mode, (Slow Update = 1° increase or decrease per minute.) With the memory not set when powered up, the EC Comp/Temp Mirror will enter Fast Update mode for 5 minutes and then enter Slow Update mode, (Fast Update = Sample and display the outside air temperature every 2 seconds.)

- **TEMPERATURE UPDATE - WARM**

On power up, when the outside temperature sensed by the ambient temperature sensor is warmer than the temperature stored in the module memory, the EC Comp/Temp Mirror will update the displayed temperature in relation to the current Update rate.

- **TEMPERATURE UPDATE - COLD**

On power up, when the outside air temperature sensed by the ambient temperature sensor is colder than the stored memory temperature, the EC Comp/Temp Mirror will update the displayed temperature to the outside temperature at a rate of -1° every 2 seconds.

- **POTENTIAL ″ICE″ CONDITIONS**

If the measured outside temperature is 3°C (37°F) or less, the temperature display will intermittently read the word ″ICE″ to indicate possible hazardous driving conditions. The alternating ″ICE″ display will end approximately 2 minutes after initial detection of approximately 3°C (37°F).

- **EXTREME TEMPERATURE / OPEN OR SHORT CONDITION**

If the measured outside temperature is more than 60°C (140°F) or the ambient temperature sensor sense circuit is shorted to ground, the temp display will be ″SC″ to indicate a short circuit condition.

If the measured outside temperature is less than -45°C (-49°F) or the ambient temperature sensor sense circuit is open, the temp display will be ″OC″ to indicate an open circuit condition.

AMBIENT TEMPERATURE SENSOR

DESCRIPTION

The ambient temperature sensor is a variable resistor that operates on a 5-volt reference signal circuit hardwired to the Compass/Temp Mirror. The outside air temperature is monitored and displayed by the Compass/Temp Mirror.

The ambient temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The resistance in the ambient temperature sensor changes as the outside temperature rises or falls. The Compass/Temp Mirror senses the change in reference voltage through the ambient temperature sensor resistor. Based on the resistance of the ambient temperature sensor, the Compass/Temp Mirror module is programmed to correspond to a specific temperature. The Compass/Temp Mirror then displays the corresponding outside temperature received from the sensor.

AMBIENT TEMPERATURE SENSOR DIAGNOSTICS

The outside temperature function is supported by the ambient temperature sensor, a signal and ground circuit hardwired to the compass/temp module, and the Compass/Temp Mirror display.

If the Compass/Temp Mirror display indicates ″SC″, the ambient temperature sensor circuit is shorted to ground.

If the Compass/Temp Mirror display indicates ″OC″, the ambient temperature sensor circuit is open.

The ambient temperature sensor can be diagnosed using the following Sensor Test. First, confirm that °C is not being mistaken for °F or vise-versa. If the ambient temperature sensor and the circuits are confirmed to be OK, but the temperature display is inoperative or incorrect, replace the Compass/Temp Mirror.

AMBIENT TEMPERATURE SENSOR TEST

1. Turn the ignition OFF.
2. Disconnect and isolate the battery negative cable.
3. Disconnect the ambient temperature sensor harness connector.
4. Measure the resistance of the ambient temperature sensor using the following values:
   > 0° C (32° F) Sensor Resistance = 29.33 - 35.99 Kilohms
   > 10° C (50° F) Sensor Resistance = 17.99 - 21.81 Kilohms
   > 20° C (68° F) Sensor Resistance = 11.37 - 13.61 Kilohms
   > 25° C (77° F) Sensor Resistance = 9.12 - 10.86 Kilohms
   > 30° C (86° F) Sensor Resistance = 7.37 - 8.75 Kilohms
   > 40° C (104° F) Sensor Resistance = 4.90 - 5.75 Kilohms

The sensor resistance should read between these min/max values. If the resistance value is OK, refer to the Wiring Diagrams to test the Signal and Ground circuits. If the resistance values are not OK, replace the Sensor.

MAP/READING LAMP OPERATION

The Map/Reading lamp feature uses LED (light emitting diode) technology as its light source. The driver and passenger map lamps each consist of 6 LED's, 2 blue-green and 4 amber. By mixing these colors through the use of a diffusing cover the output light is white in appearance. Direct viewing of the LED's will appear as blue-green and amber. The lights are activated by the door switch when entering or exiting the vehicle or manually by using the appropriate button on the mirror as described above. LED's last 10-15+ years and are not designed to be replaced in this application.

3.4 ELECTRICALLY HEATED SYSTEMS

3.4.1 REAR WINDOW DEFOGGER

The timing circuit for the Rear Window Defogger is contained internally within the cluster. When the ignition is on, the first actuation of the Rear Window Defogger switch initiates a 10 (ten) minute time cycle. After 10 (ten) minutes of the same ignition cycle has elapsed, the cluster will turn the defogger off by opening the ground to the Rear Window Defogger Relay. If the defogger switch is actuated a second time during the same ignition cycle, the cluster will turn the defogger off after 5 (five) minutes. While the defogger is on, depressing the switch a second time will turn the defogger off. If the ignition is turned off while the defogger is operating, the defogger will remain off when the ignition is cycled.

3.5 ELECTRO/MECHANICAL INSTRUMENT CLUSTER (EMIC)

3.5.1 SMART CLUSTER FEATURES

The Electro/Mechanical Instrument Cluster (EMIC) houses the Fuel, Voltmeter, Engine Coolant Temp, and Oil Pressure gauges, the Speedometer and the Tachometer. The cluster positions the analog gauges using PCI Bus messages received from the PCM. The cluster also contains warning indicators as well as indicators for the Right and Left turn signals and the High Beam headlamps. Some of the indicators are hardwired to the cluster and some indicators are controlled by messages received on the PCI Bus. The vehicle Chime function, Courtesy Lamp Output, the Battery Saver function, and the Rear Window Defogger timer are contained internally within the cluster. The cluster contains a vacuum fluorescent (VF) display for the Odometer/Trip function. The cluster VF will also display P-codes and vehicle status messages. The cluster has the ability to store DTCs, communicate on the PCI Bus, display engine information, and display certain inputs using the DRBIII®. The cluster is also able to perform a manual self-test. For complete description and operation of the Instrument Cluster, refer to the TJ Service Manual Instrument Cluster section. For diagnostic procedures, refer to the TJ Body Diagnostic Procedures Manual.

3.5.2 INSTRUMENT CLUSTER SELF TEST

The Instrument Cluster is capable of performing a diagnostic self test. The self test is actuated by depressing and holding the trip reset button while turning the ignition from the off to the on position. The self test can also be initiated using the DRBIII®. The self test will terminate if the tachometer is greater than 300 RPM, the ignition is turned off, or the test is complete. For diagnostic procedures, refer to the TJ Body Diagnostic Procedures Manual.

3.6 VEHICLE COMMUNICATION

The Programmable Communication Interface or PCI Bus is a single wire multiplexed network capable of supporting binary encoded messages shared between multiple modules. The PCI bus circuit is identified as D25 and is violet with a yellow tracer. The modules are wired in parallel. Connections are made in the harness using splices. The following modules are used on 2004 Jeep® Wrangler (TJ).

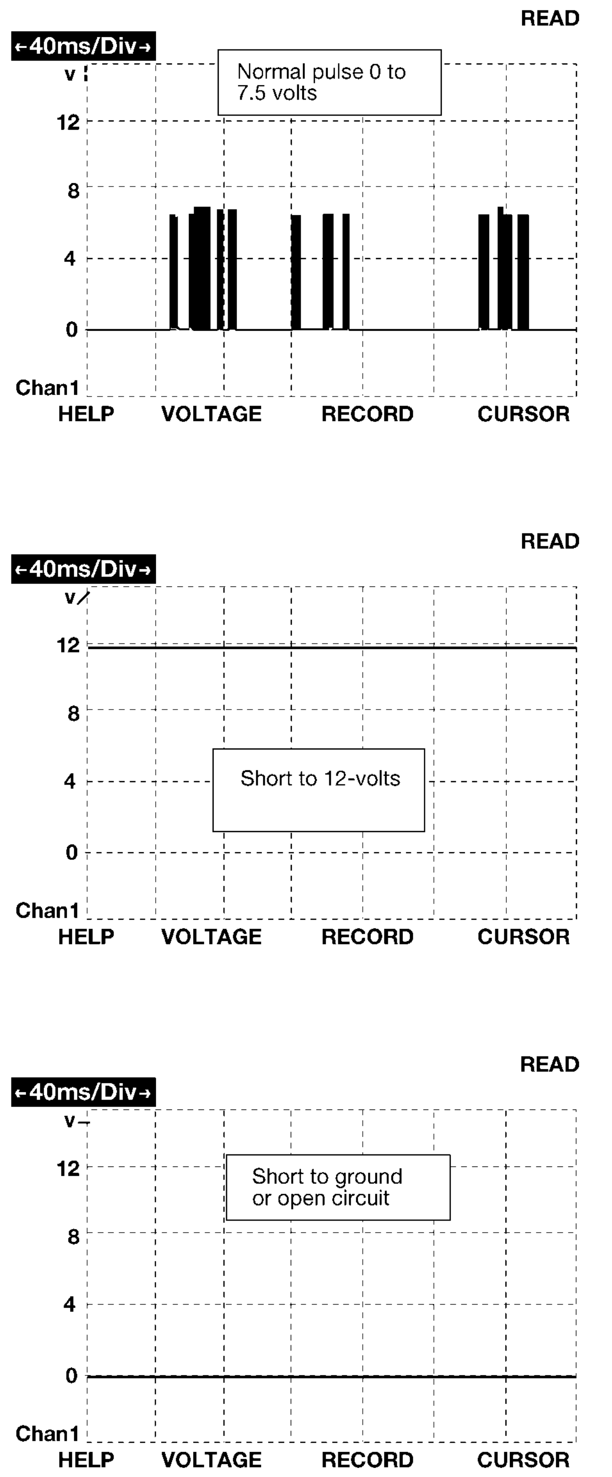
- Airbag Control Module
- Mechanical Instrument Cluster
- Radio
- Powertrain Control Module
- Transmission Control Module
- Sentry Key Immobilizer Module

Each module provides its own bias and termination in order to transmit and receive messages. The bus voltage is at zero volts when no modules are transmitting and is pulled up to about seven and a half volts when modules are transmitting.

The bus messages are transmitted at a rate averaging 10800 bits per second. Since there is only voltage present when the modules transmit and the message length is only about 500 milliseconds, it is ineffective to try and measure the bus activity with a conventional voltmeter. The preferred method is to use the DRBIII® lab scope. The 12v square wave selection on the 20-volt scale provides a good view of the bus activity. Voltage on the bus should pulse between zero and about seven and a half volts. Refer to the following figure for some typical displays.

The PCI Bus Failure modes are broken down into two categories. Complete PCI Bus Communication Failure and individual module no response. Causes of a complete PCI Bus Communication Failure include a short to ground or battery on the PCI circuit. Individual module no response can be caused by an open circuit at the module, or an open battery or ground circuit to the affected module.

Symptoms of a complete PCI Bus Communication Failure would include but are not limited to:



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- All gauges on the MIC stay at zero
- All telltales on MIC illuminate
- MIC backlighting at full intensity
- No response received from any module on the PCI bus (except PCM)
- No start (if equipped with Sentry Key Immobilizer)

Symptoms of individual module failure could include any one or more of the above. The difference would be that at least one or more modules would respond to the DRBIII®.

Diagnosis starts with symptom identification. If a complete PCI Bus Communication Failure is suspected, begin by identifying which modules the vehicle is equipped with and then attempt to get a response from the module with the DRBIII®. If any modules are responding, the failure is not related to the total bus, but can be caused by one or more modules, PCI circuit or power supply and ground circuits. The DRBIII® may display ″BUS +/- SIGNAL OPEN″ or ″NO RESPONSE″ to indicate a communication problem. These same messages will be displayed if the vehicle is not equipped with that particular module. The CCD error message is a default message used by the DRBIII® and in no way indicates whether or not the PCI Bus is operational. The message is only an indication that a module is either not responding or the vehicle is not equipped.

NOTE: Communication over the BUS is essential to the proper operation of the vehicles on-board diagnostic systems and the DRBIII®. Problems with the operation of the BUS or DRBIII® must be corrected before proceeding with diagnostic testing. If there is a problem, refer to the communications category of this manual.

3.7 USING THE DRBIII®

Refer to the DRBIII® user's guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.

3.7.1 DRBIII® ERROR MESSAGES AND BLANK SCREEN

Under normal operation, the DRBIII® will display one of only two error messages:

- User-Requested WARM Boot
- User-Requested COLD Boot

This is a sample of such an error message display:

```
ver: 2.14
date: 26 Jul93
file: key_itf.cc
date: Jul 26 1993
line: 548
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

If the DRBIII® should display any other error message, record the entire display and call the STAR Center for information and assistance.

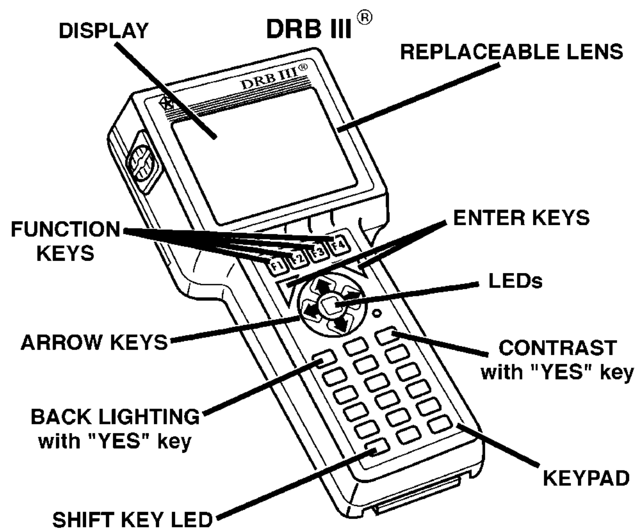
3.7.2 DRBIII® DOES NOT POWER UP

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link connector cavity 16). A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of faulty cable or vehicle wiring.

3.7.3 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



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4.0 DISCLAIMERS, SAFETY, WARNING

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: WHEN OPERATING, ENGINES PRODUCE AN ODORLESS GAS CALLED CARBON MONOXIDE. INHALING CARBON MONOXIDE GAS CAN RESULT IN SLOWER REACTION TIMES AND CAN LEAD TO PERSONAL INJURY OR DEATH. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles: the parking brake does not hold the drive wheels.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a body system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service manual. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the body system are intended to be serviced in assembly only. Attempting to remove or repair certain system sub-components may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. READ ALL DRBIII® INSTRUCTIONS BEFORE USING THE MULTIMETER. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN PERSONAL INJURY OR DEATH.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0-500 volts peak AC 0-500 volts DC
Ohms (resistance)*	0-1.12 megohms
Frequency measured Frequency generated	1-10 khz
Temperature	-58-1100°F -50-600C
*Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.	

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measured voltage above 25v DC or 25v AC.
- The circuit being tested must be protected by a 10A fuse or circuit breaker.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is ″off″. Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation: this will damage it and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

When replacing a blown fuse, it is important to use only a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical system overload. If a properly rated fuse continues to blow, it indicates a problem in the circuit that must be corrected.

Service and general information labels about the airbag system can be found on the driver's sun visor, the glove box door, and in the engine compartment.

To ensure that the airbag will be ready to deploy in a collision, have the system serviced by an authorized dealer.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

WARNING: REASSEMBLE ALL COMPONENTS BEFORE ROAD TESTING A VEHICLE. DO NOT TRY TO READ THE DRBIII® SCREEN OR OTHER TEST EQUIPMENT DURING A TEST DRIVE. DO NOT HANG THE DRBIII® OR OTHER TEST EQUIPMENT FROM THE REARVIEW MIRROR DURING A TEST DRIVE. HAVE AN ASSISTANT AVAILABLE TO OPERATE THE DRBIII® OR OTHER TEST EQUIPMENT. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN PERSONAL INJURY OR DEATH.

5.0 REQUIRED TOOLS AND EQUIPMENT

- 8310 Airbag System Load Tool
- 8443 Supplemental Restraints System Load Tool
- DRBIII® (diagnostic read-out box)
- jumper wires
- ohmmeter
- test light
- voltmeter

6.0 GLOSSARY OF TERMS

4WD	4-Wheel Drive
ABS	Antilock Braking System
ACM	Airbag Control Module
AECM	Airbag Electronic Control Module
AIRBAG	Also called ″squib″ initiator. Located inside the driver side airbag assembly.
ASDM	Airbag System Diagnostic System
CAB	Controller Antilock Brake
CTMM	Compass Temperature Mirror Module
DAB	Driver AirBag
DLC	Data Link Connector
DTC	Diagnostic Trouble Code
EMIC	Electro/Mechanical Instrument Cluster
LED	Light Emitting Diode
LFW	Low Fuel Warning
MIC	Mechanical Instrument Cluster
MIL	Malfunction Indicator Lamp
PAB	Passenger AirBag
PCI	Programmable Communication Interface
PCM	Powertrain Control Module
PDC	Power Distribution Center
S.T.A.R.	Service Technical Assistance Resource
SKIM	Sentry Key Immobilizer Module
SKIS	Sentry Key Immobilizer System
SRS	Supplemental Restraints System
TCM	Transmission Control Module
VFD	Vacuum Fluorescent Display

NOTES

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom List:
- **ACCELEROMETER 1**
- **INTERNAL 1**
- **OUTPUT DRIVER 1**
- **SAFING SENSOR**
- **STORED ENERGY FIRING 1**
- **STORED ENERGY LOGIC**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be ACCELEROMETER 1.

When Monitored and Set Condition:

ACCELEROMETER 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

INTERNAL 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

OUTPUT DRIVER 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

SAFING SENSOR

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal sensor.

STORED ENERGY FIRING 1

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

ACCELEROMETER 1 — Continued

STORED ENERGY LOGIC

When Monitored: With the ignition on, the module on board diagnostics continuously performs internal circuit tests.

Set Condition: This DTC will set if the module identifies an out of range internal circuit.

POSSIBLE CAUSES
AIRBAG CONTROL MODULE - ACM

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** Select the appropriate module and DTC type combination: ACM - ACTIVE DTC Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1. ACM - STORED DTC Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

Symptom List:

AIRBAG WARNING INDICATOR OPEN
AIRBAG WARNING INDICATOR SHORT

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be AIRBAG WARNING INDICATOR OPEN.

When Monitored and Set Condition:

AIRBAG WARNING INDICATOR OPEN

When Monitored: With ignition on the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The ACM request the warning lamp status from the MIC once every second.

Set Condition: This DTC will set immediately if the indicator status is OPEN.

AIRBAG WARNING INDICATOR SHORT

When Monitored: With ignition on the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The ACM request the warning lamp status from the MIC once every second.

Set Condition: This DTC will set immediately if the indicator status is SHORT.

POSSIBLE CAUSES
MIC, COMMUNICATION FAILURE
WARNING INDICATOR
ACM, WARNING INDICATOR
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

AIRBAG WARNING INDICATOR OPEN — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, ensure PCI Bus communications with the Instrument Cluster. Is the Instrument Cluster communicating on the PCI Bus? Yes → Go To 3 No → Refer to category COMMUNICATION CATEGORY and select the related symptom NO RESPONSE or INSTRUMENT CLUSTER BUS +/- SIGNAL OPEN.	All
3	With the DRBIII® select PASSIVE RESTRAINTS, AIRBAG and MONITOR DISPLAY. Using the DRBIII®, read the WARNING LAMP MONITOR screen. Select the LAMP STATUS displayed on the DRB monitors screen. Observe the Lamp Driver State and Actual lamp Is the LAMP DRIVER and ACTUAL LAMP STATE: OK? YES Go To 4 NO Replace Instrument Cluster. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

AIRBAG WARNING INDICATOR OPEN — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
CLUSTER MESSAGE MISMATCH

When Monitored and Set Condition:

CLUSTER MESSAGE MISMATCH

When Monitored: After the MIC bulb test is completed, the ACM compares the Lamp Request by ACM, On or Off, and the Lamp on by MIC, On or Off, PCI Bus messages. Each message is transmitted one time per second or when a change in the lamp state occur.

Set Condition: If the Lamp Request by ACM, On or Off, and the Lamp on by MIC, On or Off, messages do not match, the code will set.

POSSIBLE CAUSES
MIC DIAGNOSTIC CODES
CLUSTER MESSAGE MISMATCH
STORED CODE OR INTERMITTENT CONDITION
ACM, CLUSTER MESSAGE MISMATCH
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition on. With the DRBIII®, read the MIC DTCs. Does the DRBIII® display any active Diagnostic Codes? Yes → Refer to symptom list for problems related to Instrument Cluster. No → Go To 3	All

CLUSTER MESSAGE MISMATCH — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII® select PASSIVE RESTRAINTS, AIRBAG, MONITOR DISPLAY and WARNING LAMP STATUS. Cycle the ignition key and observe the LAMP ON BY MIC and LAMP REQ BY ACM monitors after the 6 to 8 second indicator test. Does the LAMP ON BY MIC and LAMP REQ BY ACM monitors match? YES Go To 4 NO Replace Mechanical Instrument Cluster. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 CIRCUIT OPEN

When Monitored and Set Condition:

DRIVER SQUIB 1 CIRCUIT OPEN

When Monitored: With the ignition on, the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: The ACM detects an open circuit or high resistance in the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG SQUIB 1 CIRCUIT OPEN
CLOCKSPRING SQUIB 1 CIRCUIT OPEN
DRIVER SQUIB 1 LINE 1 OR LINE 2 CIRCUITS OPEN
ACM, DRIVER SQUIB 1 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Airbag Squib connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** Connect the appropriate Load Tool to the Driver Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT OPEN? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Driver Airbag connector(s). Disconnect the Clockspring connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT OPEN? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Clockspring connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector(s). Measure the resistance of the Driver Squib 1 Line 1 and Line 2 circuits between the ACM Adaptor and the Clockspring connector(s). Is the resistance below 1.0 ohm on both circuits? Yes → Go To 5 No → Repair open or high resistance in the Driver Squib 1 Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 CIRCUIT SHORT

When Monitored and Set Condition:

DRIVER SQUIB 1 CIRCUIT SHORT

When Monitored: With the ignition on, the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: The ACM has detected low resistance on the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG SQUIB 1 CIRCUIT SHORT
CLOCKSPRING, DRIVER SQUIB 1 CIRCUITS SHORT
DRIVER AIRBAG SQUIB 1 LINE 1 SHORT TO LINE 2
ACM, DRIVER SQUIB LINE 1 SHORT TO LINE 2
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All

DRIVER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Airbag connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** Connect the appropriate Load Tool to the Driver Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT SHORT? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Driver Airbag connector(s). Disconnect the Clockspring connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 CIRCUIT SHORT? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Clockspring connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector(s). Measure the resistance between the Driver Squib 1 Line 1 and Line 2 at the Clockspring connector. Is the resistance below 10K ohms? Yes → Repair the Driver Squib 1 Line 1 circuit shorted to Driver Squib 1 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All

DRIVER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
5	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 SHORT TO BATTERY

When Monitored and Set Condition:

DRIVER SQUIB 1 SHORT TO BATTERY

When Monitored: With the ignition on, the ACM monitors the voltage of the Driver Squib 1 circuits.

Set Condition: The ACM has detected high voltage on the Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG SQUIB 1 SHORT TO BATTERY
CLOCKSPRING, DRIVER SQUIB 1 SHORT TO BATTERY
DRIVER SQUIB 1 LINE 1 OR LINE 2 SHORT TO BATTERY
ACM, DRIVER SQUIB 1 SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED ACM DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Airbag Squib connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Driver Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO BATTERY? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Driver Airbag connector(s). Disconnect the Clockspring connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO BATTERY ? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

DRIVER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Disconnect the Load Tool from the Clockspring connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Driver Squib 1 Line 1 and Line 2 circuits between the Clockspring connector and ground. Is there any voltage present? Yes → Repair the Driver Squib 1 Line 1 or Line 2 circuits shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
DRIVER SQUIB 1 SHORT TO GROUND

When Monitored and Set Condition:

DRIVER SQUIB 1 SHORT TO GROUND

When Monitored: With the ignition on, the ACM monitors the resistance of the Driver Squib 1 circuits.

Set Condition: When the ACM detects a short to ground in either Driver Squib 1 circuits.

POSSIBLE CAUSES
DRIVER AIRBAG SQUIB 1 SHORT TO GROUND
CLOCKSPRING, DRIVER SQUIB 1 SHORT TO GROUND
DRIVER SQUIB 1 LINE 1 OR LINE 2 SHORTED TO GROUND
ACM, DRIVER SQUIB 1 SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

DRIVER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Driver Airbag Squib connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** Connect the appropriate Load Tool to the Driver Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO GROUND? Yes → Go To 3 No → Replace the Driver Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Driver Airbag connector(s). Disconnect the Clockspring connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool to the Clockspring connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show DRIVER SQUIB 1 SHORT TO GROUND? Yes → Go To 4 No → Replace the Clockspring in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Clockspring connector. Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector. Measure the resistance of the Driver Squib 1 Line 1 and Line 2 circuits between Clockspring connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Driver Squib 1 Line 1 or Line 2 circuits shorted to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All

DRIVER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
5	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT, PERSONAL INJURY OR DEATH, .** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
LOSS OF IGNITION RUN - START

When Monitored and Set Condition:

LOSS OF IGNITION RUN - START

When Monitored: With the ignition in the Run-Start position the ACM monitors the Fused Ignition Switch Output Run-Start circuit for proper system voltage.

Set Condition: If the voltage on the Fused Ignition Switch Output Run-Start circuit drops below approximately 4.5 volts, the code will set.

POSSIBLE CAUSES
FUSED IGNITION SW OUTPUT RUN-START SHORT TO GROUND
IGNITION SWITCH RUN - START CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT RUN-START CIRCUIT OPEN
ACM, FUSED IGNITION OUTPUT RUN-START CIRCUIT OPEN
ACM, RUN - START SHORTED TO GROUND
ACM, RUN - START CIRCUIT SHORTED
ON - OFF SWITCH, RUN - START CIRCUIT SHORTED TO GROUND
FUSED IGNITION SWITCH OUTPUT RUN - START CIRCUIT SHORT TO GROUND
FUSED IGNITION SWITCH OUTPUT RUN - START CIRCUIT SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Ensure the battery is fully charged. Turn the ignition on. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** DETERMINE ACTIVE OR STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 10 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn Ignition off. Remove and inspect the Airbag Run-Start Fuse. **NOTE: Check connectors - Clean and repair as necessary.** Is the Fuse open? Yes → Go To 3 No → Go To 8	All

LOSS OF IGNITION RUN - START — Continued

TEST	ACTION	APPLICABILITY
3	Measure the resistance of the Fused Ignition Switch Output Run-Start circuit between the Airbag Run - Start Fuse and ground. Is the resistance below 10.0 ohms? Yes → Go To 4 No → Replace Airbag Run - Start Fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 5 No → Go To 7	All
5	Disconnect the Passenger Airbag On - Off Switch connector **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run-Start Circuit between the On - Off Switch connector and ground. Is the resistance below 10K ohms? Yes → Go To 6 No → Replace the Passenger Airbag On - Off Switch and Airbag Run - Start Fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Connect the Airbag Load Tool ACM Adaptor to the Airbag Control Module connector. Measure the resistance of the Fused Ignition Switch Output Run-Start circuit between the Airbag Control Module connector and ground. Is the resistance below 10K ohms? Yes → Repair the Fused Ignition Switch Output Run - Start circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 11	All

LOSS OF IGNITION RUN - START — Continued

TEST	ACTION	APPLICABILITY
7	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run-Start circuit between the Airbag Control Module connector and ground. Is the resistance below 10K ohms? Yes → Repair the Fused Ignition Switch Output Run - Start circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 11	All
8	Turn the ignition on. Measure the voltage of the Ignition Switch Output circuit at the Airbag Run - Start fuse. Is the voltage above approximately 4.5 volts? Yes → Go To 9 No → Repair the open Ignition Switch Output Run - Start circuit. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: Reinstall the fuse after performing this test.**	All
9	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Reinstall the previously removed Airbag Run-Start Fuse. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Fused Ignition Switch Output Run-Start Circuit between the Airbag Control Module connector ground. Is the voltage above approximately 4.5 volts? Yes → Go To 11 No → Repair open Fused Ignition Switch Output Run-Start circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LOSS OF IGNITION RUN - START — Continued

TEST	ACTION	APPLICABILITY
10	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All
11	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
LOSS OF IGNITION RUN ONLY

When Monitored and Set Condition:

LOSS OF IGNITION RUN ONLY

When Monitored: With the ignition in the run position the module monitors the Run Only circuit for proper system voltage.

Set Condition: If the voltage on the Run Only circuit drops below 4.5 volts, the code will set.

POSSIBLE CAUSES
IGNITION SWITCH OUTPUT RUN CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT OPEN
ACM, FUSED IGNITION OUTPUT RUN CIRCUIT OPEN
CHECKING FOR A SHORTED RUN CIRCUIT
FUSED IGNITION SWITCH OUTPUT RUN CIRCUIT SHORT TO GROUND
ACM, FUSED IGNITION RUN CIRCUIT SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE : ACM - ACTIVE DTC Go To 2 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition off. Remove and inspect the Airbag Run circuit fuse. Is the Fuse open? Yes → Go To 3 No → Go To 6	All
3	Remove the Airbag Run fuse. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run circuit between the Run Fuse and ground. Is the resistance below 10.0 ohms ? Yes → Go To 4 No → Replace the defective fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LOSS OF IGNITION RUN ONLY — Continued

TEST	ACTION	APPLICABILITY
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance of the Fused Ignition Switch Output Run circuit between the ACM connector and ground. Is the resistance below 10K ohms ? Yes → Repair the Fused Ignition Switch Output Run circuit for a short to ground and replace Airbag Run Fuse. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 5	All
5	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions and replace the Run Only Fuse. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	Turn the ignition on. Measure the voltage of the Ignition Switch Output Run circuit between the Airbag Run circuit fuse and ground. Is the voltage above approximately 4.5 volts? Yes → Go To 7 No → Repair the open Ignition Switch Output Run circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Reinstall the airbag Run fuse. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage of the Fused Ignition Switch Output Run circuit at the Airbag Control Module connector. Is the voltage above approximately 4.5 volts? Yes → Go To 8 No → Repair the an open or high resistance in the Fused Ignition Switch Output Run circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

LOSS OF IGNITION RUN ONLY — Continued

TEST	ACTION	APPLICABILITY
8	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
MODULE NOT CONFIGURED FOR PAB OFF SWITCH

When Monitored and Set Condition:

MODULE NOT CONFIGURED FOR PAB OFF SWITCH

When Monitored: When the ACM is not configured for an ON - OFF switch, the ACM monitors the Passenger Airbag On - Off Switch inputs to determine if a switch is present.

Set Condition: The code will set, if the ACM detects a Passenger Airbag ON - OFF Switch connected to the Airbag Control Module.

POSSIBLE CAUSES
INTERMITTENT CODES PRESENT
VERIFY CIRCUITS
ACM NOT CONFIGURED FOR PAB OFF SWITCH
ACM, MODULE NOT CONFIGURED FOR PAB OFF SWITCH
PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORT
PAB MUX SWITCH CIRCUIT SHORT TO GROUND
PAB MUX SWITCH CIRCUIT SHORT TOGETHER
ACM, PAB ON - OFF SWITCH CIRCUIT SHORTED

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure the battery is fully charged. **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC No problem found at this time. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Inspect vehicle for a Passenger Airbag On - Off Switch located in the center of the instrument panel. Is this vehicle equipped with a Passenger Airbag On - OFF Switch? Yes → Go To 3 No → Go To 5	All

MODULE NOT CONFIGURED FOR PAB OFF SWITCH — Continued

TEST	ACTION	APPLICABILITY
3	Select Restraints, Airbag and then Miscellaneous from the DRB menu. Follow instructions to verify the ACM switch configuration. Does the DRB show Configured for PAB OFF Switch? Yes → Go To 4 No → Follow instructions on the DRB to reconfigured the Airbag Control Module to support the Passenger Airbag Switch On - Off Switch. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	Inspect vehicle for a Passenger Airbag On - Off Switch wiring at the ACM connector. NOTE: Some vehicles may have the wiring for the Passenger Airbag Off Switch and no switch. Is this vehicle equipped with a Passenger Airbag On - OFF Switch wiring? Yes → Go To 6 No → Go To 9 Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Connect the appropriate Load Tool ACM Adaptor to the Airbag Control Module connector. Measure the resistance of the PAB Indicator Driver circuit between the ACM Adaptor and ground. Is the resistance below 10K ohms? Yes → Repair the Passenger Airbag Indicator Driver circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 7	All

MODULE NOT CONFIGURED FOR PAB OFF SWITCH — Continued

TEST	ACTION	APPLICABILITY
7	Measure the resistance of the PAB MUX Switch Sense circuit between the ACM Adaptor and ground. Is the resistance below 10K ohms? Yes → Repair the Passenger Airbag MUX Switch Sense circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 8	All
8	Measure the resistance between the PAB MUX Switch Sense circuit and the PAB MUX Switch Return circuit at the ACM Adaptor. Is the resistance below 10K ohms? Yes → Repair the Passenger Airbag MUX Switch circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 9	All
9	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
NO CLUSTER MESSAGE

When Monitored and Set Condition:

NO CLUSTER MESSAGE

When Monitored: With ignition on, the ACM monitors the PCI Bus for a message from the MIC containing the airbag warning indicator status. The MIC transmits the message one time at ignition on, lamp state change, or in response to the ACM message.

Set Condition: If the MIC message is not received for 10 consecutive seconds, the code will set.

POSSIBLE CAUSES
MIC, COMMUNICATION FAILURE
ACM, NO CLUSTER MESSAGES
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 4 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Turn the ignition on. With the DRBIII®, ensure PCI Bus communications with the Instrument Cluster. Is the Instrument Cluster communicating on the PCI Bus? Yes → Go To 3 No → Refer to category COMMUNICATION CATEGORY and select the related symptom NO RESPONSE or INSTRUMENT CLUSTER BUS +/- SIGNAL OPEN.	All

NO CLUSTER MESSAGE — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, TO AVOID PERSONAL INJURY OR DEATH, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All
4	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
NO PCI TRANSMISSION

When Monitored and Set Condition:

NO PCI TRANSMISSION

When Monitored: With the ignition on and the module transmitting information on the BUS.

Set Condition: The code will set immediately if the onboard diagnostic cannot detect the module transmitting information on the BUS. NOTE: Any Bus Failure will may cause a stored code to set.

POSSIBLE CAUSES
AIRBAG CONTROL MODULE - ACM
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** From the list below, select the appropriate module and DTC type for the this diagnostic trouble code. DETERMINE ACTIVE OR STORED DTC ACM - ACTIVE Go To 2 ACM - STORED Go To 3 **NOTE: When reconnecting airbag system components the Ignition must be turned off and the Battery must be disconnected.**	All
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

NO PCI TRANSMISSION — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER AIRBAG ON - OFF SWITCH OPEN

When Monitored and Set Condition:

PASSENGER AIRBAG ON - OFF SWITCH OPEN

When Monitored: With the ignition on, the PAB MUX Switch Sense circuit supplies a 3 to 10 ms pulse every 100 ms across the On or Off switch resistor to the MUX Switch Return circuit.

Set Condition: The code will set if the ACM senses an open or high resistance on the PAB MUX Switch Sense circuit or PAB MUX Switch Return circuit.

POSSIBLE CAUSES
CHECKING EQUIPMENT
PAB ON - OFF SWITCH OPEN
SWITCH DISCONNECTED
PASSENGER AIRBAG MUX SWITCH CIRCUIT OPEN
ACM, PASSENGER ON - OFF SWITCH CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 7 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 3 No → With the DRBIII® in MISCELLANEOUS, read the Configure for Airbag ON - OFF Switch current status. Enter the number 1 and press enter to re configure the ACM for NO AIRBAG ON/OFF SWITCH. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Gain access to the Passenger Airbag On - Off Switch connector. Is the Passenger Airbag On - Off Switch connected to the dash harness? Yes → Go To 4 No → Connect the Passenger Airbag On - Off switch to the dash harness connector. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag On - Off Switch. **NOTE: Check connectors - Clean and repair as necessary.** Measure the PAB On - Off Switch resistance between terminals 1 and 2 in both switch positions. The switch resistance specifications are: ON position = 175.0 to 190.0 ohms and OFF position = 820.0 to 870.0 ohms. Is the resistance within range for both switch positions? Yes → Go To 5 No → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector. Measure the resistance of the PAB MUX Switch Sense between the ACM Adaptor and the PAB On - Off Switch connector. Measure the resistance of the PAB MUX Switch Return circuit between the ACM Adaptor and the PAB On - Off Switch connector. Is the resistance below 5.0 ohms on both circuits? Yes → Go To 6 No → Repair the open Passenger Airbag MUX Switch circuit(s). Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH OPEN — Continued

TEST	ACTION	APPLICABILITY
7	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER AIRBAG ON - OFF SWITCH SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO BATTERY

When Monitored: With the ignition on, the MUX Switch Sense circuit supplies a 3 to 10 ms pulse every 100 ms across the switch resister to the MUX Switch Return circuit. Once the code is active, the ACM will disable the indicator for the duration of the ignition cycle.

Set Condition: The code will set if the ACM senses constant voltage over approximately 4.0 volts on the PAB MUX Switch circuits.

POSSIBLE CAUSES
CHECKING EQUIPMENT
PAB ON - OFF SWITCH CIRCUIT SHORT
PAB ON - OFF SWITCH SHORT
PAB MUX SWITCH CIRCUIT SHORT TO BATTERY
ACM, PAB ON - OFF SWITCH CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 3 No → With the DRBIII® in MISCELLANEOUS, read the Configure for Airbag ON - OFF Switch current status. Enter the number 1 and press enter to re configure the ACM for NO AIRBAG ON/OFF SWITCH. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag On - Off Switch. **NOTE: Check connectors - Clean and repair as necessary.** Measure the PAB On - Off Switch resistance between terminals 1 & 4 and 2 & 4. Is the resistance below 10K ohms on either test? Yes → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the PAB On - Off Switch resistance between terminals 1 and 2 in both switch positions. The switch resistance specifications are: ON position = 175.0 to 190.0 ohms and OFF position = 820.0 to 870.0 ohms. Is the resistance within range for both switch positions? Yes → Go To 5 No → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the PAB MUX Switch Sense and PAB MUX Switch Return circuits at the PAB On - Off Switch connector. Is there any voltage on either circuit? Yes → Repair the Passenger Airbag MUX Switch circuits shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 7 Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
6	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All
7	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
PASSENGER AIRBAG ON - OFF SWITCH SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO GROUND

When Monitored: With the ignition on, the PAB MUX Switch Sense circuit supplies a 3 to 10 ms pulse every 100 ms across the On or Off Switch resistor to the MUX Switch Return circuit.

Set Condition: The code will set if the ACM senses low resistance on the PAB MUX Switch sense circuit.

POSSIBLE CAUSES
CHECKING EQUIPMENT
PAB ON - OFF SWITCH CIRCUIT SHORT
PAB ON - OFF SWITCH SHORT
PAB MUX SWITCH CIRCUIT SHORT TO GROUND
PAB MUX SWITCH CIRCUIT SHORT TOGETHER
ACM, PAB ON - OFF SWITCH CONNECTOR.
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 7 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 3 No → With the DRBIII® in MISCELLANEOUS, read the Configure for Airbag ON - OFF Switch current status. Enter the number 1 and press enter to re configure the ACM for NO AIRBAG ON/OFF SWITCH. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag On - Off Switch. **NOTE: Check connectors - Clean and repair as necessary.** Measure the PAB On - Off Switch resistance between terminals 1 & 3 and 2 & 3. Is the resistance below 10K ohms on either test? Yes → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	Measure the PAB On - Off Switch resistance between terminals 1 and 2 in both switch positions. The switch resistance specifications are: ON position = 175.0 to 190.0 ohms and OFF position = 820.0 870.0 ohms. Is the resistance within range for both switch positions? Yes → Go To 5 No → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector. Measure the resistance of the PAB MUX Switch Sense circuit between the PAB On - Off Switch connector and ground. Is the resistance below 10K ohms? Yes → Repair the Passenger Airbag MUX Switch Sense circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 6	All
6	Measure the resistance between the PAB MUX Switch Sense circuit and the PAB MUX Switch Return circuit at the PAB On - Off Switch connector. Is the resistance on either circuits below 10K ohms? Yes → Repair the Passenger Airbag MUX Switch circuits shorted together. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 8 Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER AIRBAG ON - OFF SWITCH SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
7	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All
8	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
PASSENGER OFF INDICATOR CIRCUIT SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER OFF INDICATOR CIRCUIT SHORT TO BATTERY

When Monitored: With the ignition on, the ACM monitors the PAB Indicator Driver circuit for voltage from the PAB On - Off Switch indicator circuit.

Set Condition: The code will set if the ACM senses battery voltage on the PAB Indicator Driver circuit.

POSSIBLE CAUSES
CHECKING EQUIPMENT
PAB ON - OFF SWITCH INDICATOR SHORT
PASSENGER AIRBAG INDICATOR SHORT TO FUSED RUN - START CIRCUIT
PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORTED TO BATTERY
ACM, PAB INDICATOR DRIVER CIRCUIT SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 6 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 3 No → With the DRBIII® in MISCELLANEOUS, read the Configure for Airbag ON - OFF Switch current status. Enter the number 1 and press enter to re configure the ACM for NO AIRBAG ON/OFF SWITCH. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER OFF INDICATOR CIRCUIT SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag On - Off Switch. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance between PAB On - Off Switch terminals 3 and 4. Is the resistance below 14.0 ohms? Yes → Go To 4 No → Replace the Passenger Airbag On - Off Switch in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Airbag Control Module connector. **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** **WARNING: TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Passenger Airbag Indicator Driver circuit between the PAB On - Off Switch connector and ground. Is there any voltage present? Yes → Go To 5 No → Go To 7	All
5	Remove the Fused Ignition Switch Output Run - Start circuit fuse. Measure the voltage on the Passenger Airbag Indicator Driver circuit at the PAB On - Off Switch connector. Is there any voltage present? Yes → Repair the Passenger Airbag Indicator Driver circuit shorted to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Repair the Fused ignition Switch Output Run - Start circuit shorted to the PAB Indicator Driver circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER OFF INDICATOR CIRCUIT SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
6	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All
7	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
PASSENGER OFF INDICATOR CIRCUIT SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER OFF INDICATOR CIRCUIT SHORT TO GROUND

When Monitored: With the ignition on, the ACM monitors the PAB Indicator Driver circuit for voltage from the PAB On - Off Switch indicator circuit.

Set Condition: The code will set if the ACM cannot detect voltage on the PAB Indicator Driver circuit.

POSSIBLE CAUSES
ACTIVE ACM RUN - START CODES
CHECKING EQUIPMENT
FUSED IGNITION SWITCH OUTPUT RUN - START
SWITCH DISCONNECTED
PAB ON - OFF INDICATOR OPEN
PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT OPEN
PASSENGER AIRBAG INDICATOR DRIVER CIRCUIT SHORT
ACM, PASSENGER ON - OFF INDICATOR CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure that the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 9 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	With the DRBIII®, read active Airbag Control Module DTC's. Does the DRBIII® display LOSS OF IGNITION RUN - START ? Yes → Refer to symptom list for problems related to Loss of Ignition Run - Start active diagnostic trouble code test. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 3	All

PASSENGER OFF INDICATOR CIRCUIT SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
3	Is this vehicle equipped with a Passenger Airbag On - Off Switch? Yes → Go To 4 No → With the DRBIII® in MISCELLANEOUS, read the Configure for Airbag ON - OFF Switch current status. Enter the number 1 and press enter to re configure the ACM for NO AIRBAG ON/OFF SWITCH. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	Gain access to the Passenger Airbag On - Off Switch connector. Is the Passenger Airbag On - Off Switch connected to the dash harness? Yes → Go To 5 No → Connect the Passenger Airbag On - Off switch to the dash harness connector. Perform AIRBAG VERIFICATION TEST - VER 1.	All
5	**WARNING: TURN IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger On - Off Switch connector. **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Fused Ignition Switch Output Run - Start circuit between the PAB On - Off Switch connector and ground. Is the voltage above 10.0 volts? Yes → Go To 6 No → Repair the open Fused ignition Switch Output Run - Start circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All
6	**WARNING: TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag On - Off Switch. **NOTE: Check connectors - Clean and repair as necessary.** Measure the resistance between PAB On - Off Switch terminals 3 and 4. Is the resistance approximately 14 ohms? Yes → Go To 7 No → Replace the Passenger Airbag ON - OFF Switch in accordance with the service information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
7	Disconnect the Airbag Control Module connector **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED.** Connect the appropriate Load Tool ACM Adaptor to the Airbag Control Module connector(s). Measure the resistance of the PAB Indicator Driver circuit between the ACM and the PAB On - Off Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 8 No → Repair the open Passenger Airbag Indicator Driver circuit. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER OFF INDICATOR CIRCUIT SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
8	Measure the resistance of the PAB Indicator Driver circuit between the PAB On - Off Switch connector and ground. Is the resistance below 10K ohms? Yes → Repair the Passenger Airbag Indicator Driver circuit short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 10	All
9	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All
10	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
PASSENGER SQUIB 1 CIRCUIT OPEN

When Monitored and Set Condition:

PASSENGER SQUIB 1 CIRCUIT OPEN

When Monitored: With the ignition on, the ACM monitors the resistance of the Passenger Squib 1 circuits.

Set Condition: When the ACM detects an open circuit or high resistance on the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PAB SQUIB 1 CIRCUIT OPEN
PAB SQUIB 1 LINE 1 OR LINE 2 CIRCUIT OPEN
ACM, PAB SQUIB 1 CIRCUIT OPEN
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** Connect the Load Tool to the Passenger Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT OPEN? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Passenger Airbag connector(s). Disconnect the Airbag Control module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the Load Tool ACM Adaptor to the Airbag Control Module connector(s). Measure the resistance of the Passenger Squib 1 Line 1 and Line 2 circuit between the ACM Adaptor and the Passenger Airbag connector. Is the resistance below 1.0 ohms on both circuits? Yes → Go To 4 No → Repair open or high resistance in Passenger Squib 1 Line 1 or Line 2 circuits. Perform AIRBAG VERIFICATION TEST - VER 1.	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 CIRCUIT OPEN — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 CIRCUIT SHORT

When Monitored and Set Condition:

PASSENGER SQUIB 1 CIRCUIT SHORT

When Monitored: With the ignition on, the ACM monitors the resistance between the Passenger Squib 1 circuits.

Set Condition: When the ACM detects low resistance in the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PAB SQUIB 1 CIRCUIT SHORT
PAB SQUIB 1 LINE 1 SHORT TO LINE 2
ACM, PAB SQUIB 1 CIRCUIT SHORT
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: TO AVOID PERSONAL INJURY OR DEATH, DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED.** Connect the appropriate Load Tool to the Passenger Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT SHORT? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Passenger Airbag connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adapter to the Airbag Control Module connector(s). Measure the resistance between Passenger Squib 1 Line 1 and Line 2 circuits at the Passenger Airbag connector. Is the resistance below 10K ohms? Yes → Repair Passenger Squib 1 Line 1 circuit short to Passenger Squib 1 Line 2 circuit. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 CIRCUIT SHORT — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 SHORT TO BATTERY

When Monitored and Set Condition:

PASSENGER SQUIB 1 SHORT TO BATTERY

When Monitored: With the ignition on, the ACM monitors the voltage on the Passenger Squib 1 circuits.

Set Condition: When the ACM detects voltage on the Passenger Squib 1 circuits.

POSSIBLE CAUSES
PAB SQUIB 1 CIRCUITS SHORT TO BATTERY
PAB SQUIB 1 LINE 1 OR LINE 2 SHORT TO BATTERY
ACM, PAB SQUIB 1 CIRCUIT SHORT TO BATTERY
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** Connect the appropriate Load Tool to the Passenger Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show PASSENGER SQUIB 1 CIRCUIT SHORT TO BATTERY? Yes → Go To 3 No → Replace Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Passenger Airbag connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean and repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector(s). **WARNING: AVOID PERSONAL INJURY OR DEATH, TURN IGNITION ON, THEN RECONNECT THE BATTERY.** Measure the voltage on the Passenger Squib 1 Line 1 and Line 2 circuits between the Passenger Airbag connector and ground. Is there any voltage present? Yes → Repair Passenger Squib 1 Line 1 or Line 2 circuit short to battery. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 SHORT TO BATTERY — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
PASSENGER SQUIB 1 SHORT TO GROUND

When Monitored and Set Condition:

PASSENGER SQUIB 1 SHORT TO GROUND

When Monitored: With the ignition on, the ACM monitors the resistance of the Passenger Squib 1 circuits.

Set Condition: When the ACM detects a short to ground in either Passenger Squib 1 circuits.

POSSIBLE CAUSES
PAB SQUIB 1 CIRCUITS SHORT TO GROUND
PAB SQUIB 1 LINE 1 OR LINE 2 SHORT TO GROUND
ACM, PAB SQUIB 1 SHORT TO GROUND
STORED CODE OR INTERMITTENT CONDITION
ACTIVE CODE PRESENT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the battery is fully charged.** **NOTE: For the purpose of this test, the AECM and ORC modules will be referred to as an ACM.** SELECT ACTIVE or STORED DTC: ACM - ACTIVE DTC Go To 2 ACM - STORED DTC Go To 5 **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

PASSENGER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Passenger Airbag connector(s). **NOTE: Check connectors - Clean and repair as necessary.** **WARNING: DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A HARD SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED, AND COULD RESULT IN SERIOUS OR FATAL INJURY.** Connect the appropriate Load Tool to the Passenger Airbag connector(s). **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII®, read the active Airbag Control Module DTC's. Does the DRBIII® show PASSENGER SQUIB 1 SHORT TO GROUND? Yes → Go To 3 No → Replace the Passenger Airbag in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All
3	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the Load Tool from the Passenger Airbag connector(s). Disconnect the Airbag Control Module connector(s). **NOTE: Check connectors - Clean repair as necessary.** Connect the appropriate Load Tool Adaptor to the Airbag Control Module connector. Measure the resistance of the Passenger Squib 1 Line 1 or Line 2 circuit between the Passenger Airbag Module Connector and ground. Is the resistance below 10K ohms on either circuit? Yes → Repair Passenger Squib 1 Line 1 and Line 2 circuits for a short to ground. Perform AIRBAG VERIFICATION TEST - VER 1. No → Go To 4	All
4	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair: Replace the Airbag Control Module in accordance with Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

PASSENGER SQUIB 1 SHORT TO GROUND — Continued

TEST	ACTION	APPLICABILITY
5	With the DRBIII®, record and erase all DTC's from all Airbag modules. If equipped with Passenger Airbag On - Off switch, read the DTC's in all switch positions. If any ACTIVE codes are present they must be resolved before diagnosing any stored codes. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Look for chaffed, pierced, pinched, or partially broken wires and broken, bent, pushed out, spread, corroded, or contaminated terminals. The following additional checks may assist you in identifying a possible intermittent problem. Reconnect any disconnected components and harness connector. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** With the DRBIII® monitor active codes as you work through the following steps. **WARNING: TO AVOID PERSONAL INJURY OR DEATH, MAINTAIN A SAFE DISTANCE FROM ALL AIRBAGS WHILE PERFORMING THE FOLLOWING STEPS.** Wiggle the wiring harness and connectors of the related airbag circuit or component. If codes are related to the Driver Airbag circuits, rotate the steering wheel from stop to stop. You have just attempted to simulate the condition that initially set the trouble code message. Did the DTC become active? Yes → Select appropriate symptom from Symptom List. No → No problem found at this time. Erase all codes before returning vehicle to customer.	All

Symptom:
*AIRBAG INDICATOR ON WITHOUT ACTIVE TROUBLE CODES

POSSIBLE CAUSES
AIRBAG WARNING INDICATOR ON WITHOUT TROUBLE CODES
INSTRUMENT CLUSTER PROBLEMS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Make sure that all Airbag and Instrument Cluster DTCs have been repaired before performing this procedure. With the DRBIII® select MONITOR DISPLAY, WARNING LAMP STATUS and read the PASSIVE RESTRAINTS, AIRBAG, MONITOR DISPLAY, WARNING LAMP STATES. With no active DTCs, Does the LAMP REQ by ACM monitor show ON? Yes → Go To 2 No → Repair or replace the Instrument Cluster as necessary. Perform BODY VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** **WARNING: IF THE AIRBAG CONTROL MODULE IS DROPPED AT ANY TIME, IT MUST BE REPLACED. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND PERSONAL INJURY OR DEATH.** If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module in accordance with Service Instructions. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
ALL OUTPUTS SHORT - BASE AUDIO SYSTEM

When Monitored and Set Condition:

ALL OUTPUTS SHORT - BASE AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display ALL OUTPUTS SHORT? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker connector.** Disconnect each front speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the front speakers disconnected? Yes → Go To 3 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All

ALL OUTPUTS SHORT - BASE AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the rear speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM

When Monitored and Set Condition:

ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
SUBWOOFER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display ALL OUTPUTS SHORT? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Subwoofer harness connector. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with the Subwoofer disconnected? Yes → Go To 3 No → Replace the Subwoofer in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker connector.** Disconnect each front speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the front speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display ALL OUTPUTS SHORT with all the rear speakers disconnected? Yes → Go To 5 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

ALL OUTPUTS SHORT - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:

CASSETTE PLAYER INOP
CD MECHANICAL FAILURE
NO PCI TRANSMISSION
***AM/FM SWITCH INOPERATIVE**
***ANY STATION PRESET SWITCH INOPERATIVE**
***BALANCE INOPERATIVE**
***CD EJECT SWITCH INOPERATIVE**
***EQUALIZER INOPERATIVE**
***FADER INOPERATIVE**
***FF/RW SWITCH INOPERATIVE**
***HOUR/MINUTE SWITCHES INOPERATIVE**
***PAUSE/PLAY SWITCH INOPERATIVE**
***PWR SWITCH INOPERATIVE**
***SCAN SWITCH INOPERATIVE**
***SEEK SWITCH INOPERATIVE**
***SET SWITCH INOPERATIVE**
***TAPE EJECT SWITCH INOPERATIVE**
***TIME SWITCH INOPERATIVE**
***TUNE SWITCH INOPERATIVE**

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be CASSETTE PLAYER INOP.

When Monitored and Set Condition:

CASSETTE PLAYER INOP

When Monitored: Continuously with the ignition and radio turned on.

Set Condition: The code will set if the radio detects a internal cassette failure.

CD MECHANICAL FAILURE

When Monitored: Continuously with the ignition and CD player turned on.

Set Condition: The code will set if the radio detects a CD mechanical failure.

POSSIBLE CAUSES
INTERNAL FAILURE

CASSETTE PLAYER INOP — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: If a DTC is set, erase the DTC and attempt to reset the DTC. If DTC resets, follow this test.** This is an internal radio failure. View repair Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
CD PLAY FAILURE

When Monitored and Set Condition:

CD PLAY FAILURE

When Monitored: Continuously with the ignition and the radio CD player turned on.

Set Condition: The code will set if a CD that is not formatted as a music CD or is scratched, dirty so the radio can not play the CD.

POSSIBLE CAUSES
CD PLAY FAILURE

TEST	ACTION	APPLICABILITY
1	Replace the problem CD with a good, clean, unscratched, music CD. Turn the radio CD player on. With the DRBIII®, read DTC's. Does the DRBIII® display CD PLAY FAILURE? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CD READ FAILURE

When Monitored and Set Condition:

CD READ FAILURE

When Monitored: Continuously with the ignition and the radio CD player turned on.

Set Condition: The code will set if a CD that is not formatted as a music CD is installed in the radio CD player.

POSSIBLE CAUSES
CD READ FAILURE

TEST	ACTION	APPLICABILITY
1	Replace the problem CD with a good, clean, unscratched, music CD. Turn the radio CD player on. With the DRBIII®, read DTC's. Does the DRBIII® display CD READ FAILURE? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CD TEMPERATURE HIGH

When Monitored and Set Condition:

CD TEMPERATURE HIGH

When Monitored: Continuously with the ignition and the radio CD player turned on.

Set Condition: The code will set if the temperature inside the radio CD player is above +85° C (+185° F).

POSSIBLE CAUSES
HIGH TEMPERATURE FAILURE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase the audio DTC's. Start the engine and allow the engine to reach normal operating temperature. If the vehicle has been in the hot sunlight or extreme cold move the vehicle indoors and open the doors to allow the inside temperature to stabilize. The radio CD player will operate between -30° C and 85° C (-22° F and +185° F). With the DRBIII®, read DTC's. Does the DRBIII® display CD TEMPERATURE HIGH? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
LOW VOLTAGE LEVEL

When Monitored and Set Condition:

LOW VOLTAGE LEVEL

When Monitored:

Set Condition: The radio detects lower than normal voltage.

POSSIBLE CAUSES
CHECK CHARGING SYSTEM
CHECK VOLTAGE LEVEL AT RADIO
RADIO

TEST	ACTION	APPLICABILITY
1	Check the charging system in accordance with the service information. Is the charging system operating properly? Yes → Go To 2 No → Refer to the appropriate service information and repair as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Radio harness connector. Start the engine. Measure the voltage of each Fused B+ circuit and the Fused Ignition Switch Output circuit. Is the voltage above or approximately 14 volts for each measurement? Yes → Go To 3 No → Repair the circuit for high resistance. Perform BODY VERIFICATION TEST - VER 1.	All
3	**Note: Reconnect all previously disconnected components.** Turn the ignition and Radio on. With the DRBIII®, erase the audio DTC's. Start the engine. With the DRBIII®, read the audio DTC's. Did this DTC reset? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
NO ANTENNA CONNECTION

When Monitored and Set Condition:

NO ANTENNA CONNECTION

When Monitored: With the ignition on and the radio in seek up/down mode.

Set Condition: With the radio in seek or scan mode for two minutes and the radio does not detect an antenna connection or does not receive a radio station signal.

POSSIBLE CAUSES
BAD ANTENNA CONNECTION
TEST ANTENNA
RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Radio Antenna connector. Inspect the Radio Antenna connection. Was the Antenna connection clean and tight? Yes → Go To 2 No → Repair Antenna connection as needed. Perform BODY VERIFICATION TEST - VER 1.	All
2	Refer to the Audio System in the service information and test the Antenna in accordance with the service procedure. Is the Antenna ok? Yes → Go To 3 No → Repair or replace the Antenna assembly as necessary. Perform BODY VERIFICATION TEST - VER 1.	All
3	**NOTE: Reconnect all previously disconnected components.** Turn the ignition and Radio on. **NOTE: Move vehicle outside approximately 30ft from any structure.** With the DRBIII®, erase the audio DTC's, put the radio in seek up and seek down mode for approximately 2 minutes before proceeding. With the DRBIII®, read the audio DTC's. Did this DTC reset? Yes → Replace the Radio. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
POWER AMP SHUTDOWN - BASE AUDIO SYSTEM

When Monitored and Set Condition:

POWER AMP SHUTDOWN - BASE AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display POWER AMP SHUTDOWN? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker connector.** Disconnect each front speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the front speakers disconnected? Yes → Go To 3 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All

POWER AMP SHUTDOWN - BASE AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the rear speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM

When Monitored and Set Condition:

POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM

When Monitored: Ignition in RUN and IOD fuse installed.

Set Condition: The radio has sensed a short on the output for more than 10 seconds.

POSSIBLE CAUSES
DETERMINE FAULT
FRONT SHORTED SPEAKER
SUBWOOFER
REAR SHORTED SPEAKER
(+) CIRCUIT SHORTED TO GROUND
(-) CIRCUIT SHORTED TO GROUND
SPEAKER (+) & (-) CIRCUITS SHORTED TOGETHER
SPEAKER SECTION OF RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Turn the Radio on. With the DRBIII®, erase the audio DTC's. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read the audio DTC's. Does the DRBIII® display POWER AMP SHUTDOWN? Yes → Go To 2 No → Refer to the wiring diagrams located in the service information to help isolate a possible intermittent short. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Subwoofer harness connector. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with the Subwoofer disconnected? Yes → Go To 3 No → Replace the Subwoofer in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each front speaker connector.** Disconnect each front speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the front speakers disconnected? Yes → Go To 4 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. **NOTE: Perform this procedure after disconnecting each rear speaker connector.** Disconnect each rear speaker harness connector one at a time. Turn the ignition on. Turn the radio on. With the DRBIII®, erase the audio DTCs. Cycle the ignition switch from off to on and wait 10 seconds. With the DRBIII®, read DTC's. Does the DRBIII® display POWER AMP SHUTDOWN with all the rear speakers disconnected? Yes → Go To 5 No → Replace the Speaker that when disconnected the DTC did not reset. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (+) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between ground and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms? Yes → Repair the speaker (-) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All

POWER AMP SHUTDOWN - PREMIUM AUDIO SYSTEM — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Disconnect each front and rear speaker harness connector. Disconnect the Radio harness connector. Measure the resistance between each speaker (+) circuit and each speaker (-) circuit. Is the resistance below 1000.0 (1K) ohms for any of the measurements? Yes → Repair the speaker circuits shorted together. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*POOR SOUND QUALITY

POSSIBLE CAUSES
CHECK AUDIO DTCS
CHECK SELECTED RADIO EQ CURVE
SET THE RADIO EQ CURVE
VERIFY SOUND PERFORMANCE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, check for any audio related DTC's. Are any Audio related DTCs set? Yes → Refer to the Audio category for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, enter body, Instrument Cluster then miscellaneous. Check the radio EQ curve setting and follow the instructions on the DRBIII®. Is the radio EQ curve correct for the audio combination the vehicle is equipped with? Yes → Refer to the service information for problems related to poor sound quality and perform the appropriate checks. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition on. With the DRBIII®, enter body, Instrument Cluster then miscellaneous. Set the radio EQ curve. Follow the instructions on the DRBIII®. Cycle the ignition switch from off to on. Check the radio EQ curve setting. Is the radio EQ curve correct for the audio combination the vehicle is equipped with? Yes → Refer to the service information for problems related to poor sound quality and perform the appropriate checks. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE AT ALL TIMES

POSSIBLE CAUSES
INSTRUMENT CLUSTER - CHIME INOPERATIVE

TEST	ACTION	APPLICABILITY
1	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE WITH DRIVER SEAT BELT UNFASTENED

POSSIBLE CAUSES
SEAT BELT SWITCH STATUS WRONG
SEAT BELT SWITCH SHORTED
SEAT BELT SWITCH SENSE WIRE SHORT TO GROUND
INSTRUMENT CLUSTER - SEAT BELT SWITCH SHORTED

TEST	ACTION	APPLICABILITY
1	Ensure the drivers seat belt is unfastened. With the DRB III select: Electro Mech Cluster Input Output. Turn the ignition on. Read the Driver Belt SW status. Does the DRB III show Driver Belt SW: CLOSED? Yes → Go To 2 No → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Seat Belt Switch connector. With the DRB III select: Electro Mech Cluster Input Outputs. Turn the ignition on. Read the Driver Belt Sw status. Does the DRB III show Seat Belt SW: CLOSED? Yes → Go To 3 No → Repair Seat Belt switch pigtail wiring for a short to ground or replace the Seat Belt buckle assembly. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Remove the Instrument Cluster from the instrument panel. Disconnect the Seat Belt Switch connector. Measure the resistance between ground and the Seat Belt Switch Sense circuit at the Instrument Cluster C2 connector. Is the resistance below 100.0 ohms? Yes → Repair the Seat Belt Switch Sense wire for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE WITH EXTERIOR LAMPS ON AND DRIVER DOOR OPEN

POSSIBLE CAUSES
VERIFY KEY-IN IGNITION, DRIVER'S DOOR OPEN CHIME OPERATION
HEADLAMP SWITCH OUTPUT OPEN
MIC - CHIME INOP WITH EXTERIOR LAMPS ON

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Ensure the key is in the ignition switch all the way. Open the driver door. Does the chime sound? Yes → Go To 2 No → Refer to symptom *CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER'S DOOR OPEN in the CHIME category. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove the Instrument Cluster From the I/P. Turn the Exterior Lamps on. Measure the voltage of the Headlamp Switch Output circuit in the Instrument Cluster C1 connector. Is the voltage above 10.0 volts? Yes → If there are no possible causes remaining, replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Headlamp Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER'S DOOR OPEN

POSSIBLE CAUSES
OPEN DOOR AJAR GROUND CKT
OPEN/MISSING FUSE 4
DRIVER DOOR AJAR SWITCH
DOOR AJAR SWITCH OUTPUT CIRCUIT OPEN
DRIVER DOOR AJAR SWITCH SENSE CIRCUIT OPEN
INSTRUMENT CLUSTER - DOOR AJAR
IGNITION SWITCH GROUND CIRCUIT OPEN
KEY-IN IGNITION SWITCH OPEN
KEY-IN IGNITION SWITCH SENSE CIRCUIT OPEN
INSTRUMENT CLUSTER - KEY-IN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Open the driver door. With the DRB, read the ″DR DOOR AJAR SW″ state. Does the DRB display ″DR DOOR AJAR SW: CLOSED″? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Disconnect the Ignition Switch harness connector. **Note: Ensure the key is in the Ignition Switch Lock Cylinder.** Measure the resistance of the Key-in Ignition Switch with the key in. Is the resistance below 20 ohms? Yes → Go To 3 No → Check the Ignition Lock Cylinder for damage. If OK, replace the Ignition Switch. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Ignition Switch harness connector. Measure the resistance of the ground circuit in the ignition switch harness connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER'S DOOR OPEN — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Ignition Switch harness connector. Remove the Instrument Cluster from the I/P. Measure the resistance of the Key-in Ignition Switch Sense circuit between the ignition switch harness connector and the Instrument Cluster C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the key-in ignition switch sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster in accordance with the Service Information.. Perform BODY VERIFICATION TEST - VER 1.	All
6	Gain access to the Fuse Block Fuse #4 and inspect. Was the fuse missing or open? Yes → Replace Fuse. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Using a 12-volt Test Light connected to 12-volts, test the Ground circuit at fuse #4 for continuity. Does the light illuminate? Yes → Go To 8 No → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
8	Reinstall fuse if removed in previous test. Disconnect the Driver Door Ajar Switch connector. With the DRBIII® in Inputs/Outputs, read the DRV DR AJAR SW state. Connect a jumper wire between Sense circuit and the Output circuit. Does the DRBIII® display DRV DR AJAR SW: CLOSED? Yes → Replace the Driver Door Ajar Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	Disconnect the Driver Door Ajar Switch connector. Measure the resistance of the Door Ajar Output from the ajar switch to the fuse. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the Door Ajar Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*CHIME INOPERATIVE WITH KEY IN IGNITION, DRIVER'S DOOR OPEN — Continued

TEST	ACTION	APPLICABILITY
10	Remove the Instrument Cluster from the I/P. Disconnect the Driver Door Ajar Switch connector. Measure the resistance of the Driver Door Ajar Switch Sense circuit from the Driver Door Ajar switch to the Instrument Cluster C2 connector. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the Driver Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME SOUNDS WITH DRIVER SEAT BELT FASTENED

POSSIBLE CAUSES
SEAT BELT SWITCH STATUS WRONG
SEAT BELT SWITCH OPEN
GROUND WIRE OPEN
SEAT BELT SWITCH SENSE OPEN
INSTRUMENT CLUSTER - SEAT BELT SENSE OPEN

TEST	ACTION	APPLICABILITY
1	Ensure the drivers seat belt is fastened. With the DRB III select: Electro Mech Cluster Input/Outputs. Turn the ignition on. Read the Driver Belt SW status. Does the DRB III show Driver Belt SW: CLOSED? Yes → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Seat Belt Switch connector. Turn all interior lights off. Measure the resistance of the Ground circuit in the Seat Belt Switch connector to ground. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the open Ground wire. Perform BODY VERIFICATION TEST - VER 1.	All
3	Disconnect the Seat Belt Switch connector. Connect a jumper wire between Seat Belt Switch Sense circuit and the Ground circuit in the Seat Belt Switch connector. With the DRB III select: Electro Mech Cluster Input/Outputs. Turn the ignition on. Read the Driver Belt SW status. Does the DRB III show Driver Belt SW: CLOSED? Yes → Repair Seat Belt switch pigtail wiring or replace Buckle assembly. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove the Instrument Cluster from the instrument panel. Disconnect the Seat Belt Switch connector. Measure the resistance of the Seat Belt Switch Sense circuit between the Instrument Cluster C2 connector and the Seat Belt Switch connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the open Seat Belt Switch Sense wire. Perform BODY VERIFICATION TEST - VER 1.	All

*CHIME SOUNDS WITH DRIVER SEAT BELT FASTENED — Continued

TEST	ACTION	APPLICABILITY
5	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*CHIME SOUNDS WITH DRIVER'S DOOR OPEN, KEY REMOVED

POSSIBLE CAUSES
KEY-IN IGNITION SWITCH SHORTED
KEY-IN IGNITION SW SENSE SHORT TO GROUND
INSTRUMENT CLUSTER - KEY-IN IGNITION SHORTED

TEST	ACTION	APPLICABILITY
1	Disconnect the Ignition Switch connector. Did the chime turn off? Yes → Check the Ignition Lock Cylinder for damage. If OK replace the Ignition Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn ignition off. Disconnect the Ignition Switch connector. Remove the Instrument Cluster from the I/P. Measure the resistance of the Key-in Ignition Switch Sense circuit to ground at the Instrument Cluster C2 connector. Is the resistance below 100.0 ohms? Yes → Repair the Key-In Ignition Switch Sense wire for a short to ground.. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM AIRBAG CONTROL MODULE

POSSIBLE CAUSES
CHECKING FOR VOLTAGE AT ACM
GROUND CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
AIRBAG CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ensure that the battery is fully charged. **WARNING: TO AVOID PERSONAL INJURY OR DEATH TURN THE IGNITION OFF, DISCONNECT THE BATTERY AND WAIT TWO MINUTES BEFORE PROCEEDING.** Disconnect the ACM harness connector. Connect the appropriate Load Tool ACM Adapter to the ACM connector. Turn the ignition on and then reconnect the Battery. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output (Run) Circuit and the Fused Ignition Switch Output (Run/Start) Circuit at the ACM connector. NOTE: One open circuit will not cause a NO RESPONSE condition. Is the test light illuminated on both circuits? Yes → Go To 2 No → Repair the Fused Ignition Switch Output (Run) and Fused Ignition Switch Output (Run/Start) circuits for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
2	**NOTE: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** **Warning: To avoid personal injury or death, turn the ignition Off, disconnect the Battery and wait 2 minutes before proceeding.** Disconnect the Airbag Control Module harness connector. Connect the appropriate Load Tool ACM Adapter to the ACM connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **Note: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All

*NO RESPONSE FROM AIRBAG CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Turn the ignition off and wait 2 minutes before proceeding. Disconnect the Airbag Control Module harness connector. Connect the appropriate Load Tool ACM Adapter to the ACM connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the ACM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform AIRBAG VERIFICATION TEST - VER 1. **NOTE: When reconnecting Airbag system components, the ignition must be turned off and the battery must be disconnected.**	All
4	If there are no possible causes remaining, view repair. Repair Replace the Airbag Control Module (ACM) in accordance with the Service Information. Perform AIRBAG VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE PCM
CHECK FUSE #7 IN FUSE BLOCK
OPEN GROUND CIRCUITS
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
SCI TRANSMIT CIRCUIT OPEN
CONTROLLER ANTILOCK BRAKE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB attempt to communicate with the PCM. Was the DRB able to communicate with the PCM? Yes → Go To 2 No → Refer to symptom list for problems related to No Response From PCM. Perform ABS VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove and inspect fuse #7 in the Fuse Block. Is the fuse open? Yes → Refer to the wiring diagrams located in the service information to help isolate a possible short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. **NOTE: Ensure fuse #7 is installed in the Fuse Block.** Disconnect the CAB harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 5 No → Repair the Fused Ignition Switch Output circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CAB harness connector. Measure the resistance of the SCI Transmit circuit between the CAB connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the SCI Transmit circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM INSTRUMENT CLUSTER

POSSIBLE CAUSES
OPEN GROUND CIRCUIT
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN FUSED B+ CIRCUIT
OPEN PCI BUS CIRCUIT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Turn all lights off. Disconnect the Instrument Cluster C1 harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 2 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 3 No → Check the fuse in the Fuse Block for an open. Refer to the wiring diagrams. If ok, repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Using a 12-volt test light connected to ground, probe the Fused B+ circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused B+ circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM INSTRUMENT CLUSTER — Continued

TEST	ACTION	APPLICABILITY
4	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Instrument Cluster C2 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Instrument Cluster connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 5 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	If there are no possible causes remaining, view repair. Repair Replace the Instrument Cluster in accordance with the service information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*NO RESPONSE FROM PCM (PCI BUS)

POSSIBLE CAUSES
PCM PCI NO RESPONSE
PCI BUS CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: As soon as one or more module communicates with the DRB, answer the question.** With the DRBIII®, enter Body then Electro/Mechanical Cluster (MIC). With the DRBIII®, enter Passive Restraints then Airbag. Were you able to establish communications with any of the modules? Yes → Go To 2 No → Refer to symptom PCI Bus Communication Failure in the Communications category. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	With the DRBIII® read PCM Diagnostic Trouble Codes. This is to ensure power and grounds to the PCM are operational. **NOTE: If the DRBIII® will not read PCM DTC's, follow the NO RESPONSE TO PCM (SCI only) symptom path.** **NOTE: If the vehicle will not start and the DRBIII® displays a no response message, refer to the appropriate symptom in the powertrain diagnostic procedures.** Turn the ignition off. Disconnect the PCM C3 harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRBIII®. Attach the red and black leads and the cable to probe adapter to the scope input cable. Install DRBIII® SuperCard 2 CH8361 into DRBIII®. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the PCM ground. Connect the Red lead to the PCI Bus circuit in the PCM connector. Turn the ignition on. Observe the voltage display on the DRBIII® Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Repair the PCI Bus circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM PCM (SCI ONLY)

POSSIBLE CAUSES
CHECK PCM POWERS AND GROUNDS
CONTROLLER ANTILOCK BRAKE
SCI TRANSMIT CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
SCI RECEIVE CIRCUIT SHORTED TO VOLTAGE
SCI CIRCUITS SHORTED TOGETHER
SCI TRANSMIT CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT SHORTED TO GROUND
SCI RECEIVE CIRCUIT OPEN
SCI TRANSMIT CIRCUIT OPEN
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Perform the symptom Checking PCM Power and Ground Circuits in the Driveability category. **NOTE: With the DRBIII® in the generic scan tool mode, attempt to communicate with the PCM.** **NOTE: If the DRBIII® can communicate with the PCM in the generic scan tool mode, it may not be necessary to perform this step.** Did the vehicle pass this test? Yes → Go To 2 No → Repair as necessary. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off. Disconnect the CAB harness connector (if equipped). **NOTE: If vehicle is not equipped with antilock brakes, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Replace the Controller Antilock Brake in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

*NO RESPONSE FROM PCM (SCI ONLY) — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the TCM harness connector (if equipped). **NOTE: If vehicle is not equipped with a TCM, answer yes to the question.** Measure the resistance between ground and the SCI Transmit circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Transmit circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Replace the Transmission Control Module in accordance with the service information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
5	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Disconnect the TCM harness connector (if equipped). Disconnect the CAB harness connector (if equipped). Turn the ignition on. Measure the voltage of the SCI Transmit circuit at the DLC connector (cav 7). Is the voltage above 1.0 volt? Yes → Repair the SCI Transmit circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Turn the ignition on. Measure the voltage of the SCI Receive circuit at the DLC connector (cav 6). Is the voltage above 1.0 volt? Yes → Repair the SCI Receive circuit for a short to voltage. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the DRB from the DLC. Disconnect the PCM harness connectors. Measure the resistance between the SCI Transmit circuit and the SCI Receive circuit at the PCM connector. Is the resistance below 5.0 ohms? Yes → Repair the short between the SCI Transmit and the SCI Receive circuits. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance between ground and the SCI Receive circuit. Is the resistance below 5.0 ohms? Yes → Repair the SCI Receive circuit for a short to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1. No → Go To 9	All

*NO RESPONSE FROM PCM (SCI ONLY) — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Receive circuit between the PCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 10 No → Repair the SCI Receive circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
10	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the DRB from the DLC. Measure the resistance of the SCI Transmit circuit between the PCM connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 11 No → Repair the SCI Transmit circuit for an open. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All
11	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module in accordance with the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 1.	All

Symptom:
*NO RESPONSE FROM RADIO

POSSIBLE CAUSES
NO RESPONSE FROM RADIO
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
OPEN FUSED B+ CIRCUIT
RADIO GROUND CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
RADIO

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Instrument Cluster (MIC). Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Communications category and perform the symptom PCI Bus Communication Failure. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Radio harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 3 No → Check Fuse Block fuse for an open. If ok, repair the Fused Ignition Switch Output circuit for an open or short. Refer to the wiring diagrams located in the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Radio harness connector. Using a 12-volt test light connected to ground, probe each Fused B+ circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the Fused B+ circuit for an open or short. Refer to the wiring diagrams located in the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM RADIO — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Radio harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 5 No → Repair the ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the Radio harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the Radio connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 6 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Radio. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

*NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE INSTRUMENT CLUSTER
GROUND CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN
OPEN PCI BUS CIRCUIT
SENTRY KEY IMMOBILIZER MODULE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB, enter Body then Electro/Mech Cluster. Was the DRB able to I/D or communicate with the Instrument Cluster? Yes → Go To 2 No → Refer to the symptom list for problems related to no communication with the Instrument Cluster. Perform SKIS VERIFICATION.	All
2	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to 12-volts, probe the ground circuit. Is the test light illuminated? Yes → Go To 3 No → Repair the ground circuit for an open. Perform SKIS VERIFICATION.	All
3	Turn the ignition off. Disconnect the SKIM harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 4 No → Repair the Fused Ignition Switch Output circuit for an open. Perform SKIS VERIFICATION.	All
4	Turn the ignition off. Disconnect the SKIM harness connector. Using a 12-volt test light connected to ground, probe the Fused B(+) circuit. Is the test light illuminated? Yes → Go To 5 No → Check the Fuse in the Fuse Block for an open. Refer to the wiring diagrams. If OK, repair the Fused B+ circuit for an open. Perform SKIS VERIFICATION.	All

*NO RESPONSE FROM SENTRY KEY IMMOBILIZER MODULE — Continued

TEST	ACTION	APPLICABILITY
5	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the SKIM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the SKIM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 6 No → Repair the PCI Bus circuit for an open. Perform SKIS VERIFICATION.	All
6	If there are no possible causes remaining, view repair. Repair Replace and program the Sentry Key Immobilizer Module in accordance with the Service Information. Perform SKIS VERIFICATION.	All

Symptom:
*NO RESPONSE FROM TRANSMISSION CONTROL MODULE

POSSIBLE CAUSES
NO RESPONSE FROM TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT SHORT
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT(S) OPEN
OPEN PCI BUS CIRCUIT
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Instrument Cluster. Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Body Communication category and perform the symptom PCI Bus Communication Failure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams location in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the starter relay from the PDC. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Start) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Observe the test light while momentarily turning the ignition switch to the Start position. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (Start) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. With a voltmeter in the millivolt scale, measure the voltage of the Fused Ignition Switch Output (Start) circuit. **NOTE: A no response condition can exist if voltage is present on this circuit with the ignition switch in any position except for the Start position.** **NOTE: Voltage up to .080 millivolts can cause this condition.** **NOTE: Check for after market components that could cause this condition.** Perform this step with the Ignition Switch in every position except for the Start position. Is any voltage present? Yes → Repair the Fused Ignition Switch Output (Start) circuit for a short to voltage. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5 **Note: Reinstall the original Starter Relay.**	All
5	Turn the ignition off. Disconnect the TCM harness connector. Using a 12-volt test light connected to ground, check the Fused B(+) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Fused B(+) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Using a 12-volt test light connected to 12-volts, check each ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly at all the ground circuits? Yes → Go To 7 No → Repair the Ground circuit(s) for an open. Check the main ground connection to engine block and/or chassis. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the TCM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the TCM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 8 No → Repair the PCI Bus circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
8	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module in accordance with the service information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
*PCI BUS COMMUNICATION FAILURE

POSSIBLE CAUSES
WIRING HARNESS INTERMITTENT
OPEN PCI BUS CIRCUIT AT THE DATA LINK CONNECTOR (DLC)
PCI BUS CIRCUIT SHORTED TO VOLTAGE
MODULE SHORT TO VOLTAGE
PCI BUS CIRCUIT SHORTED TO GROUND
MODULE SHORT TO GROUND

TEST	ACTION	APPLICABILITY
1	**Note: Determine which modules this vehicle is equipped with before beginning.** **Note: When attempting to communicate with any of the modules on this vehicle, the DRB will display 1 of 2 different communication errors: a NO RESPONSE message or a BUS +/- SIGNALS OPEN message.** Turn the ignition on. Using the DRB, attempt to communicate with the following control modules: Airbag Control Module SKIM (SENTRY KEY IMMOBILIZER) MIC (INSTRUMENT CLUSTER) Was the DRBIII® able to communicate with one or more Module(s)? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. **Note: Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires.** **Note: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.** **Note: If the DRB can not communicate with a single module, refer to the category list for the related symptom.** Were any problems found? Yes → Repair wiring harness/connectors as necessary. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All
3	Turn the ignition off. Disconnect the PCM harness connector. Disconnect the DRB from the Data Link Connector (DLC). Disconnect the negative battery cable. Measure the resistance of the PCI Bus circuit between the Data Link Connector (DLC) and the PCM connector. Is the resistance below 5.0 ohms? Yes → Go To 4 No → Repair the PCI Bus circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*PCI BUS COMMUNICATION FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	**NOTE: Reconnect the PCM harness connector and the negative battery cable.** Turn the ignition on. Measure the voltage of the PCI Bus circuit at the Data Link Connector (DLC). Is the voltage above 7.0 volts? Yes → Go To 5 No → Go To 6	All
5	Turn the ignition off. Using a voltmeter, connect one end to the PCI Bus circuit at the DLC, and the other end to ground. **Note: When performing the next step turn the ignition off (wait one minute) before disconnecting any module. When the module is disconnected turn the ignition on to check for a short to voltage.** Turn the ignition on. While monitoring the voltmeter, disconnect each module the vehicle is equipped with one at a time. Is the voltage steadily above 7.0 volts with all the modules disconnected? Yes → Repair the PCI Bus circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to voltage was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the negative battery cable. Using a ohmmeter, connect one end to the PCI Bus circuit at the DLC, and the other end to ground. While monitoring the ohmmeter, disconnect each module the vehicle is equipped with one at a time. **NOTE: Total bus resistance to ground thru all of the modules is typically between 350 to 1000 ohms. The more modules on the bus, the lower the total bus resistance will be.** Is the resistance below 150.0 ohms with all the modules disconnected? Yes → Repair the PCI Bus circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the module that when disconnected the short to ground was eliminated. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COMPASS/TEMP MODULE WILL NOT CALIBRATE

POSSIBLE CAUSES
CALIBRATION PROCEDURE
COMPASS/TEMPERATURE MIRROR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Perform the Compass/Temperature module self-check. Press and hold the Compass/Temperature Mirror Center switch. Turn the ignition on and then release the Center switch. **NOTE: The Compass/Temp module will illuminate all of the VF segments and then display an ″F″ or ″P″.** Exit the self-check by pressing the Center switch or cycling the ignition. Did the Comp/Temp module display an ″F″ during the self-check? Yes → Replace the Compass/Temperature Mirror in accordance with the Service Information. NOTE: After replacement, set the correct compass variation and calibrate. The vehicle must be driven for more than 2 minutes to update the temperature display. Perform BODY VERIFICATION TEST - VER 1. No → Ensure that all calibration instructions have been performed properly. If calibration is unsuccessful, replace the Comp/Temp Mirror in accordance with the Service Information. NOTE: After replacement, set the correct compass variation and calibrate. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COMPASS/TEMPERATURE MODULE INOPERATIVE

POSSIBLE CAUSES
FUSED B(+) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
GROUND CIRCUIT OPEN
COMPASS/TEMPERATURE MIRROR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Compass/Temperature Mirror harness connector. Measure the voltage between the Fused B(+) circuit and ground. Is the voltage below 10.5 volts? Yes → Repair the Fused B(+) circuit for an open. If the fuse is open make sure to check for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Compass/Temperature Mirror harness connector. Turn the ignition on. Measure the voltage between the Fused Ignition Switch Output circuit and ground. Is the voltage below 10.5 volts? Yes → Repair the Fused Ignition Switch Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Compass/Temperature Mirror harness connector. Measure the resistance between ground and the Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Compass/Temperature Mirror in accordance with the Service Information. NOTE: After replacement, the vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
***TEMPERATURE DISPLAY INACCURATE OR INOPERATIVE**

POSSIBLE CAUSES
AMBIENT TEMPERATURE SENSOR
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
AMBIENT TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
AMBIENT TEMPERATURE SENSOR GROUND CIRCUIT OPEN
COMPASS/TEMPERATURE MIRROR

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Measure the resistance of the Ambient Temperature Sensor between pin 1 and pin 2. The Ambient Temperature Sensor should measure within the following values: 10°C (50°F) Sensor Resistance = 17.99k - 21.81k Ohms 20°C (68°F) Sensor Resistance = 11.37k - 13.61k Ohms 25°C (77°F) Sensor Resistance = 9.12k - 10.88k Ohms 30°C (86°F) Sensor Resistance = 7.37k - 8.75k Ohms 40°C (104°F) Sensor Resistance = 4.90k - 5.75k Ohms 50°C (122°F) Sensor Resistance = 3.33k - 3.88k Ohms Does the Ambient Temperature Sensor resistance measure between the min/max specifications? Yes → Go To 2 No → Replace the Ambient Temperature Sensor in accordance with the Service Information. NOTE: After any repair for an Ambient Temperature Sensor problem, the vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the Compass/Temperature Mirror harness connector. Measure the resistance of the Signal circuit between the Ambient Temperature Sensor connector and the Compass/Temperature Mirror connector. Is the resistance above 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Signal circuit for an open. NOTE: After any repair for an Ambient Temperature Sensor problem, thee vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All

*TEMPERATURE DISPLAY INACCURATE OR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the Compass/Temperature Mirror harness connector. Measure the resistance between ground and the Ambient Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Signal circuit for a short to ground. NOTE: After any repair for an Ambient Temperature Sensor problem, the vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Ambient Temperature Sensor harness connector. Disconnect the Compass/Temperature Mirror harness connector. Measure the resistance of the Sensor Ground circuit between the Ambient Temperature Sensor connector and the Compass/Temperature Mirror connector. Is the resistance above 5.0 ohms? Yes → Repair the Ambient Temperature Sensor Ground circuit for an open. NOTE: After any repair for an Ambient Temperature Sensor problem, the vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Compass/Temperature Mirror in accordance with the Service Information. NOTE: After any repair for an Ambient Temperature Sensor problem, the vehicle must be driven for more than 2 minutes to update the display. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:

*REAR WINDOW DEFOGGER INOPERATIVE

POSSIBLE CAUSES
REAR WINDOW DEFOGGER GROUND CKT
REAR WINDOW DEFOGGER GRID OPEN
REAR WINDOW DEFOGGER RELAY OUTPUT OPEN
FUSED IGNITION SWITCH OUTPUT (RUN) OPEN
FUSED B(+) CKT OPEN
RELAY COIL
RELAY CONTACTS
REAR WINDOW DEFOGGER RELAY CONTROL CIRCUIT OPEN
REAR WINDOW DEFOGGER SWITCH SENSE CKT OPEN
REAR WINDOW DEFOGGER SWITCH SENSE CKT SHORTED TO GROUND
REAR WINDOW DEFOGGER SWITCH SENSE CKT SHORTED TO VOLTAGE
REAR WINDOW DEFOGGER SWITCH
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Toggle the Rear Defogger switch and listen to the Rear Window Defogger Relay in the PDC. Does the relay click when the switch is pressed? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Open the tailgate. Measure resistance between ground and the Rear Window Defogger Ground circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Rear Window Defogger Ground Circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition on. Turn the Rear Window Defogger on. Using a 12-volt test light connected to ground, check the Rear Window Defogger Relay Output circuit at the defogger grid. Does the test light illuminate brightly? Yes → Repair the open in the Rear Window Defogger Grid. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*REAR WINDOW DEFOGGER INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Remove the Rear Window Defogger Relay. Turn the ignition on. Measure voltage of the Fused B+ Circuit in the Rear Window Defogger Relay connector. Is the voltage above 10.0 volts? Yes → Go To 5 No → Repair the open Fused B+ Circuit from PDC fuse #2. Perform BODY VERIFICATION TEST - VER 1.	All
5	Remove the Rear Window Defogger Relay. Install a known good relay in the Rear Window Defogger Relay connector. Turn the ignition on. Check the Rear Window Defogger for proper operation. Does the system operate normally? Yes → Replace the original Rear Window Defogger Relay. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Rear Window Defogger Relay Output Circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1.	All
6	Remove the Rear Window Defogger Relay from the PDC. Turn the ignition switch On. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit at the relay. Does the test light illuminate brightly? Yes → Go To 7 No → Repair the open Fused Ignition Switch Output circuit from PDC fuse #7 Perform BODY VERIFICATION TEST - VER 1.	All
7	Install a known good relay in the Rear Window Defogger Relay. Turn the ignition on. Check the Rear Window Defogger for proper operation. Does the system operate normally? Yes → Replace the original Rear Window Defogger Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off. Remove the Rear Window Defogger Relay from the PDC. Disconnect the Instrument Cluster C2 connector. Measure the resistance of the Rear Window Defogger Relay Control circuit between the Instrument Cluster C2 connector and the PDC. Is the resistance below 5.0 ohms? Yes → Go To 9 No → Repair the Rear Window Defogger Relay Control Circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*REAR WINDOW DEFOGGER INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the Instrument Cluster C2 connector. Disconnect the Rear Window Defogger Switch connector. Turn the ignition on. Measure voltage between the Rear Window Defogger Switch Sense Circuit and ground. Is any voltage present? Yes → Repair the Rear Window Switch Sense Circuit for a short to voltage condition. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off. Disconnect the Instrument Cluster C2 connector. Disconnect the Rear Window Defogger Switch connector. Measure resistance between ground and the Rear Window Defogger Switch Sense Circuit. Is the resistance below 5.0 ohms? Yes → Repair the Rear Window Defogger Switch Sense Circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Go To 11	All
11	Turn the ignition off. Disconnect the Instrument Cluster C2 connector. Disconnect the Rear Window Defogger Switch. Measure resistance of the Rear Window Defogger Switch Sense circuit from the Instrument Cluster C2 connector to the Defogger switch connector. Is the resistance below 5.0 ohms? Yes → Go To 12 No → Repair the Rear Window Defogger Switch Sense Circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1.	All
12	Turn the ignition off. Reinstall the Rear Window Defogger Relay. Reconnect the Instrument Cluster C2 connector. Disconnect the Rear Window Defogger Switch connector. Turn the ignition on. Connect a jumper wire between the Rear Window Defogger Switch Sense circuit in the Defogger Switch connector to ground and listen for the relay to click. Does the Defogger Relay click? Yes → Replace the Rear Window Defogger Switch. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR WINDOW DEFOGGER SWITCH INDICATOR LAMP INOPERATIVE

POSSIBLE CAUSES
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT CKT SHORTED TO GROUND
FUSE BLOCK FUSE #17
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT CKT OPEN
DEFOGGER SWITCH

TEST	ACTION	APPLICABILITY
1	Inspect Fuse Block fuse #17. Is Fuse Block fuse #17 open? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. Disconnect the Rear Defogger Switch. Measure resistance of the Fused Rear Window Defogger Relay Output circuit to ground. Is the resistance below 5.0 ohms? Yes → Repair the Fused Rear Window Defogger Relay Output circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Replace Fuse Block fuse #17. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Rear Defogger Switch. Remove the Rear Window Defogger Relay. Ensure that Fuse Block fuse #17 is installed. Measure resistance of the Fused Rear Window Defogger Relay Output circuit from the relay output terminal to the Defogger Switch connector. Is the resistance below 5.0 ohms? Yes → Replace the Rear Window Defogger Switch. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fused Rear Window Defogger Relay Output circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
ACM MESSAGE NOT REC'D BY MIC

When Monitored and Set Condition:

ACM MESSAGE NOT REC'D BY MIC

When Monitored: With the ignition in the Run/Start position, Instrument Cluster in power-up state.

Set Condition: The Instrument Cluster detects loss of communication with the Air Bag Control Module (ACM).

POSSIBLE CAUSES
ACM MESSAGE NOT RECEIVED

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the Instrument Cluster communicates on the PCI Bus.** With the DRBIII®, select Body, Electro/Mech Cluster, then read DTCs. Does the DRBIII® display ACM Message Not Rec'd by MIC? Yes → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
AIR BAG LAMP CIRCUIT OPEN

When Monitored and Set Condition:

AIR BAG LAMP CIRCUIT OPEN

When Monitored: With the ignition in the Run/Start position, Instrument Cluster in power-up state.

Set Condition: The Instrument Cluster performs an indicator check when the indicator is commanded on or off by the ACM. If an open lamp failure is detected, the Cluster sends this meesage to the ACM.

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the Instrument Cluster and the Air Bag Control Module communicate on the PCI Bus.** **NOTE: The Airbag indicator can only be turned on or off by the ACM. The Instrument Cluster reports the indicator status to the ACM on the PCI Bus.** With the DRBIII®, read DTCs. Does the DRBIII® display Air Bag Lamp Circuit Open? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
AIR BAG LAMP CIRCUIT SHORT

When Monitored and Set Condition:

AIR BAG LAMP CIRCUIT SHORT

When Monitored: With the ignition in the Run/Start position, the Instrument Cluster in power-up state.

Set Condition: The Instrument Cluster performs an indicator check when the indicator is commanded on by the ACM. If a shorted lamp failure is detected, the Cluster sends this message to the ACM.

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the Instrument Cluster and the Air Bag Control Module communicate on the PCI Bus.** **NOTE: The Airbag indicator can only be turned on or off by the ACM. The Instrument Cluster reports the status of the indicator to the ACM on the PCI Bus.** With the DRBIII®, read DTCs. Does the DRBIII® display Air Bag Lamp Circuit Shorted? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CHECKSUM FAILURE

When Monitored and Set Condition:

CHECKSUM FAILURE

When Monitored: Instrument Cluster detects battery connection.

Set Condition: Instrument Cluster fails EEPROM checksum test. (The Instrument Cluster performs an EEPROM checksum as a continuous self test to verify functionality.)

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select Body, then Electro/Mech Cluster, read DTCs. Does the DRBIII® display Checksum Failure? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PANEL DIMMER OPEN

When Monitored and Set Condition:

PANEL DIMMER OPEN

When Monitored: The Instrument Cluster detects battery voltage input on the Headlamp Switch Output circuit.

Set Condition: The Instrument Cluster detects the Panel Lamp Dimmer Signal circuit resistance is greater than 9250 ohms for five seconds. During an open circuit condition, the VF display and general panel illumination will default to full intensity.

POSSIBLE CAUSES
INTERMITTENT CONDITION
PANEL LAMP DIMMER SIGNAL CIRCUIT OPEN
MULTI-FUNCTION SWITCH
MULTI-FUNCTION SWITCH GROUND CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTCs. Cycle the ignition. With the DRBIII®, read DTCs. Does the DRBIII® display Panel Dimmer Open? Yes → Go To 2 No → The conditon is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Disconnect the Multi-Function Switch harness connector. Check connectors - Clean/repair as necessary. Measure the resistance of the Panel Lamp Dimmer Signal circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the Panel Lamp Dimmer Signal circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

PANEL DIMMER OPEN — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the Multi-Function Switch harness connector. Check connectors - Clean/repair as necessary. Measure the resistance of the Multi-Function Switch between terminal pin 7 and terminal pin 8. Does the resistance measure above 9250 ohms? Yes → Replace the Multi-Function Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Multi-Function Switch harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Multi-Function Switch Ground circuit. Is the resistance below 5.0 ohms? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Multi-Function Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
PCM MESSAGE NOT REC'D BY MIC

When Monitored and Set Condition:

PCM MESSAGE NOT REC'D BY MIC

When Monitored: With the ignition in the Run/Start position, Instrument Cluster in power-up state.

Set Condition: The Instrument Cluster detects loss of communication with Powertrain Control Module (PCM). .

POSSIBLE CAUSES
PCM MESSAGE NOT REC'D BY MIC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the Instrument Cluster communicates on the PCI Bus.** With the DRBIII®, select Body, Electro/Mech Cluster, then read DTCs. Does the DRBIII® display NO RESPONSE FROM PCM (PCI)? Yes → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SKIM MESSAGE NOT REC'D BY MIC

When Monitored and Set Condition:

SKIM MESSAGE NOT REC'D BY MIC

When Monitored: With the ignition in the Run/Start position, Instrument Cluster in power-up state.

Set Condition: The Instrument Cluster detects loss of communication with the Sentry Key Immobilizer Module (SKIM). .

POSSIBLE CAUSES
SKIM MESSAGE NOT RECEIVED

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. **NOTE: Ensure the Instrument Cluster communicates on the PCI Bus.** With the DRBIII®, select Body, Electro/Mech Cluster, then read DTCs. Does the DRBIII® display SKIM Message Not Rec'd by MIC? Yes → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*"NO BUS" IN VF DISPLAY

POSSIBLE CAUSES
PCI BUS MESSAGES NOT REC'D BY MIC
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select J1850 Module Scan. Does the DRBIII® display MIC in the J1850 Module Scan? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*"NO FUSE" IN VF DISPLAY

POSSIBLE CAUSES
FUSED B(+) CIRCUIT SHORT TO GROUND
FUSED B(+) CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Inspect the #24 fuse in the Power Distribution Center. If the fuse is open, replace with proper rated fuse. Turn the ignition on for one minute. Turn the ignition off. Inspect the #24 fuse in the Power Distribution Center. Is the fuse open? Yes → Repair the Fused B(+) circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Measure the voltage between the Fused B(+) circuit and ground. Is the voltage above 10.5 volts? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*4WD INDICATOR INOPERATIVE

POSSIBLE CAUSES
INTERMITTENT CONDITION
TRANSFER CASE SWITCH - EXCEPT OFF-ROAD PACKAGE
4WD INDICATOR CIRCUIT OPEN
TRANSFER CASE SWITCH GROUND CIRCUIT OPEN - EXCEPT OFF-ROAD PACKAGE
TRANSFER CASE SWITCH - OFF-ROAD PACKAGE
TRANSFER CASE POSITION SENSOR INPUT CIRCUIT OPEN
TRANSFER CASE SWITCH GROUND CIRCUIT OPEN - OFF-ROAD PACKAGE
INSTRUMENT CLUSTER - EXCEPT OFF-ROAD PACKAGE
INSTRUMENT CLUSTER - OFF-ROAD PACKAGE

TEST	ACTION	APPLICABILITY
1	Is vehicle equipped with the optional Off-Road Package? Yes → Go To 2 No → Go To 6	All
2	Perform the Instrument Cluster self-test. Turn the ignition off. Press and hold the Trip Reset button. Turn the ignition on. Observe the 4WD indicator during the self-test. **NOTE: The Instrument Cluster self-test can be initiated using the DRBIII®.** Did the 4WD indicator illuminate during the self-test? Yes → Go To 3 No → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition on, Transfer Case Shift Lever in 2H. With the DRBIII® in Inputs/Outputs, read the 4WD Switch state. Place the Transfer Case Shift Lever in 4H or 4L while observing the 4WD Switch State. Did the Does the DRBIII® display 4H or 4L? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*4WD INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Transfer Case Switch harness connector. Connect a jumper wire between cavity 1 and cavity 2. Turn the ignition on. With the DRBIII®, read the 4WD Switch input. Does the DRBIII® display ″Closed?″ Yes → Replace the Transfer Case Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Transfer Case Switch harness connector. Disconnect the PCM C1 harness connector. Measure the resistance of the Transfer Case Position Sensor Input circuit between the T/Case Switch connector and the PCM C1 connector. Is the resistance above 5.0 ohms? Yes → Repair the Transfer Case Position Sensor Input circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Transfer Case Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition on. With the DRBIII®, select Body, MIC, then Inputs/Outputs. Move the transfer case shift lever from the 2H to the 4H or 4L position. Does the DRBIII® display 4WD Switch ″Closed″ with the shift lever in the 4H or 4L position? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the Transfer Case Switch harness connector. Connect a jumper wire between cavity A and cavity B. Turn the ignition on. With the DRBIII®, read the 4WD Switch input. Does the DRBIII® display ″Closed″. Yes → Replace the Transfer Case Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All

*4WD INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off. Disconnect the Transfer Case Switch harness connector. Connect a jumper wire between the 4WD Indicator circuit and ground. Turn the ignition on. With the DRBIII®, read the 4WD Switch state. Does the DRBIII® display ″Closed″? Yes → Go To 9 No → Repair the 4WD Indicator circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Disconnect the Transfer Case Switch harness connector. Measure the resistance between ground and the Transfer Case Switch Ground circuit. Is the resistance below 5.0 ohms? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Transfer Case Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ABS INDICATOR INOPERATIVE

POSSIBLE CAUSES
ABS DTC
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: The Instrument Cluster ABS Indicator will not illuminate during the cluster Self Test. The indicator is controlled by PCI Bus messages received from the CAB.** **NOTE: The CAB will command the ABS Indicator on when the ignition is cycled to the Run/Start position.** With the DRBIII®, read DTCs. Does the DRBIII® display any ABS DTCs? Yes → Refer to the Anti-Lock Brake System category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*AIR BAG INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER
AIR BAG INDICATOR DTC

TEST	ACTION	APPLICABILITY
1	**NOTE: The Instrument Cluster Air Bag Indicator will not illuminate during the cluster Self Test. The indicator is controlled by PCI Bus messages received from the Air Bag Control Module (ACM).** **NOTE: The ACM will command the indicator on when the ignition is cycled to the Run/Start position.** With the DRBIII®, select Body, then MIC, read DTCs. Does the DRBIII® display Air Bag Lamp Open or Air Bag Lamp Shorted? Yes → Refer to the Service Information and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ALL GAUGES INOPERATIVE

POSSIBLE CAUSES
NO RESPONSE - PCI BUS
NO RESPONSE - PCI BUS - INSTRUMENT CLUSTER
NO RESPONSE - PCI BUS - POWERTRAIN CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT CIRCUIT SHORT TO GROUND
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
GROUND CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select System Monitors, then J1850 Module Scan. Does the DRBIII® display MIC PRESENT on the BUS? Yes → Go To 2 No → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, select Body, MIC, MODULE DISPLAY. Does the DRBIII® display NO RESPONSE from MIC? Yes → Refer to symptom *NO CLUSTER BUS MESSAGE in the Communication category. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition on. With the DRBIII®, select Body, MIC, SYSTEM TESTS, PCM Monitor. Does the DRBIII® display PCM INACTIVE ON THE BUS? Yes → Refer to the symptom list for problems related to *NO RESPONSE FROM THE POWERTRAIN CONTROL MODULE. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*ALL GAUGES INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Inspect the #10 Fuse in the Fuse Block. If the fuse is open, replace with proper rated fuse. Turn the ignition on for one minute. Turn the ignition off. Inspect the #10 Fuse in the Fuse Block. Is the fuse open? Yes → Repair the Fused Ignition Switch Output circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Turn the ignition on. Measure the voltage between the Fused Ignition Switch Output circuit and ground. Is the voltage above 10.5 volts? Yes → Go To 6 No → Repair the Fused Ignition Switch Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Instrument Cluster Ground circuit. Is the resistance below 5.0 ohms? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Instrument Cluster Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ANY PCI BUS INDICATOR INOPERATIVE

POSSIBLE CAUSES
NO RESPONSE - PCI BUS
NO RESPONSE - INSTRUMENT CLUSTER
NO RESPONSE - POWERTRAIN CONTROL MODULE
INOPERATIVE INDICATOR
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, select System Monitors, then J1850 Module Scan. Does the DRBIII® display MIC PRESENT on the Bus? Yes → Go To 2 No → Refer to the COMMUNICATION category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition on. With the DRBIII®, Select Body, MIC, then MODULE DISPLAY. Does the DRBIII® display NO RESPONSE from MIC? Yes → Refer to the symptom list for problems related to *NO RESPONSE FROM THE INSTRUMENT CLUSTER Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition on. With the DRBIII®, select Body, MIC, SYSTEM TESTS, PCM MONITOR. Does the DRBIII® display PCM INACTIVE on the BUS? Yes → Refer to the symptom list for problems related to *NO RESPONSE FROM THE POWERTRAIN CONTROL MODULE Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	**NOTE: Diagnose and repair any PCM DTCs before proceeding with this test.** Perform the Instrument Cluster Self Test. Observe the indicator in question during the Self Test. Did the indicator illuminate? Yes → Refer to the appropriate Service Information category to diagnose the related system. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*AXLE LOCK INDICATOR PROBLEMS

POSSIBLE CAUSES
DTC PRESENT
AXLE LOCKER SWITCH FUSED B(+) CIRCUIT OPEN
AXLE LOCKER SWITCH GROUND CIRCUIT OPEN
FRONT LOCKER REQUEST CIRCUIT OPEN
REAR LOCKER REQUEST CIRCUIT OPEN
AXLE LOCK SWITCH
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: The following tests are to diagnose an inoperative Axle Lock indicator. If the Axle Lock indicator flashes, the Enable conditions have not been met to lock the axle, or an axle mechanical fault exists.** **NOTE: The Front Axle Lock and Rear Axle Lock indicators can NOT be diagnosed using the Instrument Cluster self test.** With the DRBIII®, read DTCs. Are any ABS, PCM, VSS, or Transfer Case DTCs present? Yes → Refer to DRIVEABILITY or TRANSMISSION/TRANSFER CASE information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Select the inoperative indicator. Rear Axle Lock Indicator Go To 3 Front Axle Lock Indicator Go To 8	All
3	Perform the Axle Locker test. Turn the ignition on. Place transfer case in 4WD Lo and visually confirm by observing the 4WD indicator. Drive the vehicle at less than 10 MPH (16 km/h). Press the Axle Lock switch once. Did the Rear Axle Lock indicator illuminate? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*AXLE LOCK INDICATOR PROBLEMS — Continued

TEST	ACTION	APPLICABILITY
4	Place the transfer case in 4WD Lo. Drive the vehicle at less than 2.5 MPH (4 km/h). With the DRBIII® in Inputs/Outputs, read the Enable 1 state, (should read LOW). With the DRBIII® in Inputs/Outputs, read the Rear Lock Request state. Press the Axle Lock switch once. Did the Rear Lock Request change state? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Axle Lock Switch harness connector. Measure the voltage between the Fused B(+) circuit and ground. Is the voltage below 10.5 volts? Yes → Repair the Axle Locker Switch Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the Axle Lock Switch harness connector. Measure the resistance between ground and the Axle Locker Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Axle Locker Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the Axle Locker Switch harness connector. Disconnect the Instrument Cluster C1 harness connector. Measure the resistance of the Rear Locker Request circuit between the Axle Locker Switch connector and the Instrument Cluster C1 connector. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Request circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Axle Lock Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

*AXLE LOCK INDICATOR PROBLEMS — Continued

TEST	ACTION	APPLICABILITY
8	Place transfer case in 4WD Lo and drive vehicle at less than 2.5 MPH (4 km/h). Press the Axle Locker Switch once to lock the rear axle. With the DRBIII® in Inputs/Outputs, ensure that the Enable 1 and Enable 2 states both read LOW. With the DRBIII® in Inputs/Outputs, ensure that the Rear Lock Request and Rear Lock Return states both read LOCKED. Press the Axle Locker Switch again. Did the Front Axle Lock indicator illuminate? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All
9	Place the vehicle in 4WD Lo, operate vehicle at 2.5 MPH (4 km/h) or less. With the DRBIII® in Inputs/Outputs, ensure that the Enable 1 and Enable 2 states read LOW. The Rear Axle Lock indicator must be illuminated. With the DRBIII® in Inputs/Outputs, read the Front Lock Request state. Press the Axle Locker Switch. Did the Front Axle Lock Request change state? Yes → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off. Disconnect the Axle Locker Switch harness connector. Disconnect the Instrument Cluster C2 harness connector. Measure the resistance of the Front Locker Request circuit between the Axle Locker Switch connector and the Instrument Cluster C2 connector. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Request circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Axle Lock Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BRAKE WARNING INDICATOR ALWAYS ON

POSSIBLE CAUSES
BRAKE WARNING INDICATOR CIRCUIT SHORT TO GROUND
BRAKE WARNING INDICATOR SWITCH
PARK BRAKE SWITCH

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Base brake system functions properly and that the Brake Master Cylinder is filled with proper amount of fluid.** **NOTE: If equipped, diagnose and repair any ABS DTCs before continuing with this test.** Turn the ignition off. Disconnect the Park Brake Switch harness connector. Turn the ignition on and observe the Brake Warning Indicator. Does the Brake Warning Indicator remain illuminated? Yes → Go To 2 No → Replace the Park Brake Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Brake Warning Indicator Switch harness connector. Connect a jumper wire between cavity 1 and cavity 2. Turn the ignition on and observe the Brake Warning Indicator. Does the Brake Warning Indicator remain illuminated? Yes → Repair the Brake Warning Indicator circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Brake Warning Indicator Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*BRAKE WARNING INDICATOR INOPERATIVE

POSSIBLE CAUSES
BRAKE WARNING INDICATOR CIRCUIT SHORT TO VOLTAGE
BRAKE WARNING INDICATOR CIRCUIT OPEN
BRAKE WARNING INDICATOR SWITCH
PARK BRAKE SWITCH
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Perform the Instrument Cluster Self Test. Did the Brake Warning Indicator illuminate during the Self Test? Yes → Go To 2 No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Check connectors - Clean/repair as necessary. Measure the voltage between the Brake Warning Indicator circuit and ground. Is there any voltage present? Yes → Repair the Brake Warning Indicator circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	**NOTE: Ensure that the Instrument Cluster harness connector is connected.** Turn the ignition off. Disconnect the Brake Warning Indicator Switch (Pressure Switch) harness connector. Connect a jumper wire between cavity 1 and cavity 2. Disconnect the Park Brake Switch harness connector. Connect a jumper wire between the Brake Warning Indicator circuit and ground. Turn the ignition on and observe the Brake Warning Indicator. Does the Brake Warning Indicator illuminate? Yes → Replace the Park Brake Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*BRAKE WARNING INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Disconnect the Park Brake Switch harness connector. Disconnect the Brake Warning Indicator Switch harness connector. Connect a jumper wire between cavity 1 and cavity 2. Measure the resistance of the Brake Warning Indicator circuit. Is the resistance below 5.0 ohms? Yes → Replace the Brake Warning Indicator Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Brake Warning Indicator circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*FOG LAMP INDICATOR INOPERATIVE - DOMESTIC

POSSIBLE CAUSES
FOG LAMP INDICATOR CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Fog Lamps operate properly. If not, refer to EXTERIOR LIGHTING in the Service Information.** **NOTE: The Headlamps must be on Low Beam for indicator to operate.** Turn the ignition off. Disconnect the Instrument Cluster. Check connectors - Clean/repair as necessary. Turn the Headlamps on and actuate the Fog Lamps. Using a 12-volt test light connected to ground, check the Fog Lamp Indicator circuit. Does the test light illuminate brightly? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fog Lamp Indicator circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*HIGH BEAM INDICATOR INOPERATIVE

POSSIBLE CAUSES
HIGH BEAM INDICATOR CIRCUIT OPEN
INDICATOR BULB
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Headlamp High Beams operate properly. If not, refer to the Exterior Lighting Service Information.** Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Turn the Headlamps on and actuate the High Beams. **NOTE: Ensure that the Fog Lamps are not actuated (Domestic vehicles only).** Using a 12-volt test light connected to ground, back probe the High Beam Indicator circuit. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the Dimmer Switch High Beam Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Disconnect the Instrument Cluster. Check connectors - Clean/repair as necessary. Remove and inspect the High Beam Indicator bulb. Is the indicator bulb filament open? Yes → Replace the High Beam Indicator Bulb in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ONE GAUGE INOPERATIVE

POSSIBLE CAUSES
INTERMITTENT CONDITION
POWERTRAIN CONTROL MODULE DTC PRESENT
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTCs. **NOTE: The PCM will not store any DTCs regarding Oil Pressure concerns.** **NOTE: If Oil Pressure gauge readings are in question and the gauge tests good, a mechanical oil pressure gauge must be attached to the engine.** Does the DRBIII® display any PCM DTCs? Yes → Refer to the DRIVEABILITY category and perform the appropriate symptom. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Perform the Instrument Cluster Self Test. Observe the gauge in question while the Instrument Cluster performs the Self Test. The gauges should position at the following calibration points: Speedometer: 20mph (40km/h BUX), 55mph (80km/h BUX), 75mph (120km/h BUX) Tachometer: 2000, 5000 Fuel: Empty Stop, E, 1/2, F, Full Stop Temperature: Lo, Mid Lo, Mid High, High Oil Pressure: 0, 40, 60, Volt: Off, 9, 12, 14, 16, 19 Did the gauge in question operate properly? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*PANEL DIMMNG INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER PANEL DIMMING DTC
PARK LAMP FEED CIRCUIT OPEN
ILLUMINATION BULB
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Park/Headlamps operate properly before continuing with this test.** **NOTE: Ensure that other Instrument Cluster functions operate properly before continuing with this test.** Turn the ignition on. With the DRBIII®, select Body, Electro/Mech Cluster, read DTCs. Does the DRBIII® display PANEL DIMMER OPEN? Yes → Refer to PANEL DIMMER OPEN DTC in the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Turn the Park lamps on. Measure the voltage between the Park Lamp Feed circuit and ground. Is the voltage above 10.5 volts? Yes → Go To 3 No → Repair the Park Lamp Feed circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Check connectors - Clean/repair as necessary. Remove and inspect the inoperative illumination bulb(s). Is the illumination bulb filament open? Yes → Replace the Instrument Cluster Illumination Bulb(s) in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR FOG LAMP INDICATOR INOPERATIVE - BUX ONLY

POSSIBLE CAUSES
REAR FOG LAMP INDICATOR CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that the Rear Fog Lamp operates properly. If not, refer to EXTERIOR LIGHTING in the Service Information.** **NOTE: Headlamps must be turned on for Rear Fog Lamp and indicator to operate.** Turn the ignition off. Disconnect the Instrument Cluster. Check connectors - Clean/repair as necessary. Turn on the Headlamps and Rear Fog Lamp. Using a 12-volt test light connected to ground, check the Rear Fog Lamp Indicator circuit. Does the test light illuminate brightly? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fog Lamp Indicator circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SEAT BELT INDICATOR NOT OPERATING PROPERLY

POSSIBLE CAUSES
SEAT BELT SWITCH SENSE CIRCUIT SHORT TO GROUND
SEAT BELT SWITCH SENSE CIRCUIT OPEN
SEAT BELT SWITCH GROUND CIRCUIT OPEN
SEAT BELT SWITCH
SEAT BELT SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII® in Inputs/Outputs, read the Driver Belt Switch state while buckling and unbuckling the Seat Belt. Does the DRBIII® display Open while the belt is buckled and Closed while unbuckled? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. Perform the Instrument Cluster Self Test while observing the Seat Belt Indicator. Did the Seat Belt Indicator illuminate during the Self Test? Yes → Test Complete. No → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Check connectors - Clean/repair as necessary. **NOTE: Ensure that the Seat Belt is buckled.** Measure the voltage between the Seat Belt Switch Sense circuit and ground. Is there any voltage present? Yes → Repair the Seat Belt Switch Sense circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the Seat Belt Switch harness connector. Disconnect the Instrument Cluster C2 harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Seat Belt Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the Seat Belt Switch Sense circuit for a short to ground. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All

*SEAT BELT INDICATOR NOT OPERATING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the Seat Belt Switch harness connector. Disconnect the Instrument Cluster C2 harness connector. Check connectors - Clean/repair as necessary. Measure the resistance of the Seat Belt Switch Sense circuit. Is the resistance above 5.0 ohms? Yes → Repair the Seat Belt Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the Seat Belt Switch harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Seat Belt Switch Ground circuit. Is the resistance below 5.0 ohms? Yes → Replace the Seat Belt Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Seat Belt Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*SPEEDOMETER INACCURATE OR INOPERATIVE

POSSIBLE CAUSES
PCM DTC PRESENT
INCORRECT CONFIGURATION
INTERMITTENT CONDITION
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, read DTCs. Are any Powertrain DTCs present? Yes → Refer to DRIVEABILITY for the related symptom(s). No → Go To 2	All
2	With the DRBIII®, ensure that the Instrument Cluster is correctly configured for Tire Size, Axle Type, and Transfer Case Type. Are the Instrument Cluster configurations correct? Yes → Go To 3 No → Using the DRBIII®, select Miscellaneous, Configure Cluster for the correct Tire Size, Axle Type, and Transfer Case Type. With the DRBIII®, erase DTCs.	All
3	Turn the ignition off. Perform the Instrument Cluster self test. Press and hold the Trip Reset button. Turn the ignition on. Observe the Speedometer during the self test. NOTE: The self test can also be initiated using the DRBIII®. The Speedometer should pause at the following calibration points: Cal Point 1: 20 MPH (40km/h Canada/BUX) (40 MPH Aus/Japan) Cal Point 2: 55 MPH (80 km/h Canada/BUX) (80 MPH Aus/Japan) Cal Point 3: 75 MPH (120 km/h Canada/BUX) (120 MPH Aus/Japan) Did the Speedometer pause at the correct calibration points? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wire harness. Refer to any Technical Service Bulletins (TSB) that may apply. Visually inspect the related wiring harness and connector terminals. No → Replace and configure the Instrument Cluster in accordance with the Service Information.	All

Symptom:
*VF DISPLAY INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	**NOTE: Ensure that all other Instrument Cluster functions operate properly.** Turn the ignition off. Perform the Instrument Cluster Self Test. Did any or all of the VF display fail to operate? Repair Replace and configure the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*VF ODOMETER INOPERATIVE WITH DOOR OPEN

POSSIBLE CAUSES
DEFECTIVE FUSE
DOOR AJAR SENSE CIRCUIT SHORT TO VOLTAGE
AJAR SWITCH
DOOR AJAR SWITCH SENSE CIRCUIT OPEN
DOOR AJAR SWITCH GROUND CIRCUIT OPEN
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Turn the ignition off. Inspect the #4 fuse in the Fuse Block. If the fuse is open, replace with proper rated fuse. **NOTE: Ensure that the ignition is in the off position.** Open the door(s). Inspect the #4 fuse in the Fuse Block. Is the fuse open? Yes → Go To 2 No → Go To 3	All
2	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Check connectors - Clean/repair as necessary. Measure the voltage between the Door Ajar Switch Sense circuit and ground. **NOTE: This test will work for either the Driver or Passenger Door Ajar Switch Sense circuit.** Is there any voltage present? Yes → Repair the Door Ajar Switch Sense circuit for a short to voltage. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Door Ajar Switch harness connector. **NOTE: This test will work for the Driver or Passenger Door Ajar Switch.** Connect a jumper wire between cavity 1 and cavity 3. Does the VF Odometer illuminate? Yes → Replace the inoperative Door Ajar Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*VF ODOMETER INOPERATIVE WITH DOOR OPEN — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the Door Ajar Switch harness connector. Connect a jumper wire between the Door Ajar Switch Sense circuit and ground. **NOTE: This test will work for the Driver or Passenger Door Ajar Switch Sense circuit.** Does the VF display illuminate? Yes → Go To 5 No → Repair the Door Ajar Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
5	Turn the ignition off. Disconnect the Door Ajar Switch harness connector. Check connectors - Clean/repair as necessary. Measure the resistance between ground and the Door Ajar Switch Ground circuit. **NOTE: This test will work for the Driver or Passenger Door Ajar Switch.** Is the resistance below 5.0 ohms? Yes → Replace the Instrument Cluster in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Door Ajar Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS INOPERATIVE - ALL LAMPS

POSSIBLE CAUSES
FUSED B+ CIRCUIT OPEN
INSTRUMENT CLUSTER - COURTESY LAMP OPEN
COURTESY LAMP FEED CIRCUIT OPEN
INTERMITTENT CONDITION

TEST	ACTION	APPLICABILITY
1	Remove the dome lamp lens. Remove and ensure the bulb is good. Using a 12-volt test light connected to ground, check the Fused B+ circuit. Does the test light illuminate brightly? Yes → Go To 2 No → Repair the Fused B+ Circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Instrument Cluster. Connect a jumper wire between the Courtesy Lamp Feed Circuit and ground. Observe the Dome Lamp. Does the test light illuminate brightly? Yes → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the dome lamp bulb. Disconnect the Instrument Cluster. Connect a jumper wire between the Courtesy Lamp Feed Circuit in the Instrument Cluster connector and ground. Measure resistance of the Courtesy Lamp Feed Circuit from the Dome Lamp to the Instrument Cluster connector. Is the resistance below 5.0 ohms? Yes → Repair the Courtesy Lamp Feed Circuit for an open condition. Perform BODY VERIFICATION TEST - VER 1. No → The condition that caused this symptom is currently not present. Inspect the related wiring for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*COURTESY LAMPS ON AT ALL TIMES

POSSIBLE CAUSES
DRIVERS DOOR AJAR SWITCH
DRIVERS DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER
PANEL LAMPS DIMMER SIGNAL CIRCUIT SHORT TO GROUND
MULTIFUNCTION SWITCH
DOOR AJAR SWITCH OPEN
PASSENGER DOOR AJAR SWITCH SENSE CIRCUIT SHORT TO GROUND
COURTESY LAMP DRIVER CIRCUIT SHORT TO GROUND
INSTRUMENT CLUSTER

TEST	ACTION	APPLICABILITY
1	Close all the doors. Turn the Panel Lamps Dimmer Switch to the MID position. With the DRBIII®, read the Electro/Mech Cluster, I/O's. Does the DRBIII® read CLOSED? Yes → Go To 2 No → Go To 6	All
2	Open the Drivers door. Disconnect the Driver Door Ajar Switch connector. With the DRBIII® select: Body, Electro/Mech Cluster, Input/Output. Read the: Drv Door Ajar Sw - state. Does the DRBIII® show: Open? Yes → Replace the Drivers Door Ajar Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the Driver Door Ajar Switch connector. Disconnect the Instrument Cluster connector. Measure resistance of the Driver Door Ajar Switch Sense Circuit from the door ajar switch connector to ground. Is the resistance below 100.0 ohms? Yes → Repair the Drivers Door Ajar Switch Sense Circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*COURTESY LAMPS ON AT ALL TIMES — Continued

TEST	ACTION	APPLICABILITY
4	Turn the Panel Lamps Dimmer to the MID position. Remove the Instrument Cluster. Measure the resistance between ground and the Panel Lamps Dimmer Signal Circuit in the C2 connector. Is the resistance below 100.0 ohms? Yes → Go To 5 No → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All
5	Disconnect the Instrument Cluster. Disconnect the Multifunction Switch connector. Measure the resistance of the Panel Lamps Dimmer Signal Circuit in the instrument cluster connector to ground. Is the resistance below 200.0 ohms? Yes → Repair the Panel Lamps Dimmer Signal Circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Multifunction Switch. Perform BODY VERIFICATION TEST - VER 1.	All
6	Close all the passenger doors. With the DRBIII® select: Body, Electro/Mech Cluster, Input /Output. Read the, Pas Door Ajar Sw - state. Remove the passenger door ajar switch and observe the DRBIII®. Did the DRBIII® change states to read: Pas Door Ajar Sw: Open? Yes → Replace the applicable open Door Ajar Switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the passenger door ajar switch. Disconnect the Instrument Cluster connector. Measure the resistance of the Passenger Door Ajar Circuit in the Passenger Door Ajar Switch connector. Is the resistance below 100.0 ohms? Yes → Repair the Passenger Door Ajar Switch Sense Circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the Panel Lamps Dimmer to the MID position. Disconnect the Instrument Cluster Connector. Measure the resistance between ground and the Courtesy Lamp Driver Circuit. Is the resistance below 100.0 ohms? Yes → Repair the Courtesy Lamp Driver Circuit for a short to ground condition. Perform BODY VERIFICATION TEST - VER 1. No → Replace the Instrument Cluster. Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*ILLUMINATED ENTRY INOPERATIVE

POSSIBLE CAUSES
COURTESY LAMPS OPERATIONAL
INTERMITTENT CONDITION
ILLUMINATED ENTRY NOT ENABLED

TEST	ACTION	APPLICABILITY
1	Check the Courtesy Lamps for proper operation. Do the Courtesy Lamps operate properly from the Door Ajar Switches? Yes → Go To 2 No → Refer to Symptom list for problems related to COURTESY LAMPS INOPERATIVE. Perform BODY VERIFICATION TEST - VER 1.	All
2	With the DRBIII® select: ENABLE ILLUMINATED ENTRY. With the DRBIII®, read the ILLUMINATED ENTRY status. Does the DRBIII® display ENABLED? Yes → The condition that caused this symptom is currently not present. Inspect the related wiring harness for a possible intermittent condition. Look for any chafed, pierced, pinched or partially broken wires. Perform BODY VERIFICATION TEST - VER 1. No → With the DRB, enable the Illuminated Entry. Perform BODY VERIFICATION TEST - VER 1.	All

Verification Tests

42RLE TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. Connect the DRBIII® to the Data Link Connector (DLC). 2. Reconnect any disconnected components. 3. With the DRBIII®, erase all Transmission DTC's, also erase the PCM DTC's. **4. NOTE: Erase DTC P0700 in the PCM to turn the Malfunction Indicator Lamp (MIL) off after making Transmission repairs.** 5. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT - above 43° C or 110° F. 6. Check the Transmission Fluid and adjust if necessary. Refer to the Service information for the Fluid Fill procedure. **7. NOTE: If the Transmission Control Module or the Transmission has been repaired or replaced it is necessary to perform the DRBIII® Quick Learn Procedure and reset the ″Pinion Factor″** 8. Road test the vehicle. With the DRBIII®, monitor the engine RPM. Make 15 to 20 1-2, 2-3, 3-4 upshifts. Perform these shifts from a standing start to 45 MPH with a constant throttle opening of 20 to 25 degrees. 9. Below 25 MPH, make 5 to 8 wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 10. For a specific DTC, drive the vehicle to the Symptom's When Monitored/When Set conditions to verify the DTC repair. 11. If equipped with AutoStick®, up-shift and down-shift several times using the AutoStick® feature during the road test. **12. NOTE: Use the EATX OBDII Task Manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.** 13. Check for Diagnostic Trouble Codes (DTC's) during the road test. If a DTC sets during the road test , return to the Symptom list and perform the appropriate Symptom. Were there any Diagnostic Trouble Codes (DTCs) set during the road test? Yes → Refer to the Symptom List for appropriate Symptom(s). No → Repair is complete.	All

ABS VERIFICATION TEST - VER 1	APPLICABILITY
1. Turn the ignition off. 2. Connect all previously disconnected components and connectors. 3. Ensure all accessories are turned off and the battery is fully charged. 4. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. 6. If any Diagnostic Trouble Codes are present, return to Symptom list and troubleshoot new or recurring symptom. **7. NOTE: For Sensor Signal and Pump Motor faults, the CAB must sense all 4 wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator.** 8. If there are no DTC's present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several antilock braking stops. **9. Caution: Ensure braking capability is available before road testing.** 10. Again, with the DRBIII® read DTC's. If any DTC's are present, return to Symptom list. 11. If there are no Diagnostic Trouble Codes (DTC's) present, and the customer's concern can no longer be duplicated, the repair is complete. Are any DTC's present or is the original concern still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

Verification Tests — Continued

AIRBAG VERIFICATION TEST - VER 1	APPLICABILITY
1. Remove any special tools or jumper wires and reconnect all previously disconnected components - except the Battery. **2. WARNING: TO AVOID PERSONAL INJURY OR DEATH, TURN THE IGNITION ON, THEN RECONNECT THE BATTERY.** 3. Connect the DRBIII® to the Data Link Connector - use the most current software available. 4. Use the DRBIII® and erase the stored codes in all airbag system modules. 5. Turn the ignition off, and wait 15 seconds, then turn the ignition on. 6. Wait one minute, and read active codes and if there are none present read the stored codes. 7. Note: If equipped with Airbag On - Off switch, read the DTC's in all switch positions. 8. Note: Read the DTC's in all airbag system related modules. 9. If the DRBIII® shows any active or stored codes, return to the Symptom list and follow path specified for that trouble code. If no active or stored codes are present, the repair is complete. Are any DTC's present or is the original condition still present? YES Repair is not complete, refer to appropriate symptom list. NO Repair is complete.	All

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. **2. NOTE: If the SKIM or PCM was replaced, refer to the service information for proper programming procedures.** **3. NOTE: If the MIC was replaced, configure new cluster with Tire Size, Axle, T-Case Type, and EQ Setting.** 4. Ensure all accessories are turned off and the battery is fully charged. 5. With the DRBIII®, record and erase all DTC's from ALL modules. Start and run the engine for 2 minutes. Operate all functions of the system that caused the original concern. 6. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII®, read DTC's from ALL modules. Are any DTCs present or is the original condition still present? Yes → Repair is not complete, refer to the appropriate symptom. No → Repair is complete.	All

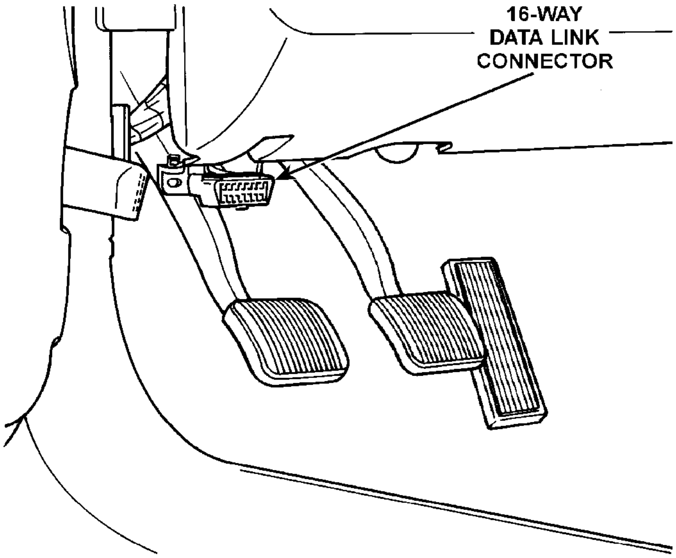
Verification Tests — Continued

POWERTRAIN VERIFICATION TEST VER - 1	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. Inspect the engine oil for contamination. If oil contamination is suspected, change the oil and filter. 3. If the PCM was not replaced skip steps 4 through 6 and continue with the verification. 4. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start. 5. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 6. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM 7. Attempt to start the engine. 8. If the conditions cannot be duplicated, erase all DTCs. Is the vehicle still unable to start and/or are there any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

SKIS VERIFICATION	APPLICABILITY
1. Reconnect all previously disconnected components and connectors. 2. Obtain the vehicle's unique Personal Identification Number (PIN) assigned to it's original SKIM. This number can be obtained from the vehicle's invoice or Chrysler's Customer Center (1-800-992-1997). **3. NOTE: When entering the PIN, care should be taken because the SKIM will only allow 3 consecutive attempts to enter the correct PIN. If 3 consecutive incorrect PINs are entered, the SKIM will Lock Out the DRB for 1 hour.** 4. To exit Lock Out mode, the ignition key must remain in the Run position continually for 1 hour. Turn off all accessories and connect a battery charger if necessary. 5. With the DRB, select Theft Alarm, SKIM and Miscellaneous. Then, select the desired procedure and follow the steps that will be displayed. 6. If the SKIM has been replaced, ensure all of the vehicle ignition keys are programmed to the new SKIM. **7. NOTE: Prior to returning vehicle to the customer, perform a module scan to be sure that all DTCs are erased. Erase any DTCs that are found.** 8. With the DRB, erase all DTCs. Perform 5 ignition key cycles leaving the key on for at least 90 seconds per cycle. 9. With the DRB, read the SKIM DTCs. Are there any SKIM DTCs? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

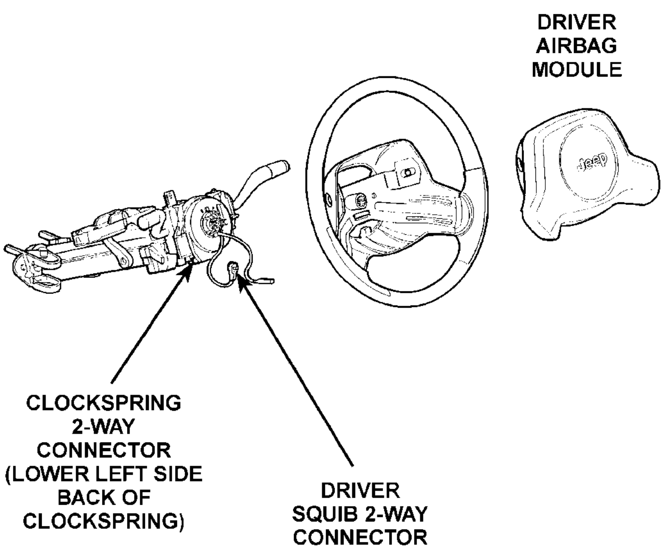
8.0 SYSTEM COMPONENT LOCATIONS

8.1 DATA LINK CONNECTOR



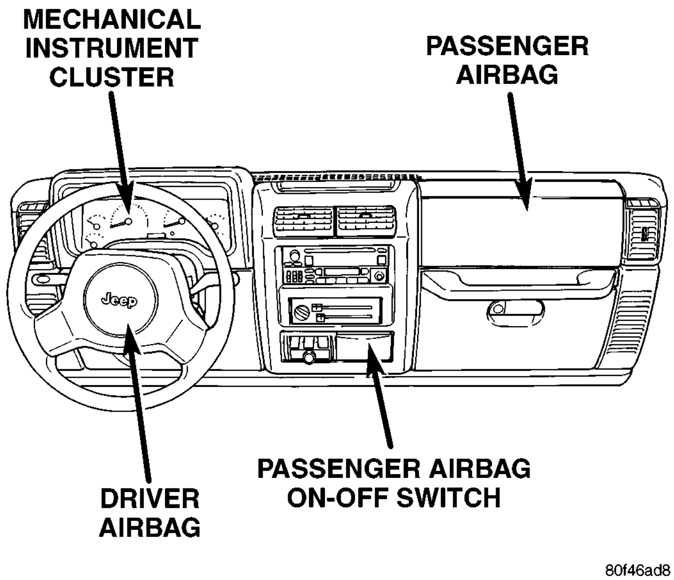
8.2 AIRBAG

8.2.1 DRIVER AIRBAG MODULE & CLOCKSPRING

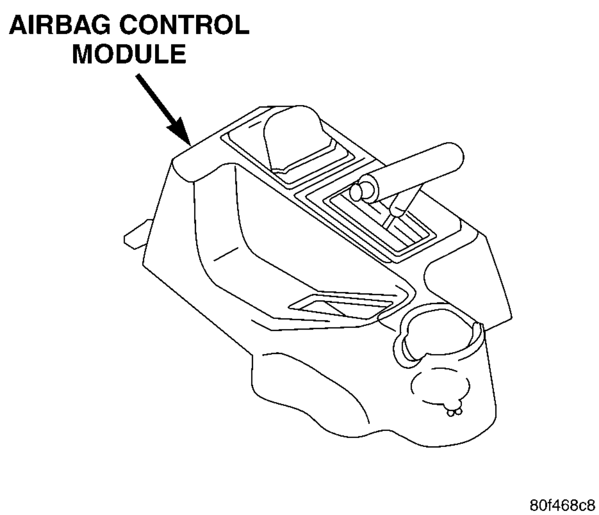


8.2 AIRBAG (Continued)

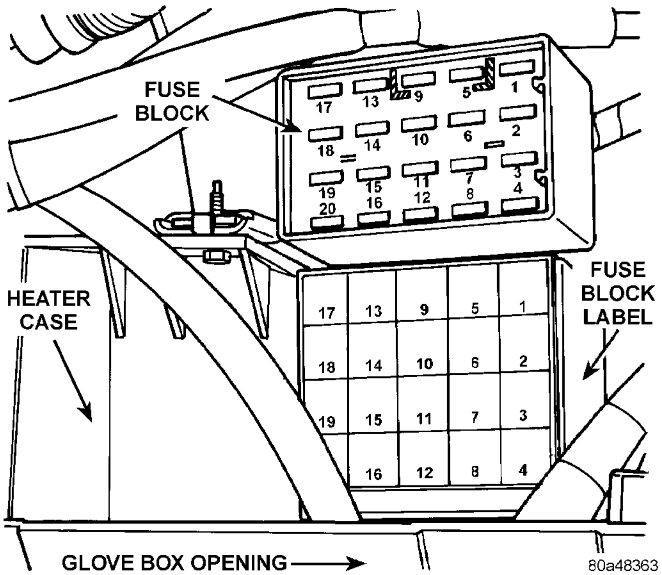
8.2.2 DRIVER/PASSENGER AIRBAG MODULES & MECHANICAL INSTRUMENT CLUSTER



8.2.3 AIRBAG CONTROL MODULE AND PASSENGER AIRBAG ON/OFF SWITCH

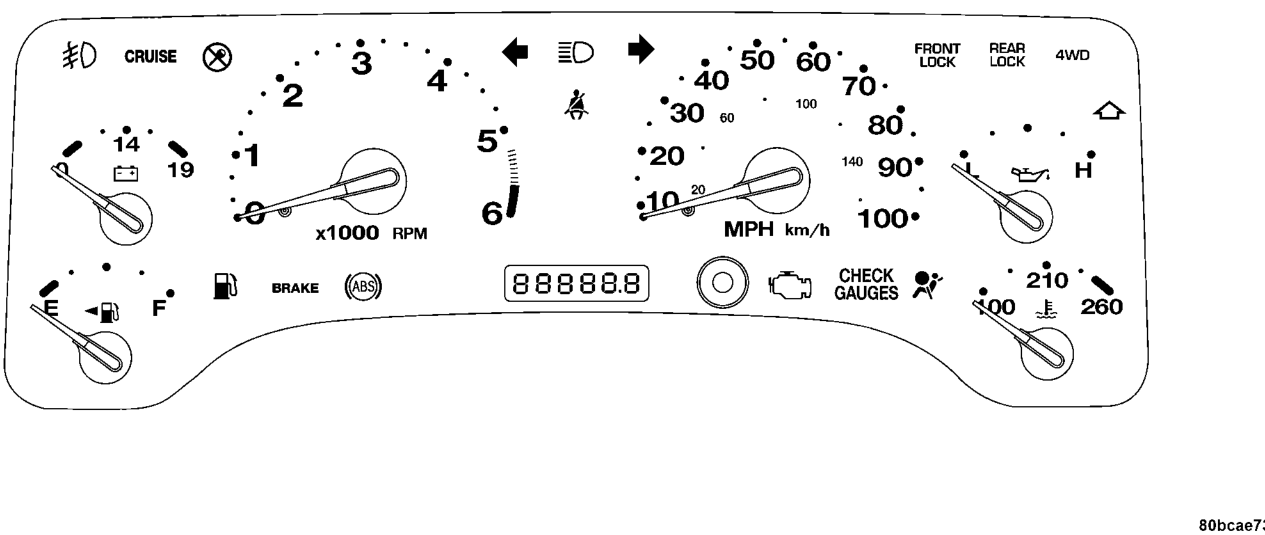


8.3 FUSE BLOCK

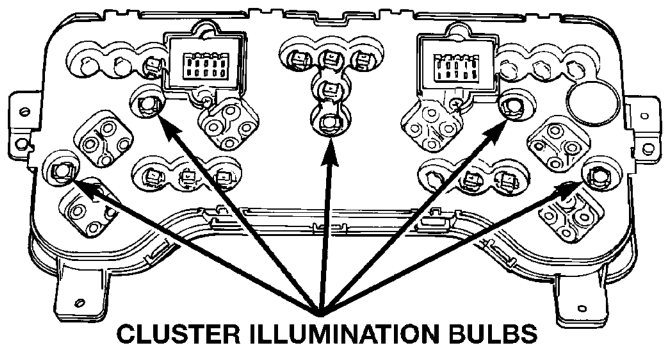


8.4 INSTRUMENT CLUSTER

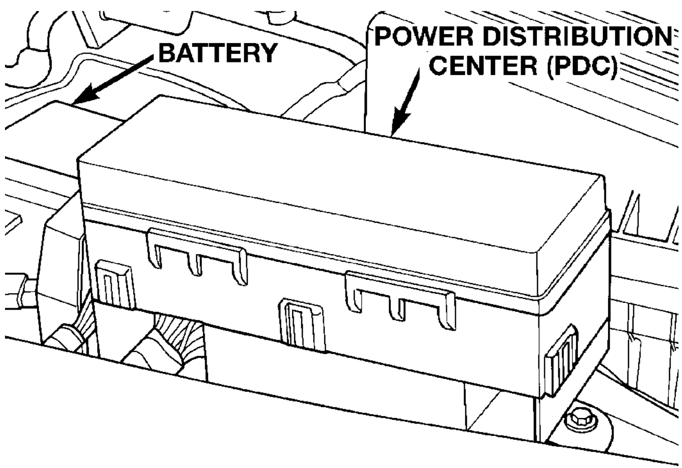
8.4.1 FRONT VIEW



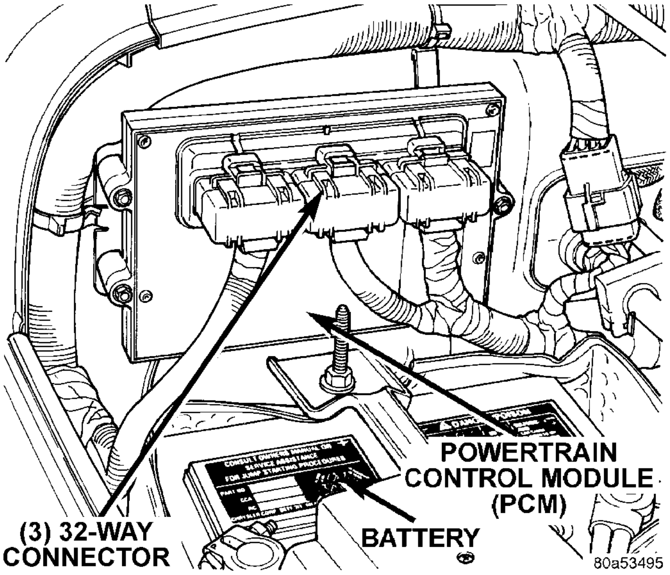
8.4 INSTRUMENT CLUSTER (Continued)
8.4.2 REAR VIEW



8.5 POWER DISTRIBUTION CENTER (PDC)

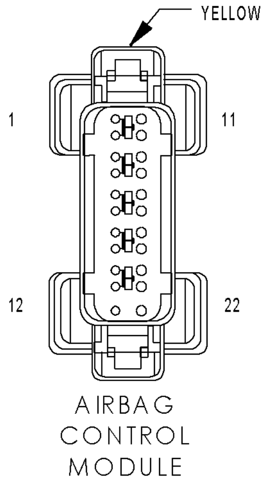


8.6 POWERTRAIN CONTROL MODULE



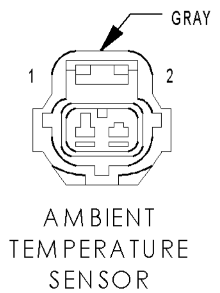
NOTES

9.0 CONNECTOR PINOUTS



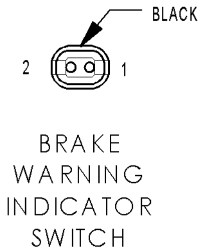
AIRBAG CONTROL MODULE - YELLOW 22 WAY

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1
3	-	-
4	-	-
5	R42 18BK/YL	PASSENGER SQUIB 1 LINE 1
6	R44 18DG/YL	PASSENGER SQUIB 1 LINE 2
7	-	-
8	R166 18LG/BR (PAD)	PASSENGER AIRBAG INDICATOR DRIVER
9	-	-
10	Z6 18BK/PK	GROUND
11	R65 18LG/OR (PAD)	PASSENGER AIRBAG MUX SWITCH SENSE
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
18	D25 18VT/YL	PCI BUS
19	-	-
20	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
21	-	-
22	R66 18YL/LG (PAD)	PASSENGER AIRBAG MUX SWITCH RETURN



AMBIENT TEMPERATURE SENSOR - GRAY 2 WAY

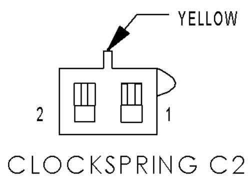
CAV	CIRCUIT	FUNCTION
1	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
2	G32 20BK/LB	SENSOR GROUND



BRAKE WARNING INDICATOR SWITCH - BLACK 2 WAY

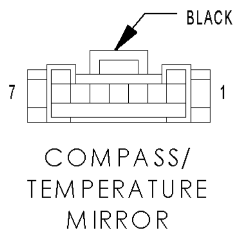
CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	BRAKE WARNING INDICATOR DRIVER
2	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER

C O N N E C T O R P I N O U T S



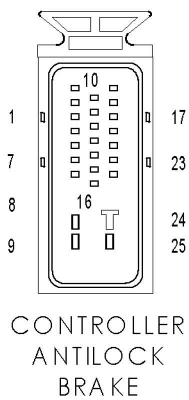
CLOCKSPRING C2 - YELLOW 2 WAY

CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1



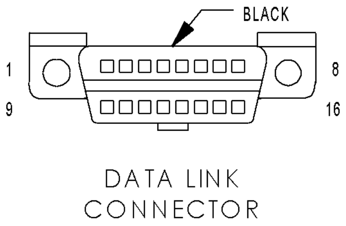
COMPASS/TEMPERATURE MIRROR - BLACK 7 WAY

CAV	CIRCUIT	FUNCTION
1	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	Z2 20BK/LG	GROUND
3	L1 20VT/BK	BACK-UP LAMP FEED
4	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
5	G32 20BK/LB	SENSOR GROUND
6	M2 20YL	COURTESY LAMPS DRIVER
7	M1 20PK/WT	FUSED B(+)



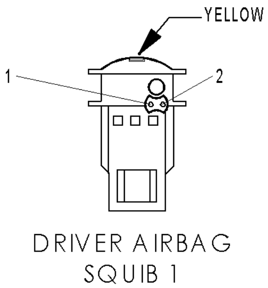
CONTROLLER ANTILOCK BRAKE - 25 WAY

CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	B41 18YL/VT	G-SWITCH NO. 1 SENSE
7	B42 18TN/WT	G-SWITCH NO. 2 SENSE
8	Z22 12BK/PK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
13	B43 18PK/OR	G-SWITCH TEST SIGNAL
14	-	-
15	-	-
16	G83 18GY/BK	ABS RELAY CONTROL
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	-	-
20	D21 18PK	SCI TRANSMIT
21	-	-
22	-	-
23	F20 18VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
24	Z22 12BK/PK	GROUND
25	A10 12RD/DG	FUSED B(+)



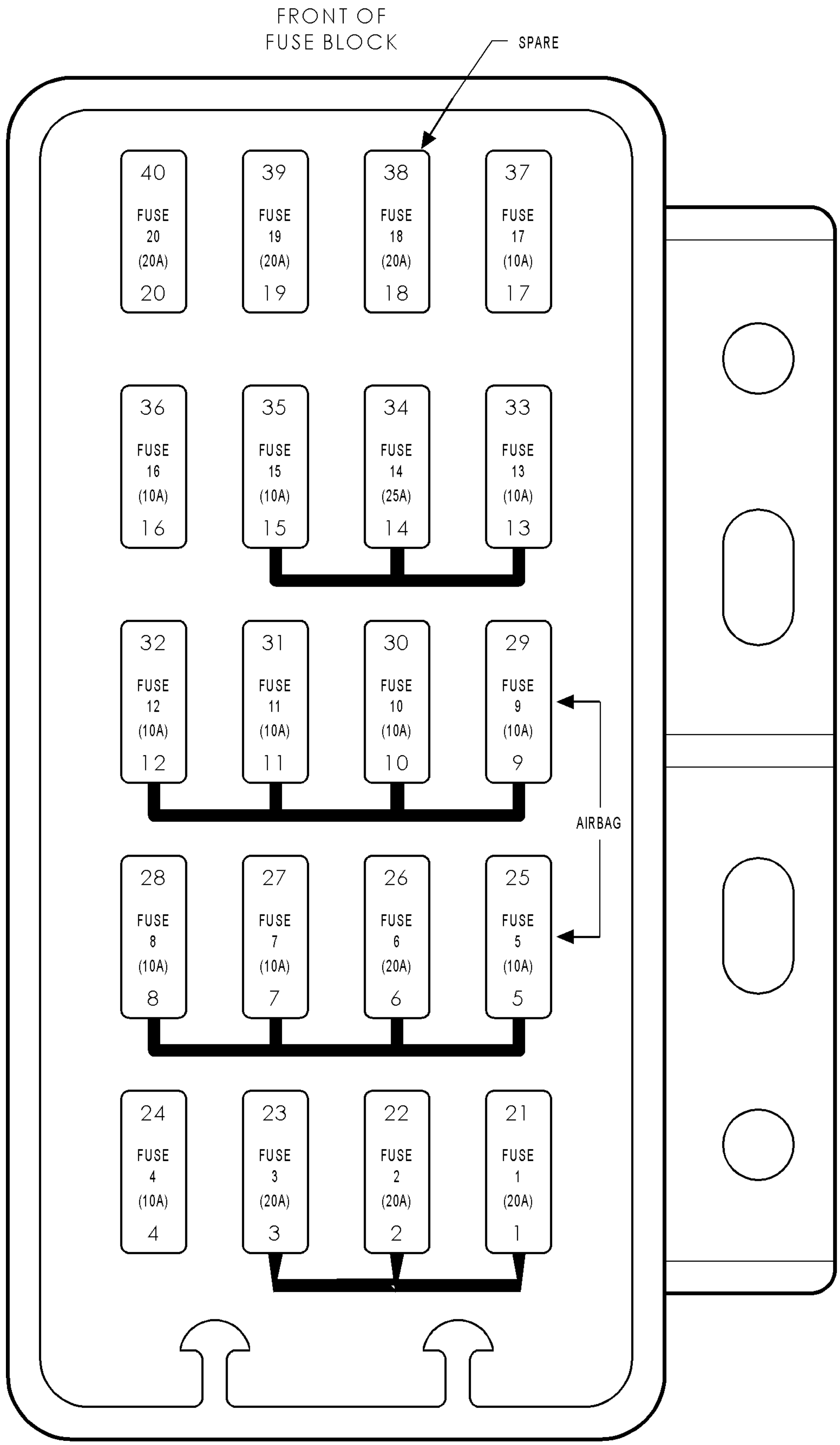
DATA LINK CONNECTOR - BLACK 16 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D23 20WT/BR	FLASH PROGRAM ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



DRIVER AIRBAG SQUIB 1 - YELLOW 2 WAY

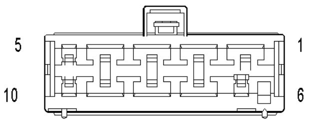
CAV	CIRCUIT	FUNCTION
1	R45 18DG/LB	DRIVER SQUIB 1 LINE 2
2	R43 18BK/LB	DRIVER SQUIB 1 LINE 1



FRONT OF FUSE BLOCK
SPARE
40 FUSE 20 (20A) 20
39 FUSE 19 (20A) 19
38 FUSE 18 (20A) 18
37 FUSE 17 (10A) 17
36 FUSE 16 (10A) 16
35 FUSE 15 (10A) 15
34 FUSE 14 (25A) 14
33 FUSE 13 (10A) 13
32 FUSE 12 (10A) 12
31 FUSE 11 (10A) 11
30 FUSE 10 (10A) 10
29 FUSE 9 (10A) 9
AIRBAG
28 FUSE 8 (10A) 8
27 FUSE 7 (10A) 7
26 FUSE 6 (20A) 6
25 FUSE 5 (10A) 5
24 FUSE 4 (10A) 4
23 FUSE 3 (20A) 3
22 FUSE 2 (20A) 2
21 FUSE 1 (20A) 1

FUSES (FUSE/RELAY BLOCK)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	20A	F33 18PK/RD	FUSED B(+)
1	20A	F33 20PK/RD	FUSED B(+)
2	20A	F32 18PK/DB	FUSED B(+)
3	20A	X13 16BK/RD (SUBWOOFER)	FUSED B(+)
4	10A	Z1 20BK	DOOR AJAR SWITCH OUTPUT
5	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
6	20A	V23 18BR/PK (HARD TOP)	FUSED IGNITION SWITCH OUTPUT (RUN)
7	10A	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
8	10A	F24 20RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
9	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
9	10A	F14 18LG/YL (PAD)	FUSED IGNITION SWITCH OUTPUT (RUN)
10	10A	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
10	10A	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
11	10A	F12 20RD/LG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	10A	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	10A	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
13	10A	L5 20BK/GY	FUSED IGNITION SWITCH OUTPUT (RUN-START)
14	10A	X12 20PK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
15	10A	F81 20DB/RD (HARD TOP)	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	10A	L22 20LG/DG (EXPORT)	FUSED IGNITION SWITCH OUTPUT (RUN-START)
16	10A	L22 20LG/DG (EXPORT)	DIMMER SWITCH LOW BEAM OUTPUT
17	25A	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
17	25A	V6 16PK/BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
18	20A	F38 16LB/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
19	20A	-	-
20	20A	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
20	20A	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)

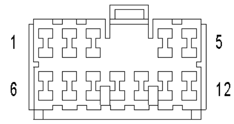


IGNITION SWITCH

IGNITION SWITCH - 10 WAY

CAV	CIRCUIT	FUNCTION
1	A1 18RD	FUSED B(+)
2	A21 18DB	IGNITION SWITCH OUTPUT (RUN-START)
3	F22 12WT/PK	IGNITION SWITCH OUTPUT (RUN-ACC)
4	F30 12RD/PK	FUSED B(+)
5	G26 20LB	KEY-IN IGNITION SWITCH SENSE
6	A41 18YL	IGNITION SWITCH OUTPUT (START)
7	A31 18BK/DG	IGNITION SWITCH OUTPUT (RUN-ACC)
8	A22 14BK/OR	IGNITION SWITCH OUTPUT (RUN)
9	A2 14PK/BK	FUSED B(+)
10	Z1 16BK	GROUND

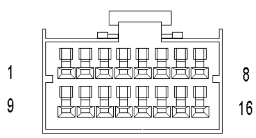
CONNECTOR PINOUTS



INSTRUMENT CLUSTER C1

INSTRUMENT CLUSTER C1 - 12 WAY

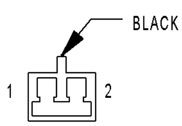
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	L60 18TN	RIGHT TURN SIGNAL
3	G34 16RD/GY (LHD)	HIGH BEAM INDICATOR DRIVER
3	L3 16RD/OR (RHD)	HIGH BEAM INDICATOR DRIVER
4	L39 16LB (EXCEPT EX-PORT)	FOG LAMP FEED
4	L38 16BR/WT (EXPORT)	REAR FOG LAMP FEED
5	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
6	G305 20VT/LG (OFF-ROAD PACKAGE)	REAR LOCKER REQUEST
7	G301 20VT/LB (OFF-ROAD PACKAGE)	REAR LOCKER INDICATOR SWITCH SENSE
8	Z2 18BK/LG	GROUND
9	G303 20VT/DG (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 2
10	D23 20WT/BR	-
11	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	M1 20PK/WT	FUSED B(+)



INSTRUMENT CLUSTER C2

INSTRUMENT CLUSTER C2 - 16 WAY

CAV	CIRCUIT	FUNCTION
1	C80 20DB/WT (HARD TOP)	REAR WINDOW DEFOGGER SWITCH SENSE
2	G10 20LG/RD	SEAT BELT SWITCH SENSE
3	G76 20TN/YL	PASSENGER DOOR AJAR SWITCH SENSE
4	G75 20TN	DRIVER DOOR AJAR SWITCH SENSE
5	M2 20YL	COURTESY LAMP FEED
6	E2 20OR	PANEL LAMPS FEED
7	C81 20LB/WT (HARD TOP)	REAR WINDOW DEFOGGER RELAY CONTROL
8	G19 20LG/OR (ABS)	ABS WARNING INDICATOR DRIVER
9	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER
10	G304 20VT/DB (OFF-ROAD PACKAGE)	FRONT LOCKER REQUEST
11	G107 20BK/RD (4X4)	4WD INDICATOR
12	D25 20VT/YL	PCI BUS
13	G26 20LB	KEY-IN IGNITION SWITCH SENSE
14	G302 20RD/WT (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 1
15	E19 20RD	PANEL LAMPS DIMMER SIGNAL
16	G300 20VT/WT (OFF-ROAD PACKAGE)	FRONT LOCKER INDICATOR SWITCH SENSE

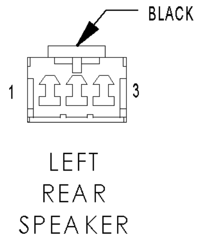


LEFT
FRONT SPEAKER

LEFT FRONT SPEAKER - BLACK 2 WAY

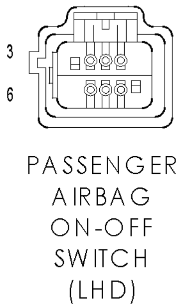
CAV	CIRCUIT	FUNCTION
1	X53 18DG	LEFT FRONT SPEAKER (+)
2	X55 18BR/RD	LEFT FRONT SPEAKER (-)

C O N N E C T O R P I N O U T S



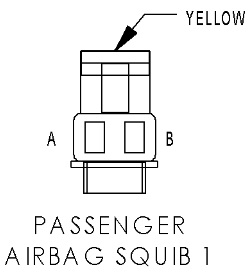
LEFT REAR SPEAKER - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	X57 20BR/LB	LEFT REAR SPEAKER (-)
2	-	-
3	X51 18BR/YL	LEFT REAR SPEAKER (+)



PASSENGER AIRBAG ON-OFF SWITCH (LHD) - 6 WAY

CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
2	R166 18LG/BR	PASSENGER AIRBAG INDICATOR DRIVER
3	R65 18LG/OR	PASSENGER AIRBAG MUX SWITCH SENSE
4	-	-
5	-	-
6	R66 18YL/LG	PASSENGER AIRBAG MUX SWITCH RETURN

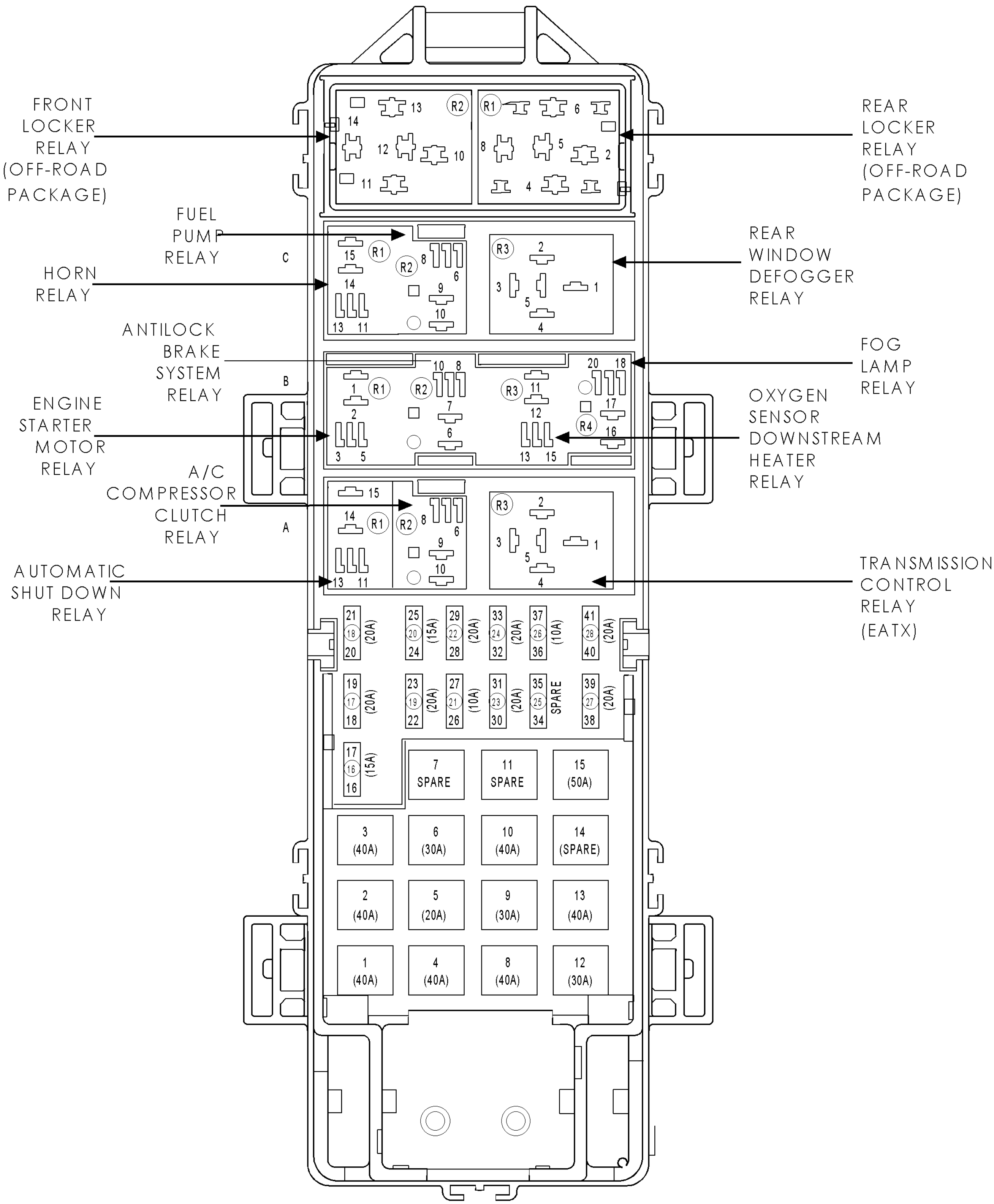


PASSENGER AIRBAG SQUIB 1 - YELLOW 2 WAY

CAV	CIRCUIT	FUNCTION
A	R44 18DG/YL	PASSENGER SQUIB 1 LINE 2
B	R42 18BK/YL	PASSENGER SQUIB 1 LINE 1

CONNECTOR PINOUTS

POWER DISTRIBUTION CENTER



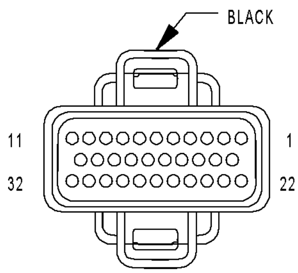
CONNECTOR PINOUTS

FUSES (PDC)

FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	A111 12RD/LB	FUSED B(+)
2	40A	A4 12BK/PK	FUSED B(+)
3	40A	A6 12RD/BK	FUSED B(+)
4	40A	A16 12GY (2.4L)	FUSED B(+)
5	20A	A30 16RD/WT (A/T)	FUSED B(+)
6	30A	A2 14PK/BK	FUSED B(+)
7	-	-	-
8	40A	A10 12RD/DG (ABS)	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
10	40A	A3 12RD/WT	FUSED B(+)
11	-	-	-
12	30A	A20 12RD/DB (ABS)	FUSED B(+)
13	40A	F30 12RD/PK	FUSED B(+)
14	-	-	-
15	50A	M1 16PK/WT	FUSED B(+)
15	50A	M1 20PK/WT (ABS)	FUSED B(+)
16	15A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	AUTOMATIC SHUT DOWN RELAY OUTPUT
17	20A	F70 16PK/BK	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
19	20A	F39 16PK/LG (FRONT FOG LAMPS)	FUSED B(+)
20	15A	F60 16RD/WT	FUSED B(+)
21	10A	A17 20RD/GY	FUSED B(+)
22	20A	A1 18RD	FUSED B(+)
23	20A	A61 18DG/BK	FUSED B(+)
24	20A	A88 18RD/DB (OFF-ROAD PACKAGE)	FUSED B(+)
25	-	-	-
26	10A	M1 20PK/WT	FUSED B(+)
27	20A	L9 18BK/WT	FUSED B(+)
28	20A	F42 18DG/LG	AUTOMATIC SHUT DOWN RELAY OUTPUT
28	20A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT

REAR WINDOW DEFOGGER RELAY (IN PDC)

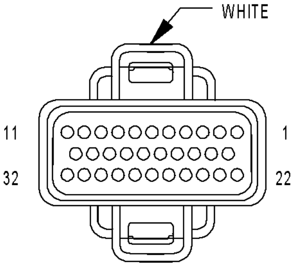
CAV	CIRCUIT	FUNCTION
C1	A4 12BK/PK	FUSED B(+)
C2	C81 20LB/WT	REAR WINDOW DEFOGGER RELAY CONTROL
C3	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
C4	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
C5	-	-



POWERTRAIN
CONTROL
MODULE C1

POWERTRAIN CONTROL MODULE C1 - BLACK 32 WAY

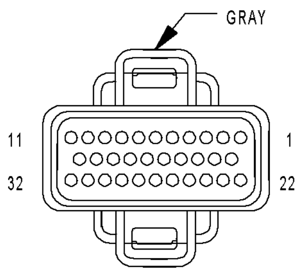
CAV	CIRCUIT	FUNCTION
1	K18 18RD/YL (4.0L)	IGNITION COIL NO. 3 DRIVER
2	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	-	-
4	K4 18BK/LB	SENSOR GROUND 1
5	-	-
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	-	-
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR (2.4L)	POWER STEERING PRESSURE SWITCH SENSE
13	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
14	-	-
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5V SUPPLY
18	K44 18TN/YL	CMP SIGNAL
19	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	-	-
22	A14 14RD/WT	FUSED B(+)
23	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2

POWERTRAIN CONTROL MODULE C2 - WHITE 32 WAY

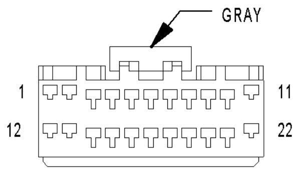
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY (4.0L)	FUEL INJECTOR NO. 5 DRIVER
7	-	-
8	-	-
9	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
10	K20 18DG	GENERATOR FIELD
11	-	-
12	K58 18BR/DB (4.0L)	FUEL INJECTOR NO. 6 DRIVER
13	-	-
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	-	-
18	-	-
19	C18 18DB (2.4L)	A/C PRESSURE SIGNAL
20	-	-
21	-	-
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SIGNAL
24	-	-
25	-	-
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	K6 18VT/WT	5V SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3

POWERTRAIN CONTROL MODULE C3 - GRAY 32 WAY

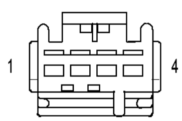
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR (A/C)	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	C24 18DB/PK (2.4L)	LOW SPEED RADIATOR FAN RELAY CONTROL
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD (SPEED CONTROL)	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD (SPEED CONTROL)	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.0L)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
10	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18YL/RD (SPEED CONTROL)	SPEED CONTROL ON/OFF SWITCH SENSE
12	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (A/T)	TORQUE MANAGEMENT REQUEST SENSE
14	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE
15	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR HEATER CONTROL
17	-	-
18	-	-
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
21	C27 18DB (2.4L)	HIGH SPEED RADIATOR FAN RELAY CONTROL
22	C21 18DB/OR (A/C)	A/C SWITCH SENSE
23	C90 18LG (A/C)	A/C SELECT INPUT
24	K29 18WT/PK	BRAKE LAMP SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18DB/LG (4.0L)	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/WT	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LB (SPEED CONTROL)	SPEED CONTROL SWITCH SIGNAL



RADIO

RADIO - GRAY 22 WAY

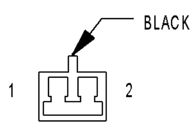
CAV	CIRCUIT	FUNCTION
1	F60 16RD/WT	FUSED B(+)
2	X12 20PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	E2 20OR	PANEL LAMPS DRIVER
4	-	-
5	-	-
6	-	-
7	X54 18VT	RIGHT FRONT SPEAKER (+)
8	X56 18DB	RIGHT FRONT SPEAKER (-)
9	X55 18BR/RD	LEFT FRONT SPEAKER (-)
10	X53 18DG	LEFT FRONT SPEAKER (+)
11	Z9 16BK	GROUND
12	F60 16RD/WT	FUSED B(+)
13	X16 20LG	RADIO 12V OUTPUT
14	D25 20VT/YL	PCI BUS
15	-	-
16	-	-
17	-	-
18	X51 18BR/YL	LEFT REAR SPEAKER (+)
19	X57 18BR/LB	LEFT REAR SPEAKER (-)
20	X58 18DB/PK	RIGHT REAR SPEAKER (-)
21	X52 18DB/WT	RIGHT REAR SPEAKER (+)
22	Z9 16BK	GROUND



REAR WINDOW DEFOGGER SWITCH (HARD TOP)

REAR WINDOW DEFOGGER SWITCH (HARD TOP) - 4 WAY

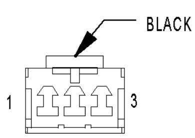
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	C80 20DB/WT	REAR WINDOW DEFOGGER SWITCH SENSE
3	F81 20DB/RD	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL



RIGHT FRONT SPEAKER

RIGHT FRONT SPEAKER - BLACK 2 WAY

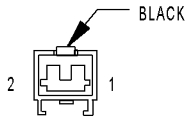
CAV	CIRCUIT	FUNCTION
1	X54 18VT	RIGHT FRONT SPEAKER (+)
2	X56 18DB	RIGHT FRONT SPEAKER (-)



RIGHT REAR SPEAKER

RIGHT REAR SPEAKER - BLACK 3 WAY

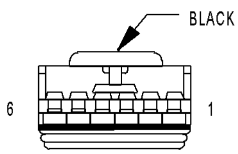
CAV	CIRCUIT	FUNCTION
1	X58 20DB/PK	RIGHT REAR SPEAKER (-)
2	-	-
3	X52 20DB/WT	RIGHT REAR SPEAKER (+)



SEAT BELT SWITCH (EXCEPT LHD EXPORT)

SEAT BELT SWITCH (EXCEPT LHD EXPORT) - BLACK 2 WAY

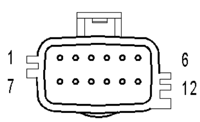
CAV	CIRCUIT	FUNCTION
1	G10 20LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



SENTRY KEY IMMOBILIZER MODULE

SENTRY KEY IMMOBILIZER MODULE - BLACK 6 WAY

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	F15 20DB	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	Z1 20BK	GROUND
6	F33 20PK/RD	FUSED B(+)



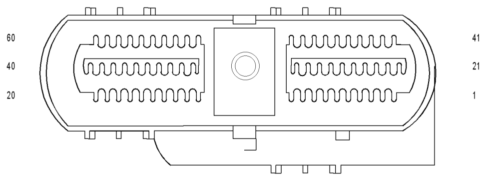
SUBWOOFER

SUBWOOFER - 12 WAY

CAV	CIRCUIT	FUNCTION
1	X54 18VT	RIGHT FRONT SPEAKER (+)
2	X56 18DB	RIGHT FRONT SPEAKER (-)
3	X53 18DG	LEFT FRONT SPEAKER (+)
4	X55 18BR/RD	LEFT FRONT SPEAKER (-)
5	X16 20LG	RADIO 12V OUTPUT
6	X13 16BK/RD	FUSED IGNITION SWITCH OUTPUT
7	X52 18GY/DB	RIGHT REAR SPEAKER (+)
8	X58 18DB/PK	RIGHT REAR SPEAKER (-)
9	X51 18BR/YL	LEFT REAR SPEAKER (+)
10	X57 18BR/LB	LEFT REAR SPEAKER (-)
11	-	-
12	Z9 16BK/WT	GROUND

TRANSMISSION CONTROL MODULE - 60 WAY

CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	-	-
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK	TRANSMISSION CONTROL RELAY CONTROL
16	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
19	T19 16WT	2-4 SOLENOID CONTROL
20	T20 16LB	LOW/REVERSE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	T411 18WT/PK	TRS T41 SENSE
42	T42 16VT/WT	TRS T42 SENSE
43	D25 18VT/YL	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T47 18YL/BK	2-4 PRESSURE SWITCH SENSE
48	-	-
49	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
50	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND 1
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z112 16BK	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A30 16RD/WT	FUSED B(+)
57	Z113 16BK/YL	GROUND
58	-	-
59	T59 16PK	UNDERDRIVE SOLENOID CONTROL
60	T60 16BR	OVERDRIVE SOLENOID CONTROL

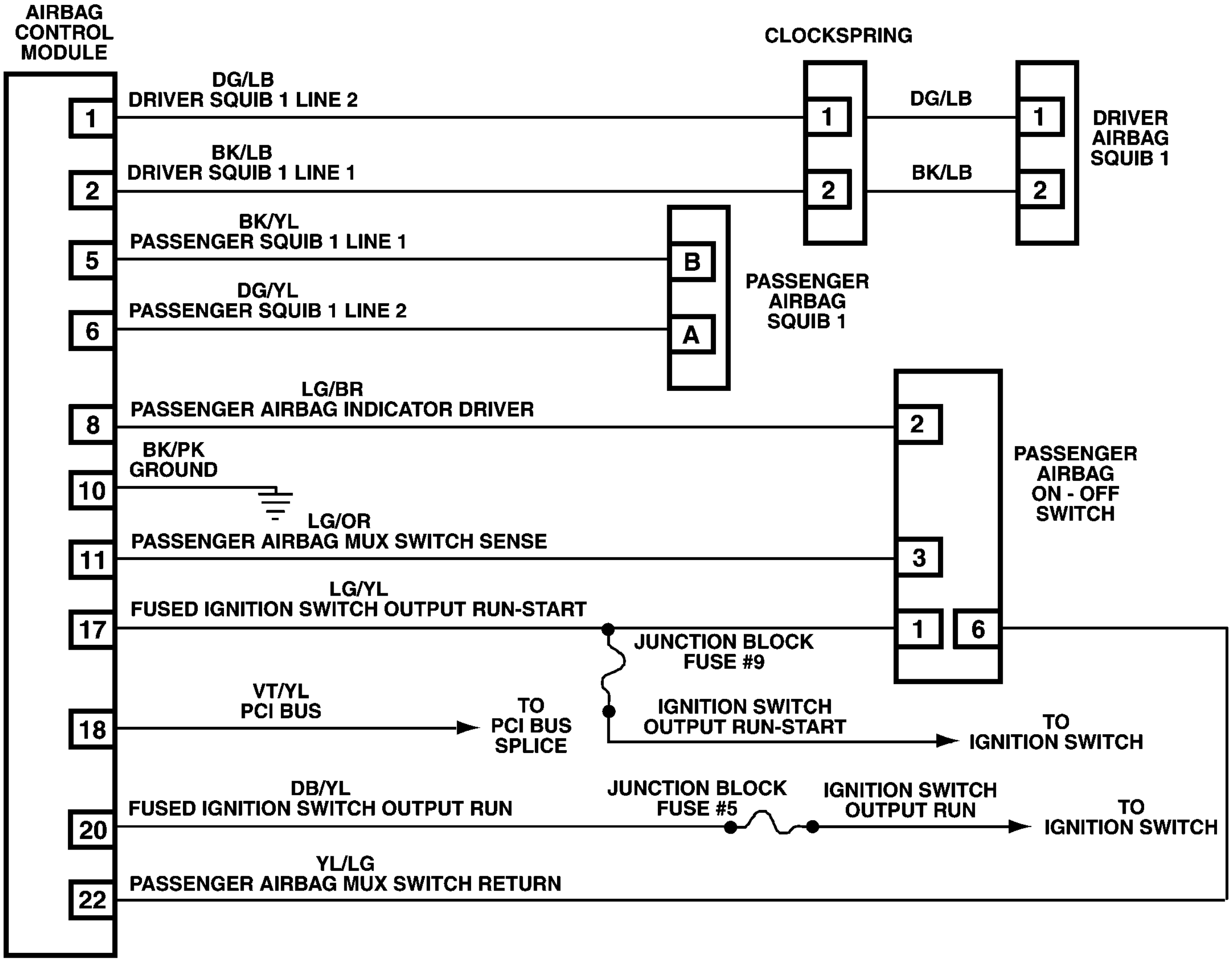


TRANSMISSION CONTROL MODULE

NOTES

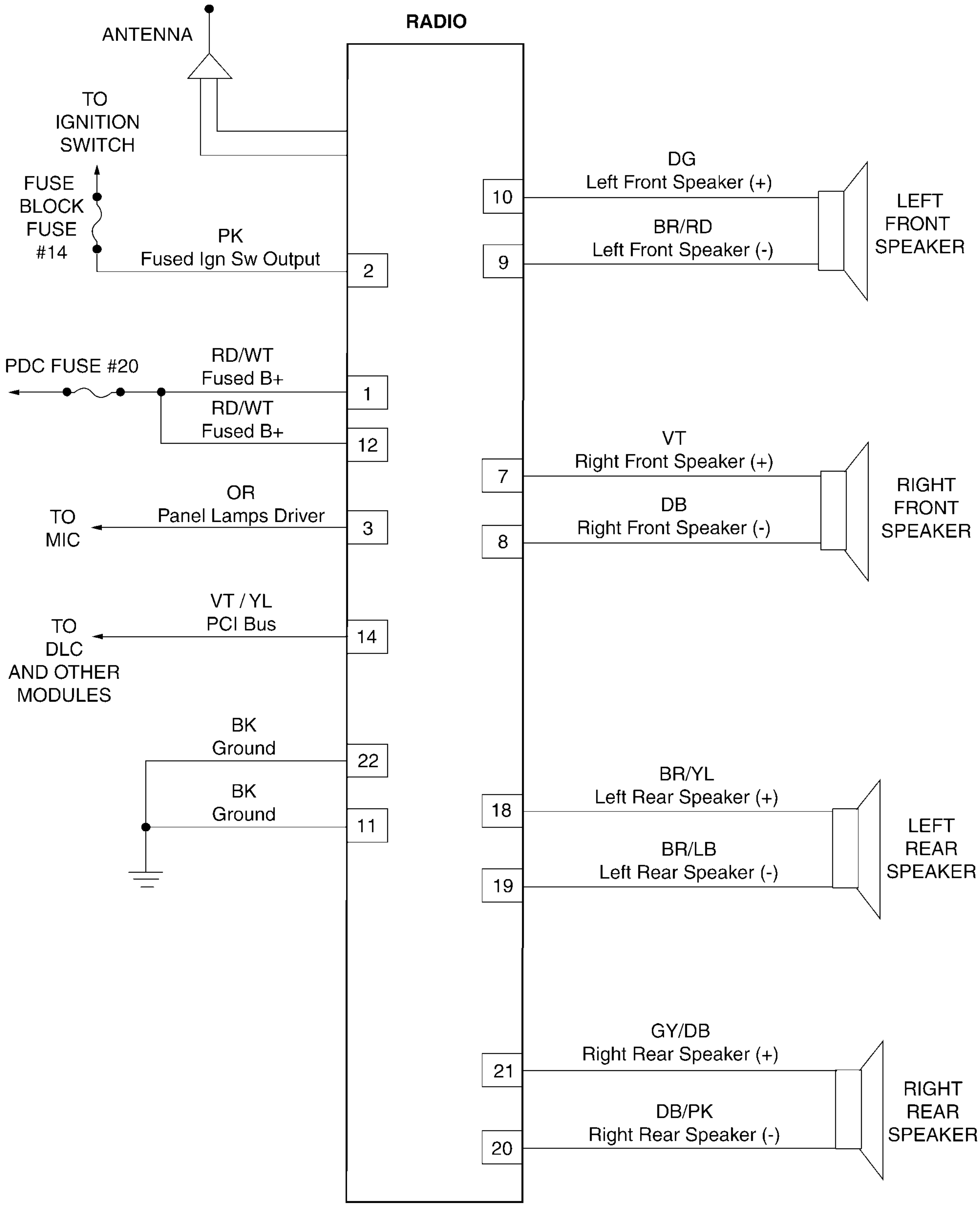
10.0 SCHEMATIC DIAGRAMS

10.1 AIRBAG SYSTEM

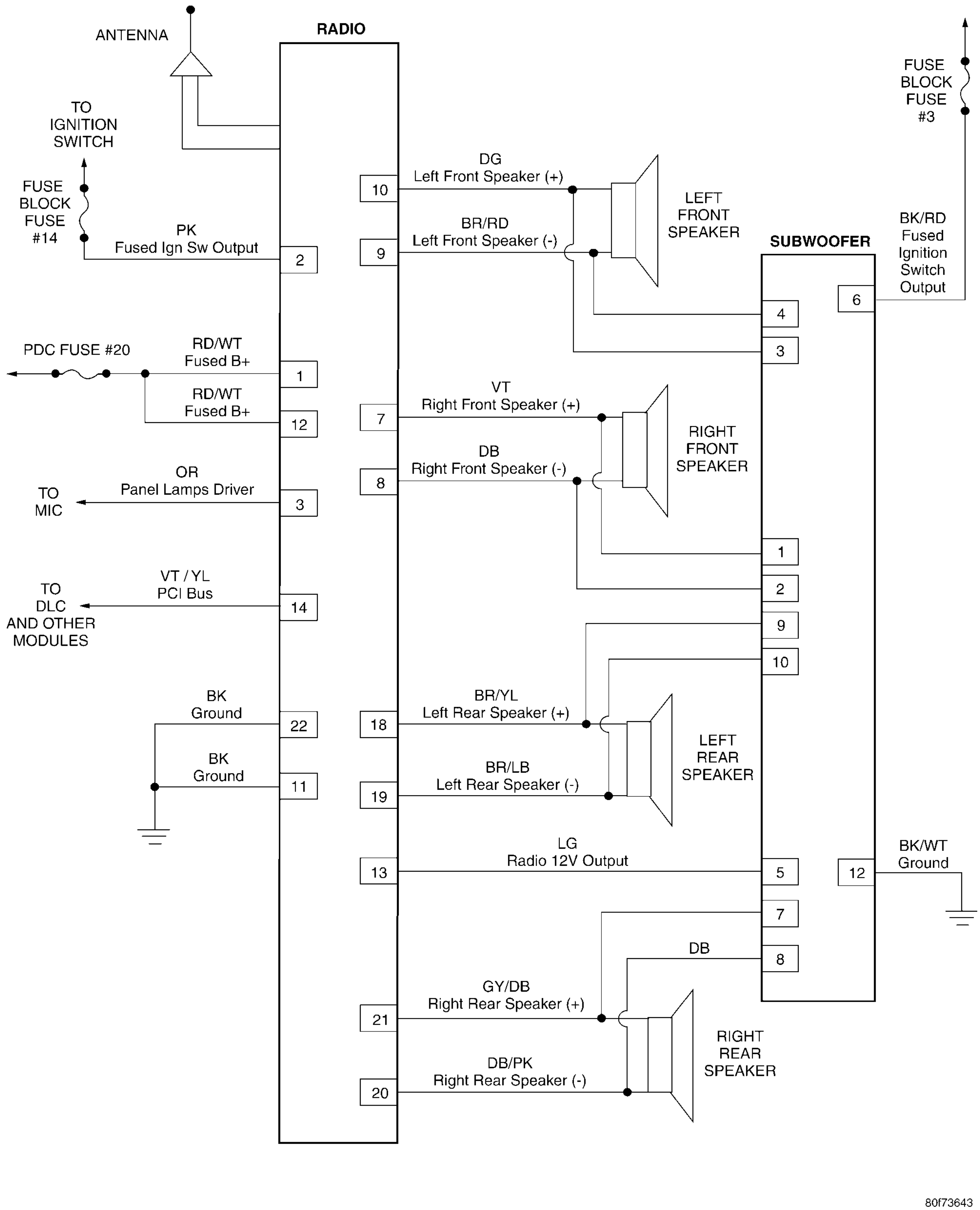


10.2 AUDIO SYSTEM

10.2.1 BASE AUDIO SYSTEM

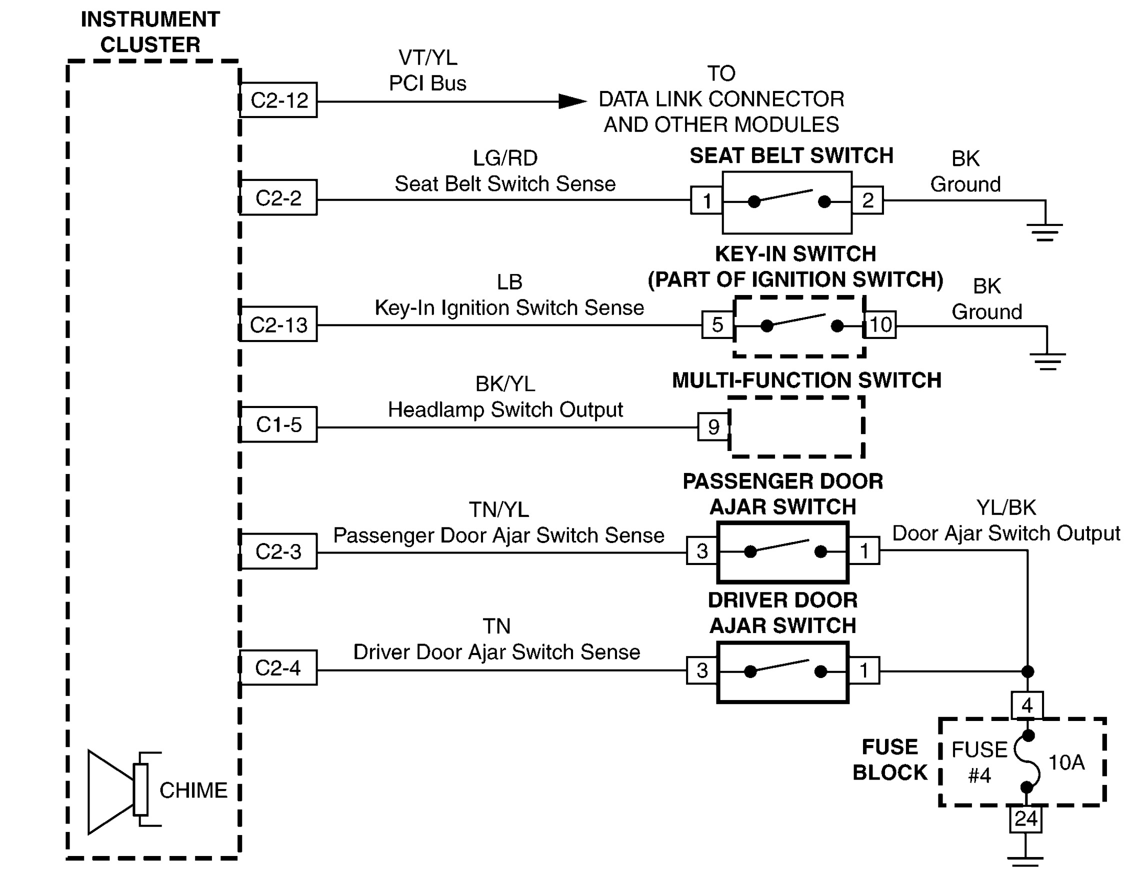


10.2.2 PREMIUM AUDIO SYSTEM



S C H E M A T I C D I A G R A M S

10.3 CHIME SYSTEM



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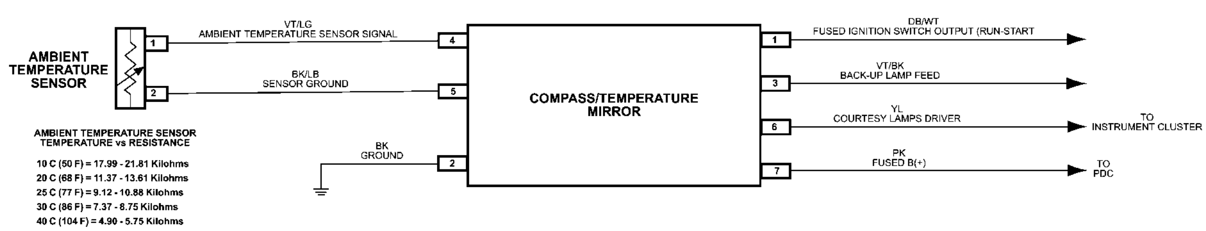
10.4 COMPASS/TEMPERATURE MIRROR



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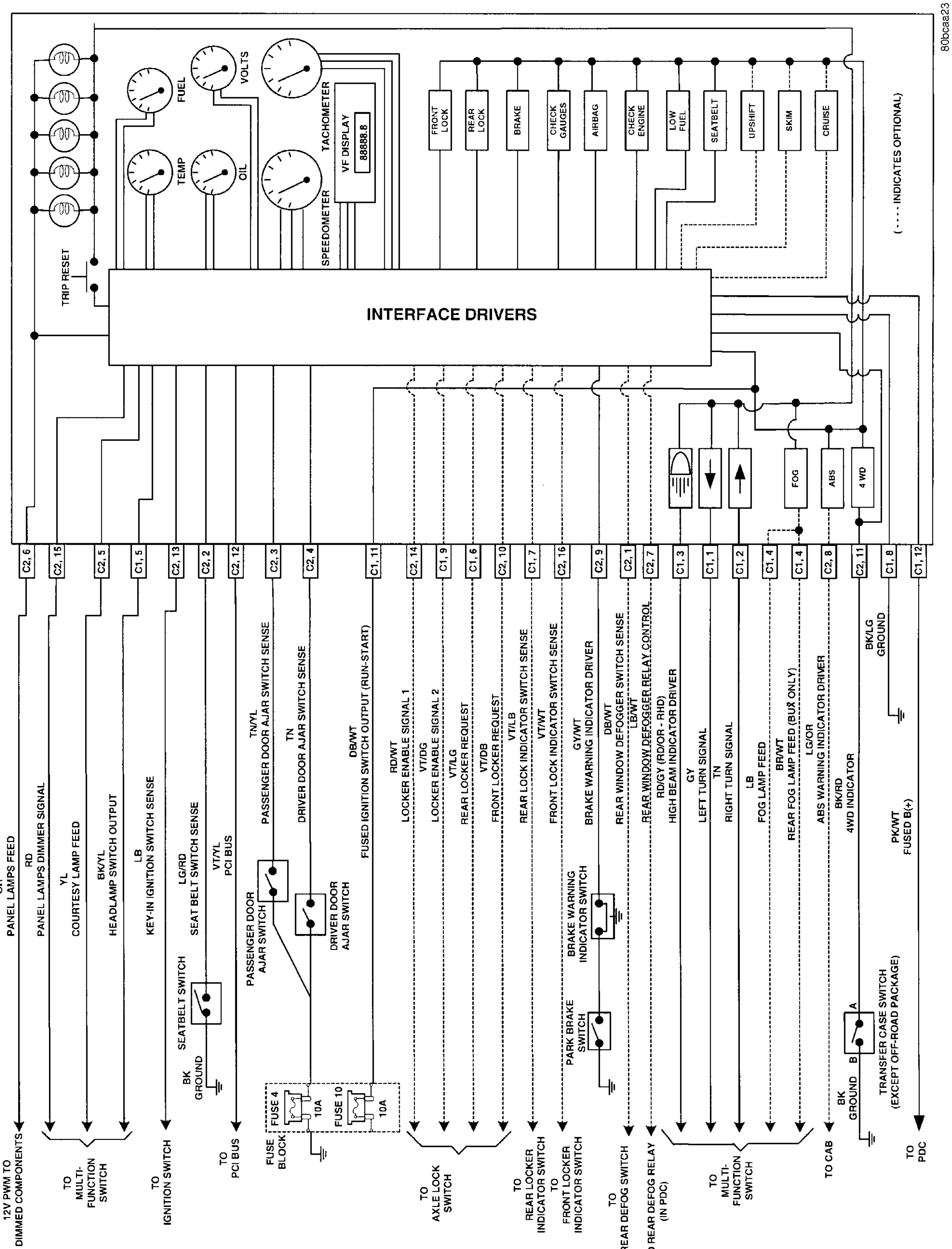
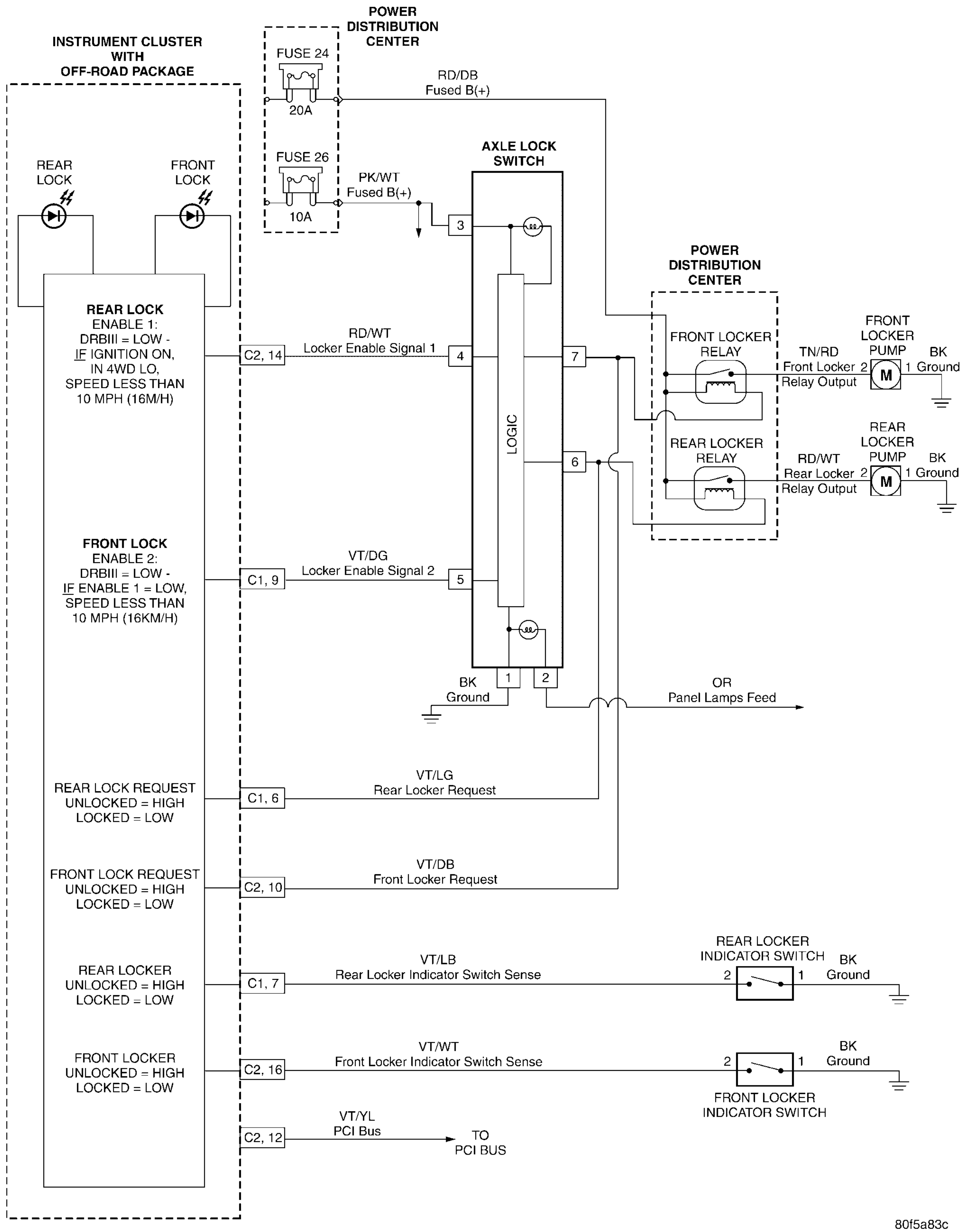
10.5 INSTRUMENT CLUSTER



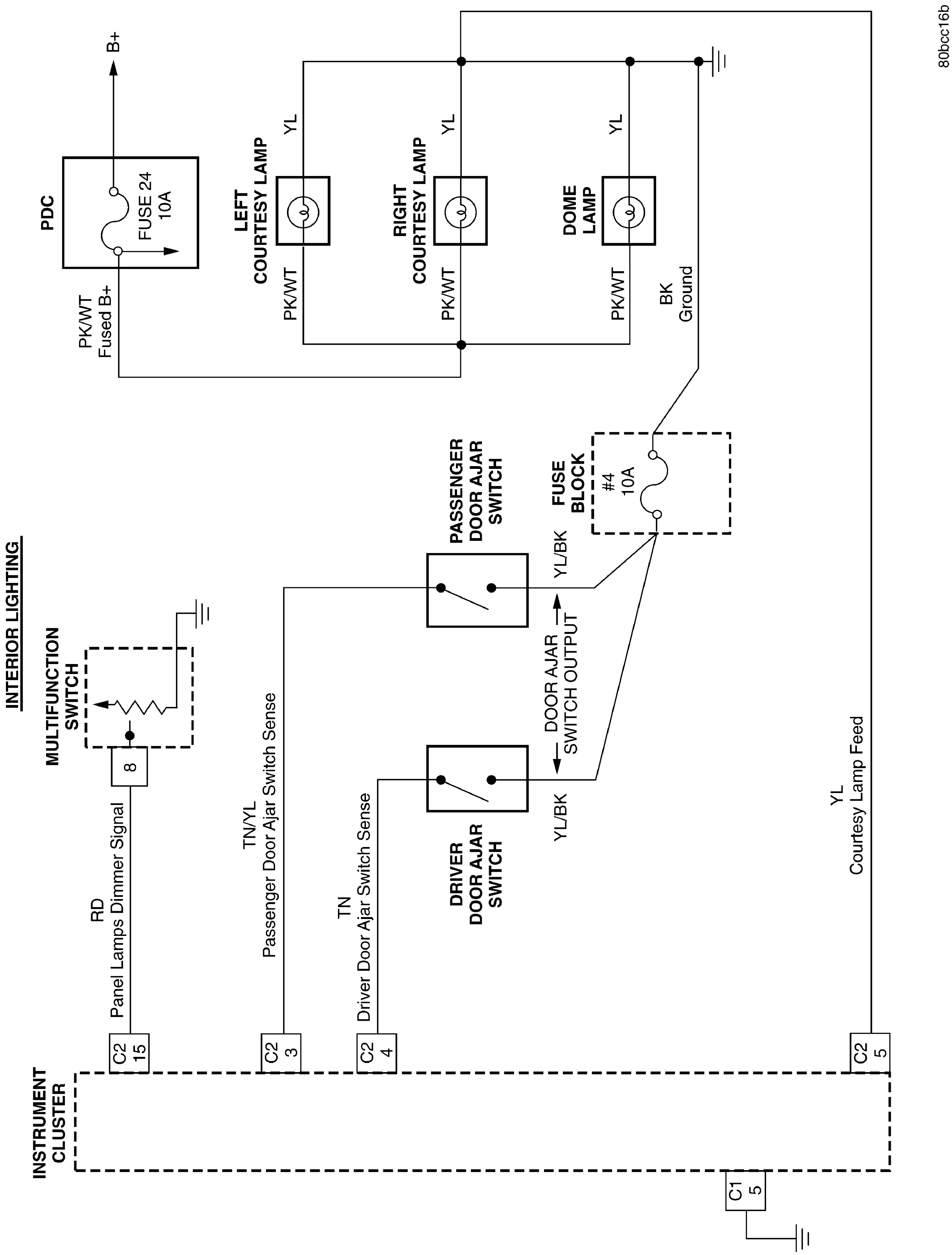
SCHEMATIC DIAGRAMS

10.5 INSTRUMENT CLUSTER (Continued)
10.5.1 INSTRUMENT CLUSTER/AXLE LOCKER SYSTEM

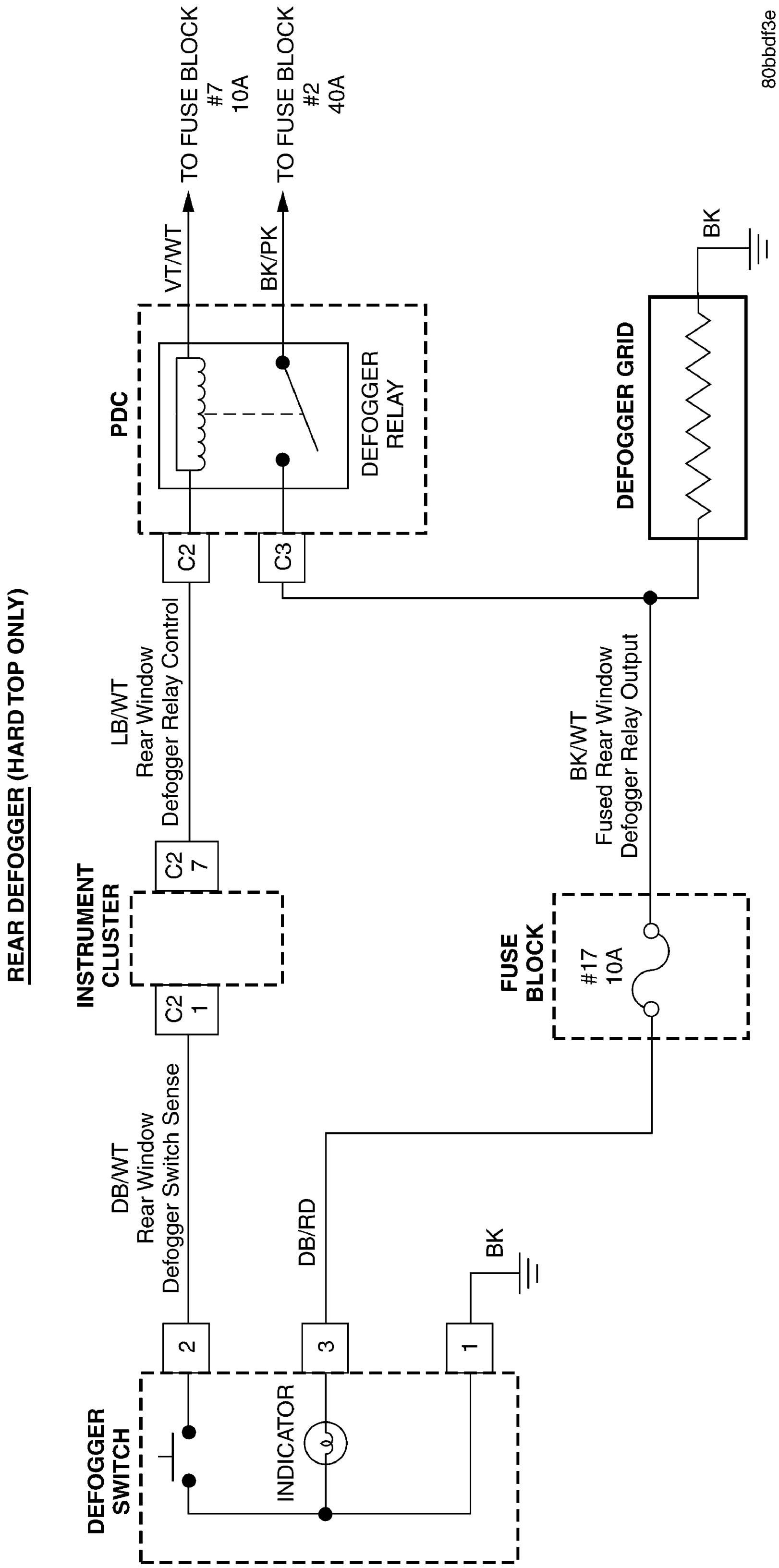


S C H E M A T I C D I A G R A M S

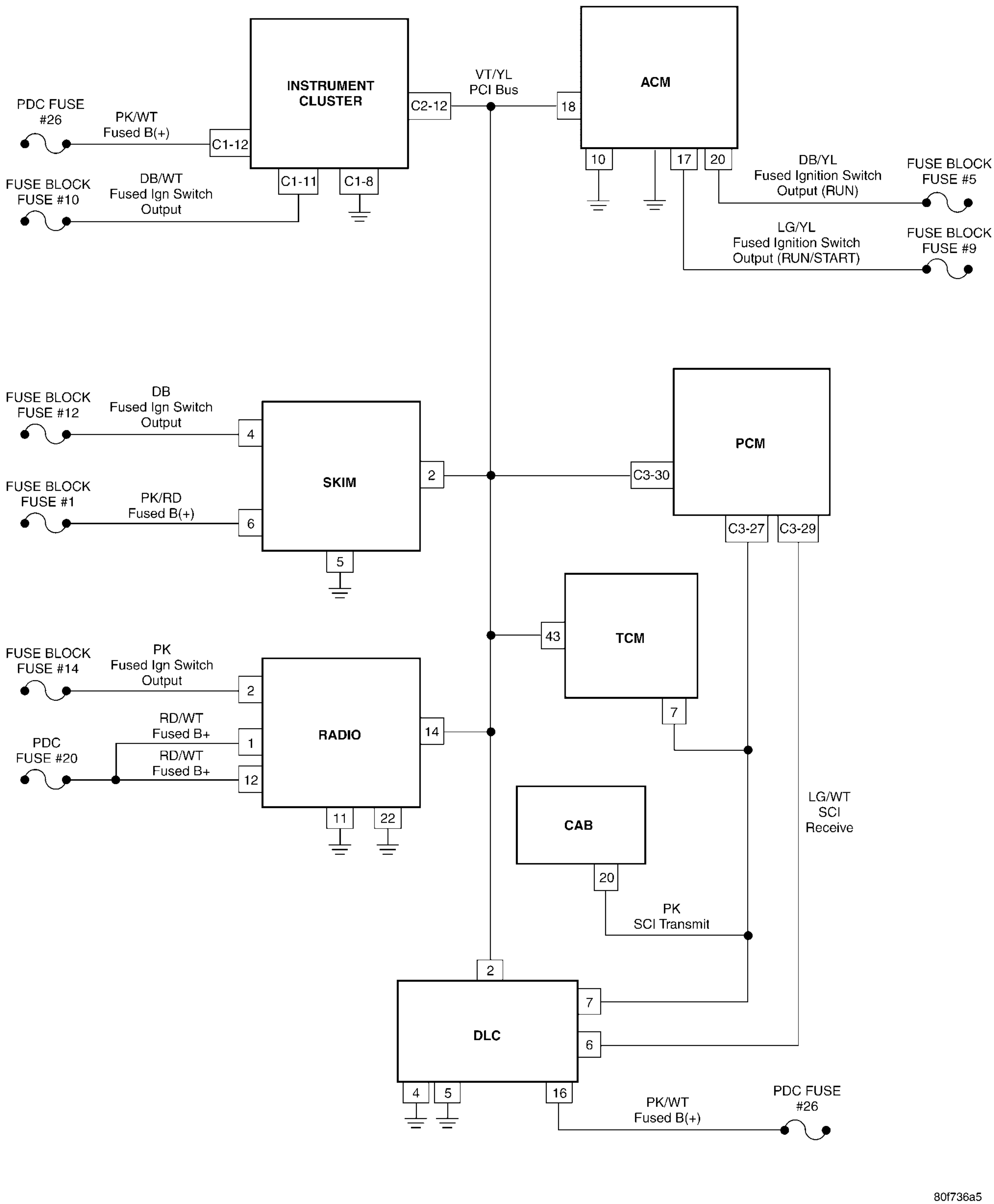
10.6 INTERIOR LIGHTING



10.7 REAR DEFOGGER



10.8 VEHICLE COMMUNICATIONS



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NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all the specifications, instructions, and graphics needed to diagnose the TJ Chassis system problems: Teves Mark 20i Antilock Braking System (ABS) and Axle Lock. The diagnostics in this manual are based on the failure condition or symptom being present at time of diagnosis.

Follow the recommendations below when choosing your diagnostic path.

1. First make sure the DRBIII® is communicating with the CAB. If the DRBIII® displays a "No Response" condition, you must diagnose that first.
2. Read DTC's (diagnostic trouble codes) with the DRBIII®.
3. If no DTC's are present, identify the customer complaint.
4. Once the DTC or customer complaint is identified, locate the matching test in the Table of Contents and begin to diagnose the symptom.

All component location views are in Section 8.0. All connector pinouts are in Section 9.0. All schematics are in Section 10.0.

An asterisk (*) placed before the symptom description indicates a customer complaint.

When repairs are required, refer to the appropriate service manual for the proper removal and repair procedure.Diagnostic procedures change every year. New diagnostic systems may be added; carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE DIAGNOSTIC TROUBLE CODE. It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic manual covers the Teves Mark 20i Antilock Braking System (ABS) found on the Jeep Wrangler. Diagnosis of the Axle Lock is covered in this manual.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the antilock brake system is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

Vehicles equipped with the Teves Mark 20i antilock brake system can be identified by the presence of the hydraulic control unit (HCU) located under the hood near the power brake booster. Vehicles equipped with Axle Lock can be identified by the presence of the Axle Lock Switch located on the lower center of the instrument panel.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 TEVES MARK 20I SYSTEM DESCRIPTION

An electronic control module is used to monitor wheel speeds and to modulate (control) hydraulic pressure in each brake channel to prevent wheel lock-up during braking.

During a non-ABS stop, the system functions as a standard front/rear split configuration. The primary hydraulic system supplies brake fluid pressure to the front brakes, and the secondary hydraulic system supplies the rear brakes. A conventional combination/proportioning valve is used.

During an ABS stop, the system still uses the front/rear hydraulic split; however, the brakes system pressure is further split into three control channels. During ABS operation, the front wheels are controlled independently and are on two separate control channels. The rear wheels are controlled together through one control channel. By using a separate control channel for each front wheel, more steering control is maintained during maximum braking.

During an antilock stop, "wheel lock-up" does not necessarily mean that the wheel has locked, it means only that the wheel is turning slower than the vehicle speed. This is called "wheel slip" and is indicated as a percentage. 0% slip means that the wheel is rolling free and 100% slip means that the wheel is locked. The antilock system maintains an average of approximately 20% wheel slip.

It is important to remember that the antilock brake system does not shorten the vehicle stopping distance under all driving conditions, but provides improved control of the vehicle while stopping. Vehicle stopping distance is still dependent on vehicle speed, weight, tires, road surface, and other factors.

3.1.1 PEDAL FEEL/VEHICLE CHARACTERISTICS

There are several pedal feel/vehicle characteristics that are considered normal for antilock braking that may require further explanation.

When stopping conditions activate the antilock brakes, the driver may feel some vibrations/pulsations in the brake pedal and may hear the solenoid valves clicking and the pump motor running. The vibrations/pulsations are caused by the isolating, building and decaying of brake fluid pressure within the brake lines. The ABS prevents complete wheel lock-up, but some wheel slip is required for the best braking performance. This slip may result in some tire chirping, depending on the road surface. This chirping should not be interpreted as total wheel lock-up. Total wheel lock-up leaves black tire marks on dry pavement. Antilock braking may leave some light marks.

At the end of an ABS stop, the ABS system may not function below 5 Km/h (3 mph). There may be a slight brake pedal drop anytime the ABS is deactivated.

In case of braking on a bumpy surface, the ABS module may detect wheel locking tendencies due to wheel hop and cycle ABS. In that event the brake pedal may pulsate with a perceived loss of deceleration. ABS braking may also be activated at times while on dry pavement with sand, gravel, or other loose debris on the road.

It should be noted that the pulsating pedal feel characteristic will not illuminate the brake warning indicators or set a diagnostic trouble code that is stored in the Controller Antilock Brake (CAB). When investigating a hard pedal feel, inspect the sensor and tone wheel teeth for chips/broken teeth, damaged sensor pole tips, excessive runout of the tone wheel, or excessive gap.

3.1.2 SYSTEM COMPONENTS

Antilock Brake System

- controller antilock brake (CAB)
- vacuum booster
- master cylinder (w/center valves)
- hydraulic control unit (HCU)
  valve block assembly: 6 valve solenoids (3 inlet valves, 3 outlet valves), 3 accumulators
- pump/motor assembly: 1 motor
  2 pumps
- G (acceleration) switch
- 1 proportioning valve
- 4 wheel speed sensor/tone wheel assemblies
- ABS warning indicator
- fuses and wiring harness
- fluid reservoir (integral part of master cylinder assembly)

3.1.3 ABS AND BRAKE WARNING INDICATORS

The amber ABS warning indicator is located in the instrument cluster. It is used to inform the driver that the antilock function has been turned off due to a system malfunction. On a TJ model the warning indicator is controlled by the CAB and the ABS relay. The CAB controls the indicator by directly grounding the ABS relay control circuit. The ABS relay grounds the indicator circuit when it is de-energized.

The red brake warning indicator is located in the instrument cluster. It can be activated by application of the parking brake, low brake fluid level or by turning the ignition switch to the start position.

3.1.4 CONTROLLER ANTILOCK BRAKE (CAB)

The controller antilock brake (CAB) is a microprocessor-based device that monitors wheel speeds and controls the antilock functions.

The primary functions of the CAB are:

- monitor wheel speeds
- detect wheel locking tendencies
- control fluid pressure modulation to the brakes during antilock stop operation
- monitor the system for proper operation
- provide communication to the DRBIII® while in diagnostic mode
- control the ABS relay
- store diagnostic information in non-volatile memory

The CAB continuously monitors the speed of each wheel. When a wheel locking tendency is detected, the CAB will command the appropriate valve in the HCU to modulate brake fluid pressure to that wheel. Brake pedal position is maintained during an antilock stop by being a closed system with the use of three accumulators. The CAB continues to control pressure in individual hydraulic circuits until a wheel locking tendency is no longer present. The CAB turns on the pump/motor during an antilock stop.

The antilock brake system is constantly monitored by the CAB for proper operation. If the CAB detects a system malfunction, it can disable the antilock system and turn on the ABS warning indicator. If the antilock function is disabled, the system will revert to standard base brake system operation.

The CAB inputs include the following:

- four wheel speed sensors
- brake lamp switch
- ignition switch
- battery voltage
- diagnostic communication
- G switch (acceleration switch)

The CAB outputs include the following:

- six valve/solenoid drivers
- pump/motor actuation
- ABS warning indicator control
- diagnostic communication

3.1.5 HYDRAULIC CONTROL UNIT

The hydraulic control unit (HCU) contains the valve block assembly, three accumulators, and the pump/motor assembly.

Valve Block Assembly: The valve block assembly contains 6 valves with three inlet valves and three outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring loaded in the closed position. During an antilock stop, these valves are cycled to maintain the proper slip ratio for each channel. If a wheel locks, the inlet valve is closed to prevent any further pressure increase. Then the outlet valve is opened to release the pressure to the accumulators until the wheel is no longer slipping. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply pressure. If the wheel is decelerating within its predetermined limits (proper slip ratio), both valves will close to hold the pressure constant.

Pump/Motor Assembly: The pump/motor assembly provides the extra amount of fluid needed during antilock braking. The pump is supplied fluid that is released to the accumulators when the outlet valve is opened during an antilock stop. The pump is also used to drain the accumulator circuits after the antilock stop is complete. The pump is operated by an integral electric motor. This motor is controlled by the CAB. The CAB turns on the motor when an antilock stop is detected. The pump continues to run during the antilock stop and is turned off approximately 3-5 seconds after the stop is complete. The pump mechanism consists of two opposing pistons operated by an eccentric cam. One piston supplies the primary hydraulic circuit. The opposing piston supplies the secondary hydraulic circuit. In operation, one piston draws fluid from the accumulators. The opposing piston pumps fluid to the valve body solenoids. The CAB monitors the pump/motor operation.

Accumulators: The accumulators provide temporary fluid storage during an antilock stop and are drained by the pump/motor.

3.1.6 RELAYS/SWITCHES

Relays: The ABS Relay is located in the power distribution center (PDC). When the relay is de-energized, it supplies a ground to turn on the ABS warning indicator. The ABS relay is controlled by the CAB. The CAB energizes the relay when it receives an ignition input signal.

3.1.7 SENSORS

Wheel Speed Sensors and Tone Wheels: One wheel speed sensor (WSS is located at each wheel and sends a small AC signal to the Controller Antilock Brake (CAB). This voltage is generated by magnetic induction when a toothed sensor ring (tone wheel) passes by a stationary magnetic sensor (wheel speed sensor). The CAB converts the AC signals into digital signals for each wheel.

The front wheel sensor is attached to a boss in the steering knuckle. The tone wheel is an integral part of the front axle shaft. The rear speed sensor is mounted in the caliper adapter plate (rear disc only) and the rear tone wheel is an integral part of the rear rotor hub. The front wheel speed sensor air gap is NOT adjustable. The correct front wheel speed sensor air gap is from 0.40mm to 1.3mm (0.016″ to 0.051″). Preferred rear sensor air gap for drum brake systems is 1.1mm (0.043″). Acceptable air gap range is 0.92mm to 1.275mm (0.036″ to 0.050″). All wheel speed sensors have a resistance between 900 and 1300 ohms.

Correct antilock system operation is dependent on correct wheel speed signals from the wheel speed sensors. The vehicle's wheels and tires should all be the same size and type. In addition, the tires should be inflated to the recommended pressures for optimum system operation. Variations in wheel and tire size or significant variations in inflation pressure can produce inaccurate wheel speed signals; however, the system will continue to function when using the mini-spare. When driven over rough road surfaces, the rear wheel speed sensor signals may be erratic and cause a false trouble code.

G (Acceleration) Switch: The CAB monitors the acceleration switch at all times. The switch assembly contains three mercury switches that monitor vehicle deceleration rates (G-force). Sudden, rapid changes in vehicle and wheel deceleration rate trigger the switch, sending a signal to the CAB. The switch assembly responds to three deceleration rates; two for forward braking and one for rearward braking.

3.2 DIAGNOSTIC TROUBLE CODES

The Teves Mark 20i Antilock Brake System (ABS) module may report any of the following diagnostic trouble codes:

- Controller Failure
- G Switch Not Processable
- Left Front Sensor Circuit Failure
- Left Front Sensor Signal Failure
- Left Rear Sensor Circuit Failure
- Left Rear Sensor Signal Failure
- CAB Power Feed Circuit
- System Over voltage
- System Under voltage
- Pump Motor Not Working Properly
- Right Front Sensor Circuit Failure
- Right Front Sensor Signal Failure
- Right Rear Sensor Circuit Failure
- Right Rear Sensor Signal Failure

Diagnostic trouble codes are retained in memory until erased using the DRBIII®, or automatically erased after 255 key cycles.

3.2.1 SYSTEM INITIALIZATION

System initialization starts when the key is turned to RUN. At this point, the CAB performs a complete self-check of all electrical components in the antilock brake systems.

At around 19 km/h (12 miles per hour), the pump motor is briefly activated to ensure operation, and wheel speed sensor circuitry is checked. If the brake pedal is applied when the vehicle reaches 19 km/h (12 mph), this check will be delayed until 40 km/h (25 mph). If, during the dynamic test, the brake pedal is applied, the driver may feel the test through brake pedal pulsations. This is a normal condition. Throughout the remainder of the drive cycle, ongoing tests are performed, and the CAB monitors ABS circuits for continuity.

If any component causes a diagnostic trouble code during system initialization or dynamic check, the CAB will illuminate the ABS warning indicator.

3.2.2 DIAGNOSTIC MODE

To enter diagnostic mode, vehicle speed must be below 10 km/h (6 mph), a "no response" message will be displayed by the DRBIII®. The following are characteristics of diagnostic mode:

- The ABS warning indicator will flash. If a hard diagnostic trouble code is present, such as a Speed Sensor Circuit or Signal Failure trouble code or CAB Power Feed Circuit diagnostic trouble code, the indicator will be illuminated without blinking and limited diagnostic operations only will be available until the diagnostic trouble code condition is corrected.
- Antilock operation is disabled.

3.2.3 INTERMITTENT DIAGNOSTIC TROUBLE CODES

If the malfunction is not present while performing a test procedure, the diagnostic procedures will not locate the problem. In this case, the code can only suggest an area to inspect. Check for the following:

- loose or corroded connections
- damaged components (sensors, tone wheels especially)
- damaged wiring
- excessive axle shaft runout
- brake system hydraulic leaks
- base brake system problems, non-ABS related.

If no obvious problems are found, erase diagnostic trouble codes and, with the key on, wiggle the wire harness and connectors. Recheck for codes periodically as you work through the system. This procedure may uncover an intermittent or difficult to locate malfunction.

3.3 AXLE LOCK

3.3.1 GENERAL

For this vehicle, the Axle Lock has no dedicated module controller. A manual switch located on the instrument panel controls the system. No DTC's will occur for this system.

3.3.2 DESCRIPTION

The axle lock has the ability to lock the front and rear axle differentials. The system components are the instrument cluster, axle lock switch, front and rear locker relays, front and rear locker pumps, and locker indicator switches. To operate both lockers three requirements need to be met:

1. ignition in the ON position
2. transfer case range sensor indicating 4 "LOW" range
3. vehicle speed less than 16km/h (10 mph)

The 16km/h (10 mph) engagement is for engagement only. All axles will remain locked if vehicle speed does not exceed 72 km/h (45 mph).

The instrument cluster has the control logic that monitors these requirements. If the requirements are not met the axle lock switch will be disabled. The axle lock switch receives the enable signals from the instrument cluster. Any subsequent downward press of the axle lock switch will operate the front locker relay and front locker pump. The first downward press on the axle lock switch locks the rear axle, the second downward press locks the front axle (rear is still locked), the third downward press unlocks the front axle (rear is still locked), the fourth downward press locks the front axle (rear axle is still locked). An upward press on the axle lock switch at any time will unlock any axle that is currently locked.

The enabled axle lock switch energizes the locker relay and voltage is sent to the locker pump to supply 5 psi of air to the axle allowing the differential to lock up. The “axle lock” indicator on the instrument cluster flashes during the transition state. The instrument cluster is seeking lock feedback from the locking indicator switch. With a successful lock request the “axle lock” indicator will be illuminated and a chime will sound.

If an axle is engaged the axle lock switch remains enabled until all axles are unlocked, regardless if the key is removed from the ignition switch. If the ignition key is removed and either axle is locked the instrument cluster “axle lock” indicator to the corresponding axle will flash and the chime will sound three times to alert of battery discharge. Flashing “axle lock” indicators will continue until axles are unlocked. Once the axles have been locked it will remain locked until one of the following happens:

1. an upward press of the axle lock switch for all locked axles or downward press for front axle only
2. transfer case is shifted out of 4 “LOW” range
3. vehicle speed exceeds 72 km/h (45 mph)
4. loss of battery power

3.4 USING THE DRBIII®

Refer to the DRBIII® user’s guide for instructions and assistance with reading diagnostic trouble codes, erasing trouble codes and other DRBIII® functions.

3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

– User–Requested WARM Boot or User–Requested COLD Boot

This is a sample of such an error message display:

```
ver: 2.14
date: 26 Jul93
file: key_itf.cc
date: Jul 26 1993
line: 548
err: 0x1
User-Requested COLD Boot

Press MORE to switch between this display
   and the application screen.
Press F4 when done noting information.
```

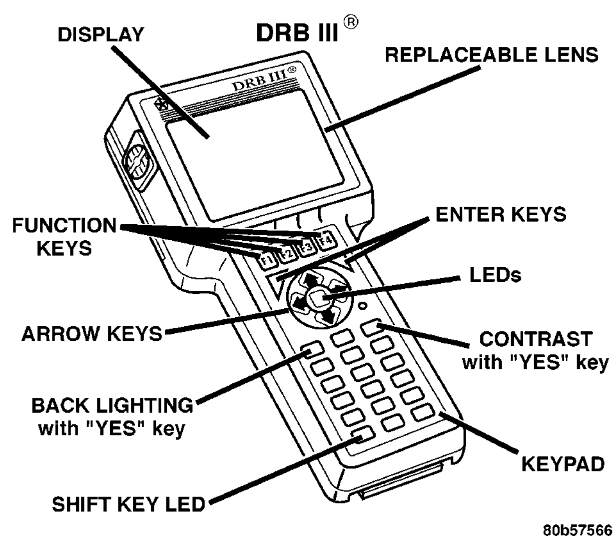
3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED’s do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage (data link 16-way connector cavity 16). A minimum of 11 volts is required to adequately power the DRBIII®. Also, check for a good ground at the DLC.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, and inoperative DRBIII® may be the result of faulty cable or vehicle wiring.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.



4.0 DISCLAIMERS, SAFETY WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING, KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. It is especially important to block the wheels on front-wheel drive vehicles; the parking brake does not hold the drive wheels.

When servicing a vehicle always wear eye protection and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

Additional safety procedures can be found in the service manual. Following these procedures is very important to avoid injury.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If is does not, false diagnostic trouble codes or error messages may occur.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the antilock brake system are intended to be serviced in assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service manual should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table below:

FUNCTION	INPUT LIMIT
Volts	0 - 500 peak volts AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-50 - 600°C -58 - 1100°F

* Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measuring voltage above 25v DC or 25v AC.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNING

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is OFF. Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not pierce wire insulation; this will damage it and eventually cause it to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second code could be set, making diagnosis of the original problem more difficult.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic code or symptom condition.

NOTE: After the repair of pump or speed signal DTC's, the vehicle must be driven at 25 km/h (15 mph) to clear the DTC from the CAB.

WARNING: BEFORE ROAD TESTING A VEHICLE, BE SURE THAT ALL COMPONENTS ARE REASSEMBLED. DURING THE TEST DRIVE, DO NOT TRY TO READ THE DRBIII® SCREEN WHILE IN MOTION. DO NOT HANG THE DRB FROM THE REAR VIEW MIRROR OR OPERATE IT YOURSELF. HAVE AN ASSISTANT AVAILABLE TO OPERATE THE DRBIII®.

4.4 DIAGNOSIS

1. Your diagnostic test procedure must begin with a thorough visual inspection of the ABS for damaged components or disconnected connectors. The brake lamps must be operational prior to continuing.
2. Connect the DRBIII® to the data link connector located under the dash. If the DRBIII® does not power up, check the power and ground supplies to the connector.
3. Select "Antilock Brakes". Turn the ignition on. If the DRBIII® displays "No Response", perform the proper test.
4. Read and record all ABS diagnostic trouble codes. If the "CAB Power Feed Circuit" trouble code is present, it must be repaired prior to addressing any other DTC's. If any additional codes are present, proceed to the appropriate test.
5. If there are no diagnostic trouble codes present, select "Inputs/Outputs" and read the brake switch input as you press and release the brake pedal. If the display does not match the state of the pedal, perform the appropriate test. Read the "G-Switch" status, with the vehicle on a level surface, both switches should read "CLOSED". If the status is not correct, perform the appropriate test. If a problem with the ABS warning indicator exists, refer to the appropriate test.
6. If no other problem are found, it will be necessary to road test the vehicle. **THE DRBIII® MUST NOT BE CONNECTED TO THE DATA LINK CONNECTOR WHEN ROAD TESTING FOR PROPER ANTILOCK OPERATION. THE SYSTEM IS DISABLED WHILE IN DIAGNOSTIC MODE.** Perform several antilock stops from above 50 Km/h (30 mph) and then repeat steps 2, 3, and 4. If any diagnostic trouble codes are present, proceed to the appropriate test.
7. The following conditions should be considered "NORMAL" operation, and no repairs should be attempted to correct them.
   – Brake pedal feedback during an ABS stop (clicking, vibrating)
   – Clicking, groaning or buzzing at 10 Km/h (6 mph) (drive off self test)
   – Groaning noise during an ABS stop
   – Slight brake pedal drop and pop noise when ignition is initially turned on
   – Brake pedal ratcheting down at the end of an ABS stop
8. If the complaint is "ABS cycling" at the end of a stop at low speeds, it may be caused by a marginal wheel speed sensor signal. The sensor air gap, tone wheel condition, and/or brakes hanging up are possible causes of this condition.
9. After a road test in which no problems were found, refer to any Technical Service Bulletins that may apply.

5.0 REQUIRED TOOLS AND EQUIPMENT

DRBIII® (diagnostic read-out box)
jumper wires
ohmmeter
voltmeter
test lamp

6.0 GLOSSARY OF TERMS

ABS	antilock brake system
AC	alternating current
BCM	Body Control Module
CAB	controller antilock brake
CCD	Chrysler Collision Detection
DC	direct current
DLC	data link connector
DRBIII®	diagnostic read-out box
DTC	diagnostic trouble code
HCU	hydraulic control unit
HZ	Hertz
JBLK	junction block
JTEC	Jeep and Truck Engine Controller
LF	left front
LR	left rear
PCM	Powertrain Control Module
PDC	power distribution center
P/M	pump motor
RF	right front
RR	right rear
SCI	Serial Communication Interface
SOL	Solenoid
WSS	wheel speed sensor

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
CAB POWER FEED CIRCUIT

When Monitored and Set Condition:

CAB POWER FEED CIRCUIT

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the Fused B(+) voltage is missing when the CAB detects that an internal main driver is not ″on″, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
INTERMITTENT DTC
B(+) CIRCUIT SHORTED TO GROUND
BLOWN FUSE - FUSED B(+) CIRCUIT
CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND
FUSED B(+) CIRCUIT OPEN
NO B+ SUPPLY TO FUSE
CAB - FUSED B(+) CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Drive the vehicle above 25 km/h (15 mph) for at least 10 seconds. Stop the vehicle. With the DRBIII®, read DTC's. Does the DRBIII® display CAB Power Feed Circuit DTC present right now? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Remove and Inspect Fuse 12 in the PDC. Is the Fuse blown? Yes → Go To 3 No → Go To 6	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Remove Fuse 12 from the PDC. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Using a test light connected to 12 volts, probe the Fused B(+) Circuit. Does the test light illuminate brightly? Yes → Repair the Fused B(+) Circuit Shorted to Ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Remove Fuse 12 from the PDC. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B+ circuit at the PDC fuse terminal. Does the test light illuminate brightly? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. If there are no potential causes remaining, view repair. Continue Replace the Fuse. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Remove Fuse 12 from the PDC. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the Fused B+ circuit between the PDC fuse terminal and the CAB connector. Is the resistance below 5 ohms? Yes → Go To 7 No → Repair the Fused B+ circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
7	Remove Fuse 12 from the PDC. Turn the ignition on. Measure the voltage of the Fused B+ supply to Fuse 12 in the PDC. Is the voltage above 10 volts? Yes → Go To 8 No → Repair the B+ Supply circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
8	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

CAB POWER FEED CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
CONTROLLER FAILURE

When Monitored and Set Condition:

CONTROLLER FAILURE

When Monitored: Ignition on. The CAB monitors its internal microprocessors for correct operation.

Set Condition: If the CAB detects an internal fault, the DTC is set.

POSSIBLE CAUSES
GROUND AND POWER CONNECTIONS
GROUND CIRCUIT HIGH RESISTANCE
GROUND CIRCUIT INTERFERENCE
CAB - INTERNAL FAILURE

TEST	ACTION	APPLICABILITY
1	Inspect for non-factory wiring that may interfere with CAB power or ground circuits. Disconnect the CAB harness connector. Inspect the CAB wiring harness for incorrect routing and damage. Inspect the CAB harness and component connectors for corrosion and damage. Were any concerns found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition off. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the CAB ground circuits to body ground. Is the resistance below 1.0 ohm? Yes → Go To 3 No → Repair the Ground circuit high resistance. Perform ABS VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Disconnect the CAB harness connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Turn on all accessories. Measure the voltage of the Ground circuit. Is the voltage below 1.0 volts? Yes → Go To 4 No → Repair as necessary. Unsplice any accessories connected to the CAB ground circuit. Reroute and shield any high voltage cables away from the CAB ground circuit. Perform ABS VERIFICATION TEST - VER 1.	All

CONTROLLER FAILURE — Continued

TEST	ACTION	APPLICABILITY
4	If there are no possible causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
G-SWITCH NOT PROCESSABLE

When Monitored and Set Condition:

G-SWITCH NOT PROCESSABLE

When Monitored: Ignition on. The CAB sends a test signal out to the G-switch and monitors the sense circuits #1 and #2.

Set Condition: If the sense circuits are open for 2 minutes while driving or an otherwise improper signal is detected at any time, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
G-SWITCH TEST SIGNAL CIRCUIT OPEN
INTERMITTENT DTC
G-SWITCH TEST SIGNAL OR SENSE CIRCUIT SHORT TO VOLTAGE OR GROUND
G-SWITCH SIGNAL CIRCUIT INTERNAL OPEN
CAB - TEST SIGNAL CIRCUIT OPEN
G-SWITCH #1 SENSE CIRCUIT OPEN
G-SWITCH #1 SENSE SWITCH OPEN
CAB - #1 SENSE CIRCUIT OPEN
G-SWITCH #2 SENSE CIRCUIT OPEN
G-SWITCH #2 SENSE SWITCH OPEN
CAB - #2 SENSE CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the status of the G-Switch internal switches. What is the status of both of the G-Switches? Both G-Switches are closed. Go To 2 Both G-Switches are open. Go To 3 Only the #1 G-Switch is open. Go To 7 Only the #2 G-Switch is open. Go To 10	All

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All
3	Turn the ignition off. Disconnect the CAB connector. **Check connector - Clean/repair as necessary.** Disconnect the G-Switch Sensor Connector. **NOTE: Check connector - Clean/repair as necessary.** Measure the resistance of the G-Switch Test Signal circuit. Is the resistance below 5 ohms? Yes → Go To 4 No → Repair the G-Switch Test Signal Circuit Open. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the CAB Connector. **Check connector - Clean/repair as necessary.** Disconnect the G-Switch Sensor Connector. **Check connector - Clean/repair as necessary.** Turn the ignition on. Using a 12-volt test light connected to ground, check the Test Signal and both Sense circuits. Using a 12-volt test light connected to 12-volts, check the Test Signal and both Sense circuits. **CAUTION: The test light should not light at any test point.** Does the test light illuminate at any test point? Yes → Repair the G-Switch Test Signal or Sense circuit for a short to voltage or ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the G-Switch Connector. **Check connector - Clean/repair as necessary.** Remove G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #1 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 6 No → Replace G-Switch. Perform ABS VERIFICATION TEST - VER 1.	All

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
6	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the CAB Connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the G-Switch Sensor Connector. Measure the resistance of the G-Switch #1 Sense Circuit. Is the resistance below 5 ohms? Yes → Go To 8 No → Repair the G-Switch #1 Sense circuit open. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. **Check connector - Clean/repair as necessary.** Remove G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #1 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 9 No → Replace G-Switch Assembly. Perform ABS VERIFICATION TEST - VER 1.	All
9	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect the CAB Connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the G-Switch Connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the G-Switch #2 Sense Circuit. Is the resistance below 5 ohms? Yes → Go To 11 No → Repair the G-Switch #2 Sense Circuit Open. Perform ABS VERIFICATION TEST - VER 1.	All
11	Turn the ignition off. Disconnect the G-Switch connector. **Note: Check connector - Clean/repair as necessary.** Remove the G-Switch from vehicle. While holding the G-Switch level, measure the resistance of the G-Switch Test Signal circuit and the G-Switch #2 Sense circuit in the G-Switch connector. Is the resistance below 5 ohms? Yes → Go To 12 No → Replace the G-Switch Assembly. Perform ABS VERIFICATION TEST - VER 1.	All

G-SWITCH NOT PROCESSABLE — Continued

TEST	ACTION	APPLICABILITY
12	If there are no potential causes remaining, view repair. Repair Replace the CAB. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom List:

LEFT FRONT SENSOR CIRCUIT FAILURE
LEFT REAR SENSOR CIRCUIT FAILURE
RIGHT FRONT SENSOR CIRCUIT FAILURE
RIGHT REAR SENSOR CIRCUIT FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LEFT FRONT SENSOR CIRCUIT FAILURE.

When Monitored and Set Condition:

LEFT FRONT SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

LEFT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

RIGHT FRONT SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

RIGHT REAR SENSOR CIRCUIT FAILURE

When Monitored: Ignition on. The CAB monitors the Wheel Speed Sensor circuits continuously.

Set Condition: If the CAB detects an open or shorted Wheel speed sensor circuit, the Diagnostic Trouble Code (DTC) will set.

POSSIBLE CAUSES
SENSOR OR CONNECTOR DAMAGE
INTERMITTENT DTC
WHEEL SPEED SENSOR OPEN OR SHORTED TO GROUND
WHEEL SPEED SENSOR (+) OR (-) CIRCUIT SHORTED TO VOLTAGE

LEFT FRONT SENSOR CIRCUIT FAILURE — Continued

POSSIBLE CAUSES
WHEEL SPEED SENSOR (+) OR (-) CIRCUIT SHORTED TO GROUND
WHEEL SPEED SENSOR CIRCUITS SHORTED TOGETHER
SPEED SENSOR (+) OR (-) CIRCUIT OPEN
CAB - INTERNAL SHORT OR OPEN

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, read DTC's. Does the DRBIII® display a Wheel Speed Sensor Circuit Failure DTC? Yes → Go To 2 No → Go To 9	All
2	Turn the ignition off. Inspect the affected Wheel Speed Sensor and Connector. Is the Sensor or Connector Damaged? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the affected Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance across the Wheel Speed Sensor (+) and (-) circuits at the Sensor side of the connector. Measure the resistance between ground and the (+) and (-) circuits on the Sensor side of the connector. Is the Sensor resistance 900 to 1300 ohms and resistance to ground more than 15k ohms? Yes → Go To 4 No → Repair the short or replace the Wheel Speed Sensor, as necessary. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Disconnect the affected Wheel Speed Sensor connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Turn the ignition on. Measure the voltage of the Wheel Speed Sensor (+) and (-) circuits. Is the voltage above 1 volt at either circuit? Yes → Repair the Wheel Speed Sensor circuit for a short to voltage. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All

LEFT FRONT SENSOR CIRCUIT FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the affected Wheel Speed Sensor Connector. Disconnect the CAB Connector. Measure the resistance between the Wheel Speed Sensor (+) and (-) circuits and ground. Is the resistance below 15,000 ohms for either circuit? Yes → Repair the Wheel Speed Sensor circuit short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the CAB Connector. Disconnect the affected Wheel Speed Sensor harness connector. Measure the resistance through the Wheel Speed Sensor (+) and (-) circuits at the CAB harness connector. Is the resistance below 200 ohms? Yes → Repair the Wheel Speed Sensor circuits shorted together. Perform ABS VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off. Disconnect the affected Wheel Speed Sensor Connector. **Note: Check connector - Clean/repair as necessary.** Disconnect the CAB Connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the Wheel Speed Sensor (+) and (-) circuits. Is the resistance below 5 ohms for both circuits? Yes → Go To 8 No → Repair the Wheel Speed Sensor (+) or (-) circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
8	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness component and in-line connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom List:
LEFT FRONT SENSOR SIGNAL FAILURE
LEFT REAR SENSOR SIGNAL FAILURE
RIGHT FRONT SENSOR SIGNAL FAILURE
RIGHT REAR SENSOR SIGNAL FAILURE

Test Note: All symptoms listed above are diagnosed using the same tests. The title for the tests will be LEFT FRONT SENSOR SIGNAL FAILURE.

When Monitored and Set Condition:

LEFT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

LEFT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

RIGHT FRONT SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

RIGHT REAR SENSOR SIGNAL FAILURE

When Monitored: Wheel speed comparison is checked at drive off and continuously thereafter.

Set Condition: If, during an ABS stop, the CAB commands any valve solenoid on for an extended length of time, and does not see a corresponding wheel speed change, the Diagnostic Trouble Code (DTC) is set. The DTC can also set if the signal is missing or erratic.

LEFT FRONT SENSOR SIGNAL FAILURE — Continued

POSSIBLE CAUSES
SPEED SENSOR OR CONNECTOR DAMAGED
TONE WHEEL DAMAGED
WHEEL SPEED SENSOR AIR GAP OUT OF SPECIFICATION
WHEEL BEARING EXCESS RUNOUT
WHEEL SPEED SENSOR INOPERATIVE
CAB - CAN'T READ WHEEL SPEED SENSOR SIGNAL
INTERMITTENT SIGNAL DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Using the DRBIII®, monitor all Wheel Speed Sensors while an assistant drives the vehicle. Slowly accelerate as straight as possible from a stop to 24 km/h (15 mph). Note the DRBIII® Wheel Speed Sensor readings. Is one wheel speed signal zero or differing from others by more than 5 km/h (3 mph)? Yes → Go To 2 No → Go To 7	All
2	Turn the ignition off. Inspect the Wheel Speed Sensor and Connector at the affected wheel. Is the Sensor or Connector Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. At the affected wheel, inspect the Tone Wheel for damaged or missing teeth, cracks, or looseness. **Note: The Tone Wheel Teeth should be perfectly square, not bent or nicked.** Is the Tone Wheel OK? Yes → Go To 4 No → Replace the Tone Wheel. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Using a Feeler Gauge, measure the Wheel Speed Sensor Air Gap. **NOTE: The Air Gap should be checked in at least four places on the Tone Wheel.** Is the Air Gap between 0.42 mm - 1.71 mm (0.017″ - 0.068″) ? Yes → Go To 5 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

LEFT FRONT SENSOR SIGNAL FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Inspect the wheel bearing for excessive runout or clearance. **Note: Refer to the appropriate service information, if necessary, for procedures or specifications.** Is the bearing runout OK ? Yes → Go To 6 No → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Raise the affected wheel off the ground. Disconnect the Wheel Speed Sensor connector at the affected wheel. Set up an AC voltmeter to read the output of the Wheel Speed Sensor. Quickly rotate the wheel by spinning the tire by hand. Measure the Wheel Speed Sensor AC voltage output. Does the voltage go above 650 millivolts as the wheel is rotated? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Wheel Speed Sensor in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Visually inspect the affected Wheel Speed Sensor for correct installation. Visually inspect the Tone Wheel for looseness and correct installation. Visually inspect the wiring harness for loose or intermittent connections. Visually inspect mechanical brake components. Inspect for conditions that may cause lockup or drag. Inspect for seized caliper or wheel cylinder piston. Inspect all components for a condition which may cause a Wheel Speed Signal DTC to set. Is any Component Damaged? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
PUMP MOTOR NOT WORKING PROPERLY

When Monitored and Set Condition:

PUMP MOTOR NOT WORKING PROPERLY

When Monitored: Ignition on. The CAB commands the pump on at 20 km/h (12 mph) to check its operation, if the brake switch is not applied. If the driver has their foot on the brake, the test will run at 40 km/h (25 mph). The CAB monitors pump voltage continuously.

Set Condition: The DTC is stored when the CAB detects: 1) Improper voltage decay after the pump was turned off. 2) Pump not energized by the CAB, but voltage is present for 3.5 seconds. 3) Pump is turned on by the CAB, but their is insufficient voltage to operate it.

POSSIBLE CAUSES
ABS PUMP MOTOR INTERMITTENT DTC
FUSED B(+) CIRCUIT INTERMITTENTLY SHORTED TO GROUND
FUSED B(+) CIRCUIT SHORTED TO GROUND
CAB - FUSED B(+) CIRCUIT SHORTED TO GROUND
FUSE BLOWN - PUMP MOTOR CIRCUIT
NO B+ SUPPLY TO FUSE
ABS PUMP MOTOR INOPERATIVE
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT OPEN
GROUND CIRCUIT HIGH RESISTANCE
CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read DTC's. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. With the DRBIII®, actuate the ABS pump motor. Did the Pump Motor operate when actuated? No → Go To 2 Yes → Go To 13	All
2	Turn the ignition off. Remove and inspect the ABS Pump fuse in the PDC. Is the Fuse blown? Yes → Go To 3 No → Go To 7	All

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Make sure the Pump Motor connector is secure. Visually inspect the Fused B(+) Circuit in the wiring harness from the PDC to the CAB. Look for any sign of an Intermittent Short to Ground. Is the wiring harness OK? Yes → Go To 4 No → Repair the Fused B(+) Circuit shorted to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. Remove ABS PUMP Fuse 8 from the Power Distribution Center (PDC). Disconnect the CAB connector. Make sure the Pump Motor connector is secure. **Note: Check connector - Clean/repair as necessary.** Using a test light connected to 12 volts, probe the Fused B (+) Circuit. Is the test light on? Yes → Repair the Fused B(+) circuit short to ground. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Remove ABS PUMP Fuse 12 from the PDC. The CAB must be connected for the results of this test to be valid. Using a test light connected to 12 volts, probe the Fused B (+) circuit in the PDC. Is the test light on? Yes → Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Make sure the Pump Motor connector is secure If there are no potential causes remaining, replace the Fuse. If there are no possible causes remaining, view repair. Repair Replace the ABS Pump Motor Fuse. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off. Remove ABS PUMP Fuse #12 from the Power Distribution Center (PDC). Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the Fused B (+) circuit between the PDC Fuse Terminal and the CAB connector. Is the resistance below 10 ohms? Yes → Go To 8 No → Repair the Fused B(+) circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
8	Turn the ignition on. Using a 12-volt test light connected to ground, check the B+ supply to Fuse 12 in the PDC. Is the B+ supply OK? Yes → Go To 9 No → Repair the B+ supply for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
9	Turn the ignition off. Disconnect Pump Motor Connector. Connect a 10 gauge jumper wire between pump motor Fused B (+) circuit and a 40 Amp Fused B (+) circuit. Connect a 10 gauge jumper wire between pump motor ground circuit and a known good body ground. Monitor Pump Motor operation. Is the pump motor running? Yes → Go To 10 No → Replace the Controller Antilock Brake in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
10	Turn the ignition off. Disconnect CAB Connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the CAB ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 11 No → Repair the ground circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

PUMP MOTOR NOT WORKING PROPERLY — Continued

TEST	ACTION	APPLICABILITY
11	Make sure the Pump Motor connector is secure. Turn the ignition on. With the DRBIII®, enable pump motor actuation. **NOTE: Pump motor will not operate, but voltage will be applied.** Measure the voltage drop across the ABS ground circuit connection, with pump motor actuation enabled. Is the voltage below 0.1 volt? Yes → Go To 12 No → Repair the Ground circuit for an open. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
12	If there are no possible causes remaining, view repair. Repair Replace the Controller Anti-Lock Brake in accordance with the Service Information. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
13	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Make sure the Pump Motor connecter is secure. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. The CAB must sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM OVER VOLTAGE

When Monitored and Set Condition:

SYSTEM OVER VOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused B(+) circuit at all times for proper system voltage.

Set Condition: If the voltage is above 16.5 volts, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
BATTERY OVERCHARGED
FUSED IGNITION SWITCH OUTPUT HIGH
GROUND CIRCUIT OPEN
CAB - INTERNAL FAULT
INTERMITTENT DTC

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. With the DRBIII®, read DTC's. Does the DRBIII® display System Overvoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Turn the ignition off. Inspect for battery charger connected to battery. Is a battery charger connected to the battery? Yes → Charge battery to proper level. Disconnect the battery charger. Clear DTC's. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All

SYSTEM OVER VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Start the engine. Raise engine RPM's above 1,800. Measure the battery voltage. Is the voltage above 16.5 volts ? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 5 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
SYSTEM UNDER VOLTAGE

When Monitored and Set Condition:

SYSTEM UNDER VOLTAGE

When Monitored: Ignition on. The CAB monitors the Fused Ignition Switch Output for proper system voltage.

Set Condition: If the voltage is below 9.5 volts, the Diagnostic Trouble Code (DTC) is set.

POSSIBLE CAUSES
BATTERY VOLTAGE LOW
INTERMITTENT DTC
FUSED IGNITION SWITCH OUTPUT CIRCUIT HIGH RESISTANCE
GROUND CIRCUIT OPEN
CAB - INTERNAL FAULT

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, erase DTC's. Turn the ignition off. Turn the ignition on. Start the engine. Drive the vehicle above 16 km/h (10 mph) for at least 20 seconds. Stop the vehicle With the DRBIII®, read DTC's. Does the DRBIII® display System Undervoltage DTC? Yes → Go To 2 No → Go To 6	All
2	Engine Running. Measure the battery voltage. Is the battery voltage below 10 volts? Yes → Refer to appropriate service information for charging system testing and repair. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB connector. **Note: Check connector - Clean/repair as necessary.** Measure the resistance of the ground circuits. Is the resistance below 1.0 ohm? Yes → Go To 4 No → Repair the Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

SYSTEM UNDER VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
4	Disconnect the CAB harness connector. Turn the ignition on. Measure the voltage of the Fused Ignition Switch circuit. Is the voltage above 10 volts? Yes → Go To 5 No → Repair the Fused Ignition Switch Output Circuit for high resistance Perform ABS VERIFICATION TEST - VER 1.	All
5	If there are no potential causes remaining, view repair. Repair Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Turn the ignition off. Visually inspect the related wiring harness. Look for any chafed, pierced, pinched, or partially broken wires. Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals. Refer to any Hotline letters or Technical Service Bulletins that may apply. Were any problems found? Yes → Repair as necessary. Perform ABS VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*ABS WARNING INDICATOR ALWAYS ON

POSSIBLE CAUSES
ABS RELAY STUCK
ABS RELAY FUSED B+ CIRCUIT OPEN
ABS RELAY CONTROL CIRCUIT OPEN
CAB INTERNAL OPEN
ABS INDICATOR DRIVER SHORT TO GROUND
INSTRUMENT CLUSTER CONCERN

TEST	ACTION	APPLICABILITY
1	Remove the ABS relay from PDC. Perform the key-on bulb test. Does the ABS Indicator light and remain lit? Yes → Go To 2 No → Go To 3	All
2	Disconnect the Instrument Cluster C2 harness connector. Remove the ABS relay from the PDC. Using a 12-volt test light connected to 12-volts, check the ABS Warning Indicator Driver circuit. Does the test light illuminate? Yes → Repair the ABS Indicator circuit for a short to ground. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Refer to symptom list for problems related to Instrument Cluster. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
3	Install a substitute relay in place of the ABS relay. Perform the key-on bulb check. Does the ABS Warning Indicator operate OK? Yes → Replace the ABS relay. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All

*ABS WARNING INDICATOR ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
4	Remove the ABS relay from the PDC. Turn the ignition on. Using a 12-volt test light connected to ground, check the Fused B+ circuit. Does the test light illuminate? Yes → Go To 5 No → Repair the ABS relay Fused B+ circuit for an open. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All
5	Remove the ABS relay. Disconnect the CAB harness connector. Measure the resistance of the ABS Relay Control circuit. Is the resistance below 5.0 ohms? Yes → Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1. No → Repair the ABS Relay Control circuit for an open. The CAB may have to sense all four wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*ABS WARNING INDICATOR INOPERATIVE

POSSIBLE CAUSES
INSTRUMENT CLUSTER CONCERN
ABS RELAY STUCK
ABS RELAY GROUND CIRCUIT OPEN
ABS RELAY CONTROL CIRCUIT SHORT TO GROUND
CAB INTERNAL SHORT TO GROUND
ABS INDICATOR BULB OPEN
ABS INDICATOR DRIVER OPEN
INSTRUMENT CLUSTER INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	Perform the key-on bulb check. Do all bulbs check OK except for the ABS Warning Indicator? Yes → Go To 2 No → Refer to symptom list for problems related to Instrument Cluster. Perform ABS VERIFICATION TEST - VER 1.	All
2	Install a substitute relay in place of the ABS relay. Perform the key-on bulb check. Does the ABS Warning Indicator operate OK? Yes → Replace the ABS relay. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Remove the ABS relay from PDC. Connect a jumper wire between the ABS Warning Indicator driver cavity of the ABS relay socket and ground. Key to RUN Does the ABS Indicator light? Yes → Go To 4 No → Go To 6	All
4	Remove the ABS relay from the PDC. Using a 12-volt test light connected to 12-volts, check the ABS relay ground circuit. Does the test light illuminate? Yes → Go To 5 No → Repair the ABS relay Ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

*ABS WARNING INDICATOR INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
5	Remove the ABS relay. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, check the ABS Relay Control circuit. Does the test light illuminate? Yes → Repair the ABS Relay Control circuit for a short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Controller Antilock Brake. Perform ABS VERIFICATION TEST - VER 1.	All
6	Install a substitute bulb in place of the ABS Indicator bulb. Perform the key-on bulb check. Does the ABS bulb illuminate? Yes → Replace the ABS indicator bulb. Perform ABS VERIFICATION TEST - VER 1. No → Go To 7	All
7	Disconnect the Instrument Cluster C2 harness connector. Remove the ABS relay from the PDC. Measure the resistance of the ABS Indicator driver circuit. Is the resistance below 5.0 ohms? Yes → Replace the Instrument Cluster in accordance with the Service Information.. Perform ABS VERIFICATION TEST - VER 1. No → Repair the ABS Indicator Driver circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*BRAKE LAMP SWITCH

POSSIBLE CAUSES
CHECK BRAKE LAMP SWITCH OUTPUT
BRAKE LAMP SWITCH B+ OPEN
BRAKE LAMP SWITCH OUTPUT CIRCUIT SHORT OR OPEN
BRAKE LAMP SWITCH OPEN
CAB -- INTERNAL OPEN

TEST	ACTION	APPLICABILITY
1	With the DRBIII® in Inputs/Outputs, read the Brake Lamp Switch state. Press and release the brake pedal. Does the DRBIII® display PRESSED and RELEASED? Yes → The Brake Lamp Switch is OK. Perform ABS VERIFICATION TEST - VER 1. No → Go To 2	All
2	Disconnect the Brake Lamp Switch harness connector. Using a 12-volt test light connected to ground, check the Brake Lamp Switch Fused B+ circuit. Does the test light illuminate brightly ? Yes → Go To 3 No → Repair the Brake Lamp Switch Fused B+ circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
3	Disconnect the Brake Lamp Switch harness connector. Connect a jumper wire between the Brake Lamp Switch B+ and Output circuits. With the DRBIII® in Inputs/Outputs, read the Brake Lamp Switch state. Does the DRBIII® display PRESSED? Yes → Replace the Brake Lamp Switch in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1. No → Go To 4	All
4	Disconnect the CAB harness connector. Disconnect the Brake Lamp Switch harness connector. Check the Brake Lamp Switch Output circuit for a short to voltage and an open. Is the Brake Lamp Switch Output circuit shorted or open? Yes → Repair the Brake Lamp Switch Output circuit for a short to voltage or an open. Perform ABS VERIFICATION TEST - VER 1. No → Replace the Controller Anti-Lock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*FRONT AXLE LOCK INDICATOR REMAINS FLASHING

POSSIBLE CAUSES
CHECKING OPERATION
INTERMITTENT CONDITION
FUSED B(+) CIRCUIT OPEN TO THE FRONT LOCKER RELAY
FRONT LOCKER RELAY
FRONT LOCKER RELAY OUTPUT CIRCUIT OPEN
FRONT LOCKER PUMP GROUND CIRCUIT OPEN
FRONT LOCKER PUMP
FRONT LOCKER INDICATOR SWITCH SENSE CIRCUIT OPEN
FRONT LOCKER INDCATOR SWITCH GROUND CIRCUIT OPEN
MECHANICAL FAULT EXISTS

TEST	ACTION	APPLICABILITY
1	**NOTE: For this test to be valid the Rear Axle must be locked and the Rear Lock indicator must be illuminated.** Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Vehicle speed is less than 16km/h (10 mph). Depress the Axle Lock Switch once. Does the Front Axle Lock indicator remain flashing? Yes → Go To 2 No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Disconnect the Front Locker Relay. Measure the voltage of the Fused B(+) circuit in the Front Locker Relay PDC connector. Is the voltage above 10 volts? Yes → Go To 3 No → Repair the Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition off. Replace the Front Locker Relay with a known good part. Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Depress the Axle Lock Switch once. Did the Front Locker Pump turn ON? Yes → Replace the Front Locker Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*FRONT AXLE LOCK INDICATOR REMAINS FLASHING — Continued

TEST	ACTION	APPLICABILITY
4	Measure the resistance of the Front Locker Relay Output circuit between the PDC connector and the Front Locker Pump connector. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off. Disconnect the Front Locker Pump harness connector. Measure the resistance between ground and the Front Locker Pump Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Pump Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Depress the Axle Lock Switch once. Did the Front Locker Pump operate? Yes → Go To 7 No → Refer to Differential/Driveline for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
7	Turn the ignition off. Disconnect the Instrument Cluster C2 harness connector. Disconnect the Front Locker Indicator Switch harness connector. Measure the resistance of the Front Locker Indicator Switch Sense circuit between the Instrument Cluster C2 connector and the Front Locker Indicator Switch connector. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Indicator Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off. Disconnect the Front Locker Indicator Switch harness connector. Measure the resistance between ground and the Front Locker Indicator Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Front Locker Indicator Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Refer to Differential/Driveline information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom List:
*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE

POSSIBLE CAUSES
ATTEMPT TO COMMUNICATE WITH THE PCM
CHECK FUSE #7 IN FUSE BLOCK
OPEN GROUND CIRCUITS
OPEN FUSED IGNITION SWITCH OUTPUT CIRCUIT
SCI TRANSMIT CIRCUIT OPEN
CONTROLLER ANTILOCK BRAKE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRB attempt to communicate with the PCM. Was the DRB able to communicate with the PCM? Yes → Go To 2 No → Refer to symptom list for problems related to No Response From PCM. Perform ABS VERIFICATION TEST - VER 1.	All
2	Turn the ignition off. Remove and inspect fuse #7 in the Fuse Block. Is the fuse open? Yes → Refer to the wiring diagrams located in the service information to help isolate a possible short to ground. Perform ABS VERIFICATION TEST - VER 1. No → Go To 3	All
3	Turn the ignition off. Disconnect the CAB harness connector. Using a 12-volt test light connected to 12-volts, probe each ground circuit. Is the test light illuminated for each circuit? Yes → Go To 4 No → Repair the ground circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
4	Turn the ignition off. **NOTE: Ensure fuse #7 is installed in the Fuse Block.** Disconnect the CAB harness connector. Turn the ignition on. Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit. Is the test light illuminated? Yes → Go To 5 No → Repair the Fused Ignition Switch Output circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM CONTROLLER ANTILOCK BRAKE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off. Disconnect the CAB harness connector. Measure the resistance of the SCI Transmit circuit between the CAB connector and the DLC. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the SCI Transmit circuit for an open. Perform ABS VERIFICATION TEST - VER 1.	All
6	If there are no possible causes remaining, view repair. Repair Replace the Controller Antilock Brake in accordance with the Service Information. Perform ABS VERIFICATION TEST - VER 1.	All

Symptom:
*REAR AXLE LOCK INDICATOR REMAINS FLASHING

POSSIBLE CAUSES
CHECKING OPERATION
INTERMITTENT CONDITION
OPEN FUSE IN PDC
FUSED B(+) CIRCUIT OPEN TO THE REAR LOCKER RELAY
REAR LOCKER RELAY
REAR LOCKER RELAY OUTPUT CIRCUIT OPEN
REAR LOCKER PUMP GROUND CIRCUIT OPEN
REAR LOCKER PUMP
REAR LOCKER INDICATOR SWITCH SENSE CIRCUIT OPEN
REAR LOCKER INDCATOR SWITCH GROUND CIRCUIT OPEN
MECHANICAL FAULT EXISTS

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Vehicle speed is less than 16km/h (10 mph). Depress the Axle Lock Switch once. Does the Rear Axle Lock indicator remain flashing? Yes → Go To 2 No → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1.	All
2	Inspect Fuse 24 in the PDC. Is the Fuse open, missing, or loose? Yes → Replace the open or missing fuse. If the fuse is open make sure to check for a short to ground in the Fused B(+) circuit between the fuse and the relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 3	All
3	Disconnect the Rear Locker Relay. Measure the voltage of the Fused B(+) circuit in the Rear Locker Relay PDC connector. Is the voltage above 10 volts? Yes → Go To 4 No → Repair the Fused B(+)circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

*REAR AXLE LOCK INDICATOR REMAINS FLASHING — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Replace the Rear Locker Relay with a known good part. Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Depress the Axle Lock Switch once. Did the Rear Locker Pump turn ON? Yes → Replace the Rear Locker Relay. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Measure the resistance of the Rear Locker Relay Output circuit between the PDC connector and the Rear Locker Pump connector. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Relay Output circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off. Disconnect the Rear Locker Pump harness connector. Measure the resistance between ground and the Rear Locker Pump Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Pump Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Depress the Axle Lock Switch once. Did the Rear Locker Pump operate? Yes → Go To 8 No → Refer to Differential/Driveline for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
8	Turn the ignition off. Disconnect the Instrument Cluster C1 harness connector. Disconnect the Rear Locker Indicator Switch harness connector. Measure the resistance of the Rear Locker Indicator Switch Sense circuit between the Instrument Cluster C1 connector and the Rear Locker Indicator Switch connector. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Indicator Switch Sense circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Go To 9	All

*REAR AXLE LOCK INDICATOR REMAINS FLASHING — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off. Disconnect the Rear Locker Indicator Switch harness connector. Measure the resistance between ground and the Rear Locker Indicator Switch Ground circuit. Is the resistance above 5.0 ohms? Yes → Repair the Rear Locker Indicator Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1. No → Refer to Differential/Driveline information for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All

Symptom:
*REAR AXLE LOCK INOPERATIVE

POSSIBLE CAUSES
CHECKING OPERATION
INSTRUMENT CLUSTER NOT PROPERLY CONFIGURED
VSS, PCM, OR TRANSFER CASE DTC'S PRESENT
OPEN FUSE IN PDC
AXLE LOCK SWITCH GROUND CIRCUIT OPEN
FUSED B(+) CIRCUIT OPEN TO AXLE LOCK SWITCH
AXLE LOCK SWITCH FAILURE

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. Ensure Transfer Case is in 4 ″LOW″ range. Vehicle speed is less than 16 km/h (10 mph). Depress the Axle Lock Switch once. Does the Axle Lock Switch indicator illuminate? Yes → The condition is not present at this time. Monitor DRBIII® parameters while wiggling the related wiring harness. Refer to any Technical Service Bulletins(TSB) that may apply. Visually inspect the related wiring harness and connector terminals. Perform BODY VERIFICATION TEST - VER 1. No → Go To 2	All
2	Turn the ignition on. With the DRBIII®, ensure the Instrument Cluster is correctly configured for Tire size, Axle type, and Transfer Case. Is the vehicle Instrument Cluster configured correctly? Yes → Go To 3 No → Refer to Body for the related symptom(s). Perform BODY VERIFICATION TEST - VER 1.	All
3	Turn the ignition on. With the DRBIII®, ensure there are no VSS, PCM, or Transfer Case DTC's present. **NOTE: When ALL conditions are met the Instrument Cluster Enable 1 State must indicate - LOW.** Vehicle must indicate the transfer case is in 4 ″LOW″ range, the ignition ON, and vehicle speed is less than 16 km/h (10 mph). Are any VSS, PCM, or Transfer Case DTC's present? Yes → Refer to the appropriate service information for the related DTC's. Perform BODY VERIFICATION TEST - VER 1. No → Go To 4	All

*REAR AXLE LOCK INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
4	Inspect Fuse 26 in the PDC. Is the Fuse open, missing, or loose? Yes → Replace the open or missing fuse. If the fuse is open make sure to check for a short to ground in the Fused B(+) circuit from the fuse to the switch. Perform BODY VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn on the Park lamps. Observe the Axle Lock Switch. Does the Axle Lock Switch illuminate? Yes → Go To 6 No → Repair the Axle Lock Switch Ground circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All
6	Disconnect the Axle Lock Switch connector. Measure the voltage of the Fused B(+) circuit in the Axle Lock Switch connector. Is the voltage above 10 volts? Yes → Replace the Axle Lock Switch in accordance with the Service Information. Perform BODY VERIFICATION TEST - VER 1. No → Repair the Fused B(+) circuit for an open. Perform BODY VERIFICATION TEST - VER 1.	All

Verification Tests

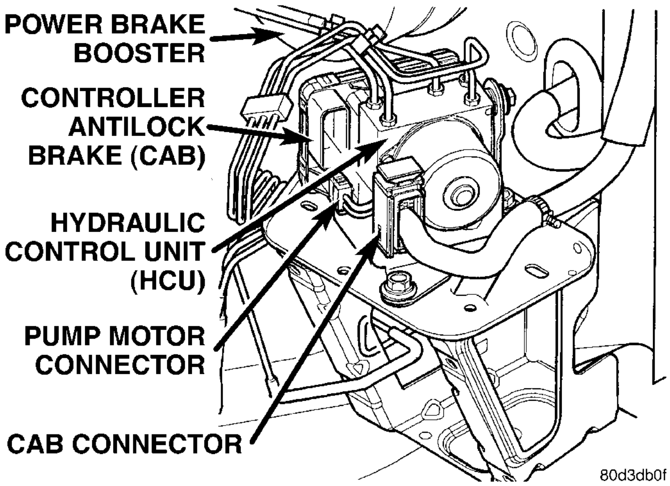
ABS VERIFICATION TEST - VER 1	APPLICABILITY
1. Turn the ignition off. 2. Connect all previously disconnected components and connectors. 3. Ensure all accessories are turned off and the battery is fully charged. 4. Ensure that the Ignition is on, and with the DRBIII, erase all Diagnostic Trouble Codes from ALL modules. Start the engine and allow it to run for 2 minutes and fully operate the system that was malfunctioning. 5. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII, read DTC's from ALL modules. 6. If any Diagnostic Trouble Codes are present, return to Symptom list and troubleshoot new or recurring symptom. **7. NOTE: For Sensor Signal and Pump Motor faults, the CAB must sense all 4 wheels at 25 km/h (15 mph) before it will extinguish the ABS Indicator.** 8. If there are no DTC's present after turning ignition on, road test the vehicle for at least 5 minutes. Perform several antilock braking stops. **9. Caution: Ensure braking capability is available before road testing.** 10. Again, with the DRBIII® read DTC's. If any DTC's are present, return to Symptom list. 11. If there are no Diagnostic Trouble Codes (DTC's) present, and the customer's concern can no longer be duplicated, the repair is complete. Are any DTC's present or is the original concern still present? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

BODY VERIFICATION TEST - VER 1	APPLICABILITY
1. Disconnect all jumper wires and reconnect all previously disconnected components and connectors. **2. NOTE: If the SKIM or PCM was replaced, refer to the service information for proper programming procedures.** **3. NOTE: If the MIC was replaced, configure new cluster with Tire Size, Axle, T-Case Type, and EQ Setting.** 4. Ensure all accessories are turned off and the battery is fully charged. 5. With the DRBIII®, record and erase all DTC's from ALL modules. Start and run the engine for 2 minutes. Operate all functions of the system that caused the original concern. 6. Turn the ignition off and wait 5 seconds. Turn the ignition on and using the DRBIII®, read DTC's from ALL modules. Are any DTCs present or is the original condition still present? Yes → Repair is not complete, refer to the appropriate symptom. No → Repair is complete.	All

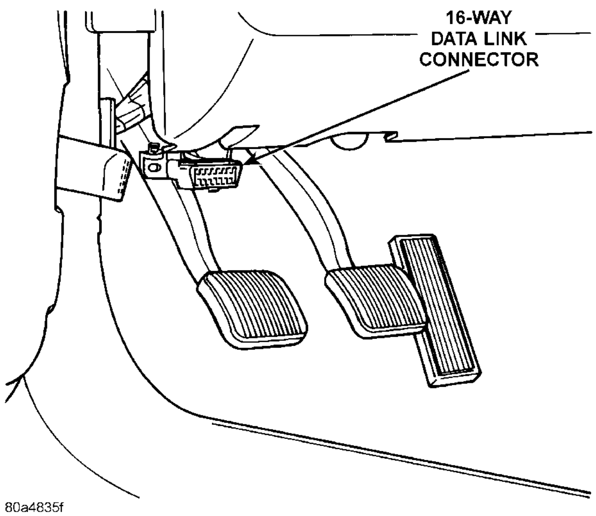
NOTES

8.0 COMPONENT LOCATIONS

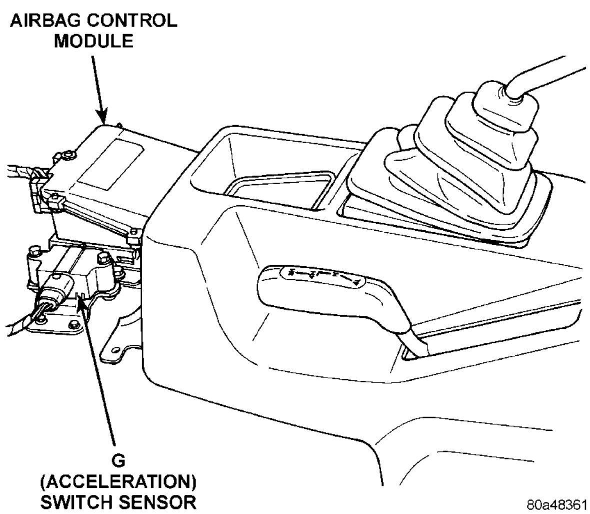
8.1 CONTROLLER ANTILOCK BRAKE



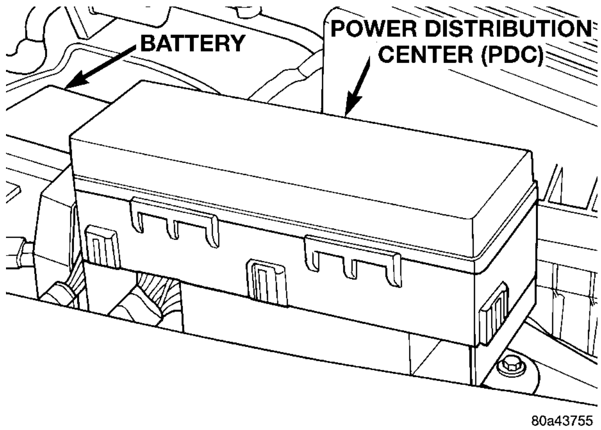
8.2 DATA LINK CONNECTOR



8.3 G-SWITCH

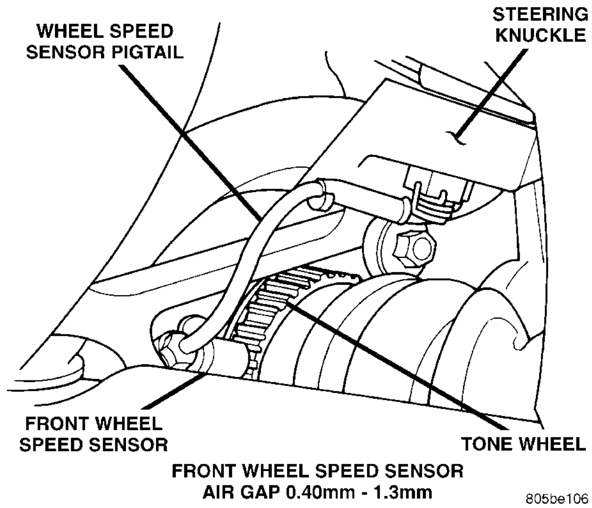


8.4 FUSES & RELAYS

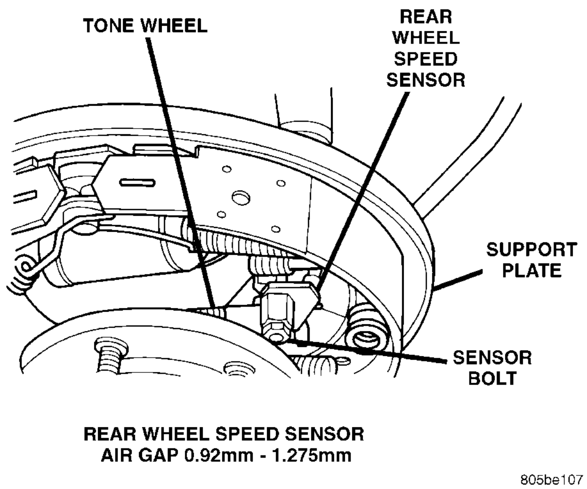


8.5 WHEEL SPEED SENSORS

FRONT

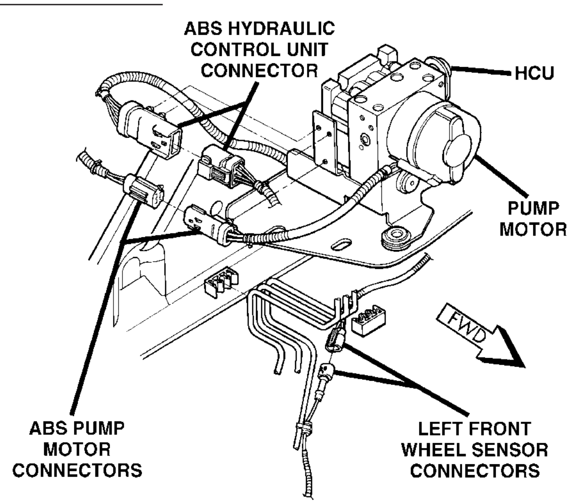


REAR DRUM BRAKES

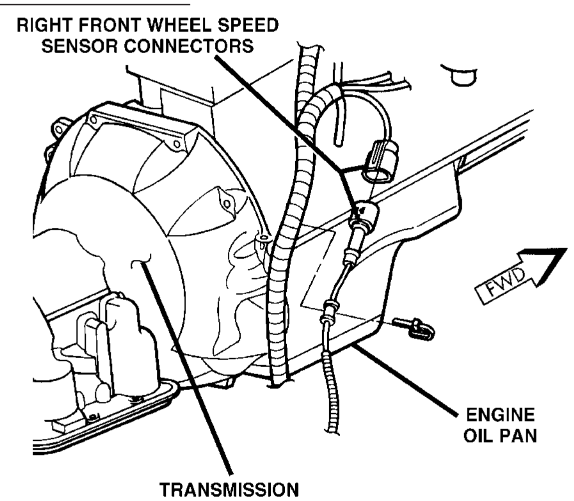


8.6 WHEEL SPEED SENSOR CONNECTORS

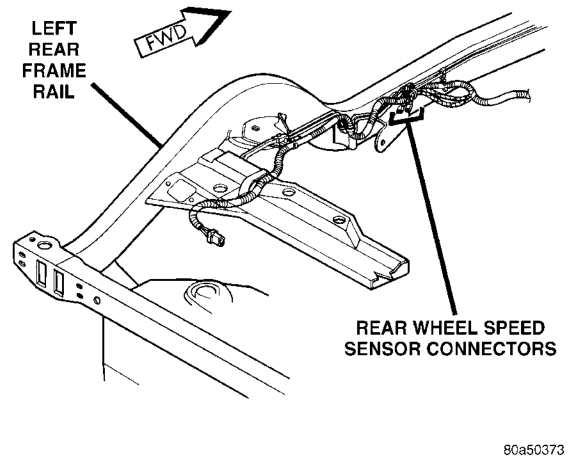
LEFT FRONT



RIGHT FRONT

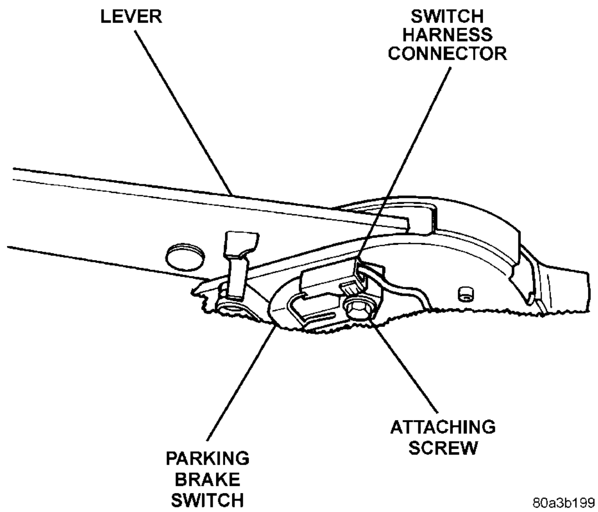


REAR

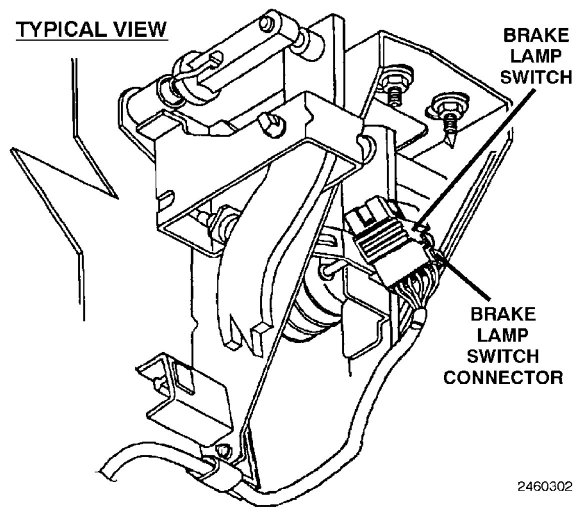


8.7 BRAKE SWITCHES

8.7.1 PARKING BRAKE

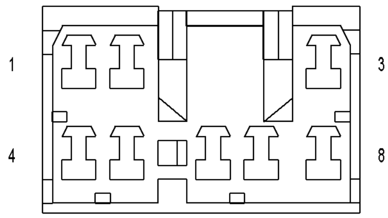


8.7.2 BRAKE SWITCH



NOTES

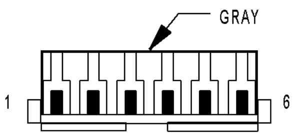
9.0 CONNECTOR PINOUTS



AXLE LOCK SWITCH (OFF-ROAD PACKAGE)

AXLE LOCK SWITCH (OFF-ROAD PACKAGE) - 8 WAY

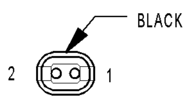
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	E2 20OR	PANEL LAMPS FEED
3	M1 20PK/WT	FUSED B(+)
4	G302 20RD/WT	LOCKER ENABLE SIGNAL 1
5	G303 20VT/DG	LOCKER ENABLE SIGNAL 2
6	G305 20VT/LG	REAR LOCKER REQUEST
7	G304 20VT/DB	FRONT LOCKER REQUEST
8	-	-



BRAKE LAMP SWITCH

BRAKE LAMP SWITCH - GRAY 6 WAY

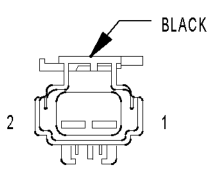
CAV	CIRCUIT	FUNCTION
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
1	K29 20WT/PK	BRAKE LAMP SWITCH SENSE
2	Z1 20BK/WT	GROUND
3	V32 20YL/RD	SPEED CONTROL ON/OFF SWITCH SENSE
4	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
5	F32 18PK/DB	FUSED B(+)
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



BRAKE WARNING INDICATOR SWITCH

BRAKE WARNING INDICATOR SWITCH - BLACK 2 WAY

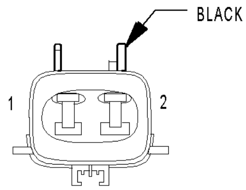
CAV	CIRCUIT	FUNCTION
1	G9 20GY/BK	BRAKE WARNING INDICATOR DRIVER
2	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER



C115 (OFF-ROAD PACKAGE)

C115 (OFF-ROAD PACKAGE) - BLACK (ENGINE SIDE)

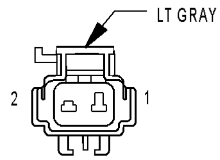
CAV	CIRCUIT
1	Z1 20BK
2	G300 20VT/WT



C115
(OFF-ROAD
PACKAGE)

C115 (OFF-ROAD PACKAGE) - BLACK (FRONT FEEDBACK OVERLAY SIDE)

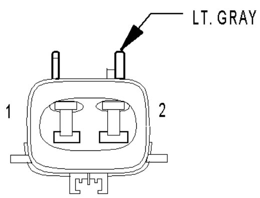
CAV	CIRCUIT
1	Z1 16BK
2	G300 16VT/WT



C116
(OFF-ROAD
PACKAGE)

C116 (OFF-ROAD PACKAGE) - LT GRAY (ENGINE SIDE)

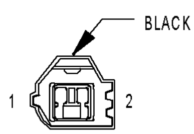
CAV	CIRCUIT
1	Z1 20BK
2	G301 20VT/LB



C116
(OFF-ROAD
PACKAGE)

C116 (OFF-ROAD PACKAGE) - LT GRAY (REAR FEEDBACK OVERLAY SIDE)

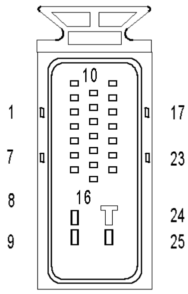
CAV	CIRCUIT
1	Z1 16BK
2	G301 16VT/LB



CLUTCH PEDAL
POSITION SWITCH
(M/T)

CLUTCH PEDAL POSITION SWITCH (M/T) - BLACK 2 WAY

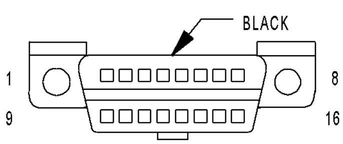
CAV	CIRCUIT	FUNCTION
1	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
2	A41 18YL	FUSED IGNITION SWITCH OUTPUT (START)



CONTROLLER ANTILOCK BRAKE

CONTROLLER ANTILOCK BRAKE - 25 WAY

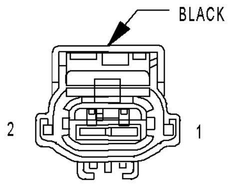
CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	B41 18YL/VT	G-SWITCH NO. 1 SENSE
7	B42 18TN/WT	G-SWITCH NO. 2 SENSE
8	Z22 12BK/PK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
13	B43 18PK/OR	G-SWITCH TEST SIGNAL
14	-	-
15	-	-
16	G83 18GY/BK	ABS RELAY CONTROL
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	-	-
20	D21 18PK	SCI TRANSMIT
21	-	-
22	-	-
23	F20 18VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
24	Z22 12BK/PK	GROUND
25	A10 12RD/DG	FUSED B(+)



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

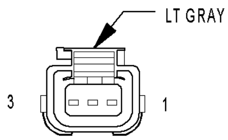
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D23 20WT/BR	FLASH PROGRAM ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

FRONT LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

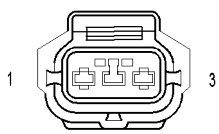
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G300 16VT/WT	FRONT LOCKER INDICATOR SWITCH SENSE



FRONT LOCKER PUMP (OFF-ROAD PACKAGE)

FRONT LOCKER PUMP (OFF-ROAD PACKAGE) - LT GRAY 3 WAY

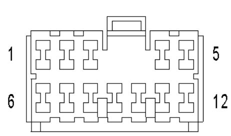
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT



G-SWITCH (LHD)

G-SWITCH (LHD) - 3 WAY

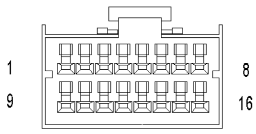
CAV	CIRCUIT	FUNCTION
1	B42 20TN/WT	G-SWITCH NO. 2 SENSE
2	B41 20YL/VT	G-SWITCH NO. 1 SENSE
3	B43 20PK/OR	G-SWITCH TEST SIGNAL



INSTRUMENT CLUSTER C1

INSTRUMENT CLUSTER C1 - 12 WAY

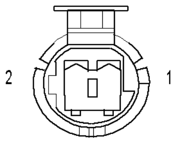
CAV	CIRCUIT	FUNCTION
1	L61 18GY	LEFT TURN SIGNAL
2	L60 18TN	RIGHT TURN SIGNAL
3	G34 16RD/GY (LHD)	HIGH BEAM INDICATOR DRIVER
3	L3 16RD/OR (RHD)	HIGH BEAM INDICATOR DRIVER
4	L39 16LB (EXCEPT EX-PORT)	FOG LAMP FEED
4	L38 16BR/WT (EXPORT)	REAR FOG LAMP FEED
5	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
6	G305 20VT/LG (OFF-ROAD PACKAGE)	REAR LOCKER REQUEST
7	G301 20VT/LB (OFF-ROAD PACKAGE)	REAR LOCKER INDICATOR SWITCH SENSE
8	Z2 18BK/LG	GROUND
9	G303 20VT/DG (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 2
10	D23 20WT/BR	-
11	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	M1 20PK/WT	FUSED B(+)



INSTRUMENT CLUSTER C2

INSTRUMENT CLUSTER C2 - 16 WAY

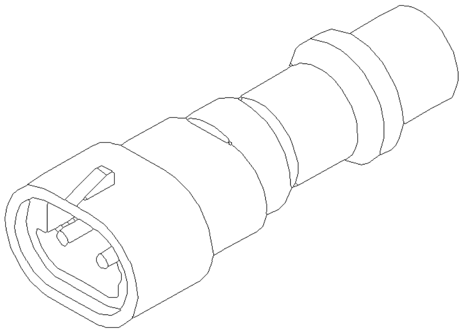
CAV	CIRCUIT	FUNCTION
1	C80 20DB/WT (HARD TOP)	REAR WINDOW DEFOGGER SWITCH SENSE
2	G10 20LG/RD	SEAT BELT SWITCH SENSE
3	G76 20TN/YL	PASSENGER DOOR AJAR SWITCH SENSE
4	G75 20TN	DRIVER DOOR AJAR SWITCH SENSE
5	M2 20YL	COURTESY LAMP FEED
6	E2 20OR	PANEL LAMPS FEED
7	C81 20LB/WT (HARD TOP)	REAR WINDOW DEFOGGER RELAY CONTROL
8	G19 20LG/OR (ABS)	ABS WARNING INDICATOR DRIVER
9	G99 20GY/WT	BRAKE WARNING INDICATOR DRIVER
10	G304 20VT/DB (OFF-ROAD PACKAGE)	FRONT LOCKER REQUEST
11	G107 20BK/RD (4X4)	4WD INDICATOR
12	D25 20VT/YL	PCI BUS
13	G26 20LB	KEY-IN IGNITION SWITCH SENSE
14	G302 20RD/WT (OFF-ROAD PACKAGE)	LOCKER ENABLE SIGNAL 1
15	E19 20RD	PANEL LAMPS DIMMER SIGNAL
16	G300 20VT/WT (OFF-ROAD PACKAGE)	FRONT LOCKER INDICATOR SWITCH SENSE



LEFT FRONT WHEEL SPEED SENSOR

LEFT FRONT WHEEL SPEED SENSOR - 2 WAY

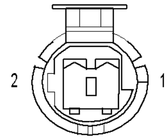
CAV	CIRCUIT	FUNCTION
1	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



LEFT FRONT WHEEL SPEED SENSOR (SENSOR SIDE)

LEFT FRONT WHEEL SPEED SENSOR (SENSOR SIDE) - 2 WAY

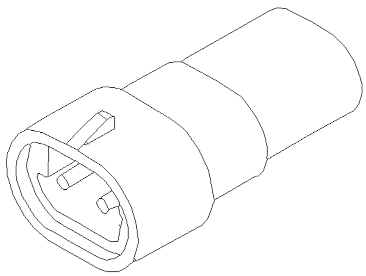
CAV	CIRCUIT	FUNCTION
1	RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	RD	LEFT FRONT WHEEL SPEED SENSOR (+)



LEFT REAR
WHEEL SPEED
SENSOR

LEFT REAR WHEEL SPEED SENSOR - 2 WAY

CAV	CIRCUIT	FUNCTION
1	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)

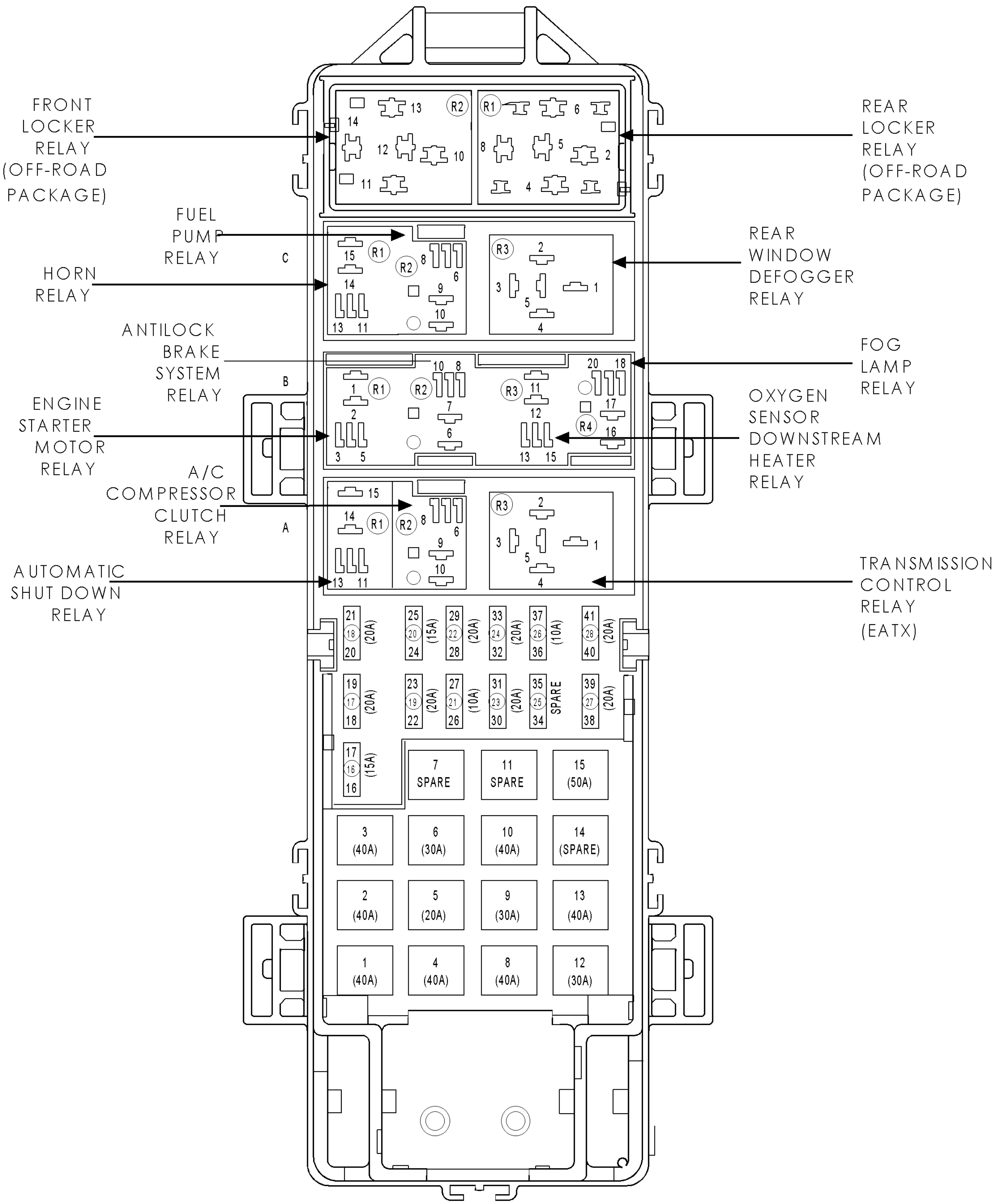


LEFT REAR
WHEEL SPEED
SENSOR
(SENSOR SIDE)

LEFT REAR WHEEL SPEED SENSOR (SENSOR SIDE) - 2 WAY

CAV	CIRCUIT	FUNCTION
1	LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	LG	LEFT REAR WHEEL SPEED SENSOR (+)

POWER DISTRIBUTION CENTER



FUSES (PDC)

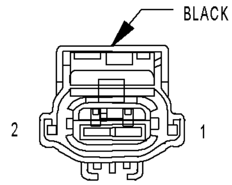
FUSE NO.	AMPS	FUSED CIRCUIT	FUNCTION
1	40A	A111 12RD/LB	FUSED B(+)
2	40A	A4 12BK/PK	FUSED B(+)
3	40A	A6 12RD/BK	FUSED B(+)
4	40A	A16 12GY (2.4L)	FUSED B(+)
5	20A	A30 16RD/WT (A/T)	FUSED B(+)
6	30A	A2 14PK/BK	FUSED B(+)
7	-	-	-
8	40A	A10 12RD/DG (ABS)	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
9	30A	A14 14RD/WT	FUSED B(+)
10	40A	A3 12RD/WT	FUSED B(+)
11	-	-	-
12	30A	A20 12RD/DB (ABS)	FUSED B(+)
13	40A	F30 12RD/PK	FUSED B(+)
14	-	-	-
15	50A	M1 16PK/WT	FUSED B(+)
15	50A	M1 20PK/WT (ABS)	FUSED B(+)
16	15A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
16	15A	F142 18OR/DG	AUTOMATIC SHUT DOWN RELAY OUTPUT
17	20A	F70 16PK/BK	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
18	20A	F31 18VT	FUSED B(+)
19	20A	F39 16PK/LG (FRONT FOG LAMPS)	FUSED B(+)
20	15A	F60 16RD/WT	FUSED B(+)
21	10A	A17 20RD/GY	FUSED B(+)
22	20A	A1 18RD	FUSED B(+)
23	20A	A61 18DG/BK	FUSED B(+)
24	20A	A88 18RD/DB (OFF-ROAD PACKAGE)	FUSED B(+)
25	-	-	-
26	10A	M1 20PK/WT	FUSED B(+)
27	20A	L9 18BK/WT	FUSED B(+)
28	20A	F42 18DG/LG	AUTOMATIC SHUT DOWN RELAY OUTPUT
28	20A	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT

FRONT LOCKER RELAY (IN PDC/OFF-ROAD PACKAGE)

CAV	CIRCUIT	FUNCTION
D10	A88 18RD/DB	FUSED B(+)
D11	G304 20VT/DB	FRONT LOCKER REQUEST
D12	-	-
D13	A88 18RD/DB	FUSED B(+)
D14	A750 18TN/RD	FRONT LOCKER RELAY OUTPUT

REAR LOCKER RELAY (IN PDC/OFF-ROAD PACKAGE)

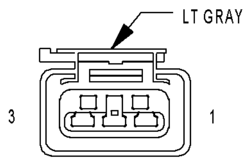
CAV	CIRCUIT	FUNCTION
D2	A88 18RD/DB	FUSED B(+)
D4	A88 18RD/DB	FUSED B(+)
D5	-	-
D6	G305 20VT/LG	REAR LOCKER REQUEST
D8	A850 18RD/WT	REAR LOCKER RELAY OUTPUT



REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE)

REAR LOCKER INDICATOR SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

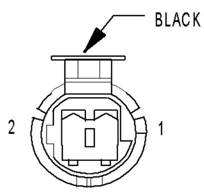
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	G301 16VT/LB	REAR LOCKER INDICATOR SWITCH SENSE



REAR LOCKER PUMP (OFF-ROAD PACKAGE)

REAR LOCKER PUMP (OFF-ROAD PACKAGE) - LT GRAY 3 WAY

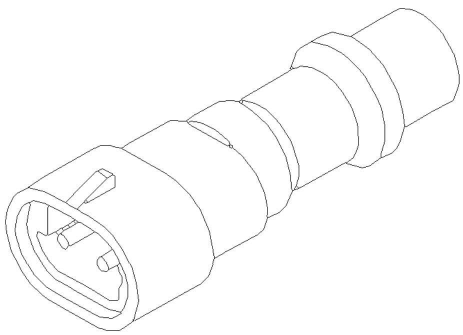
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	-	-
3	A850 18RD/WT	REAR LOCKER RELAY OUTPUT



RIGHT FRONT WHEEL SPEED SENSOR

RIGHT FRONT WHEEL SPEED SENSOR - BLACK 2 WAY

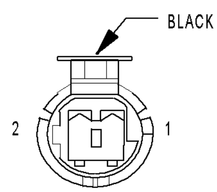
CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



RIGHT FRONT
WHEEL SPEED
SENSOR
(SENSOR SIDE)

RIGHT FRONT WHEEL SPEED SENSOR (SENSOR SIDE) - 2 WAY

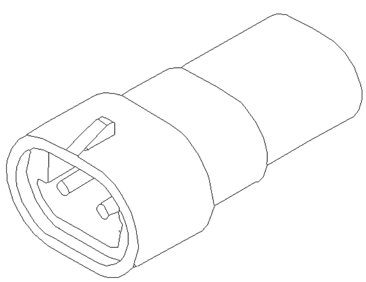
CAV	CIRCUIT	FUNCTION
1	WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



RIGHT REAR
WHEEL SPEED
SENSOR

RIGHT REAR WHEEL SPEED SENSOR - BLACK 2 WAY

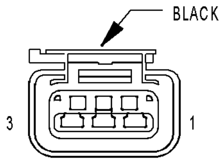
CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)



RIGHT REAR
WHEEL SPEED
SENSOR
(SENSOR SIDE)

RIGHT REAR WHEEL SPEED SENSOR (SENSOR SIDE) - 2 WAY

CAV	CIRCUIT	FUNCTION
1	YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	YL	RIGHT REAR WHEEL SPEED SENSOR (+)



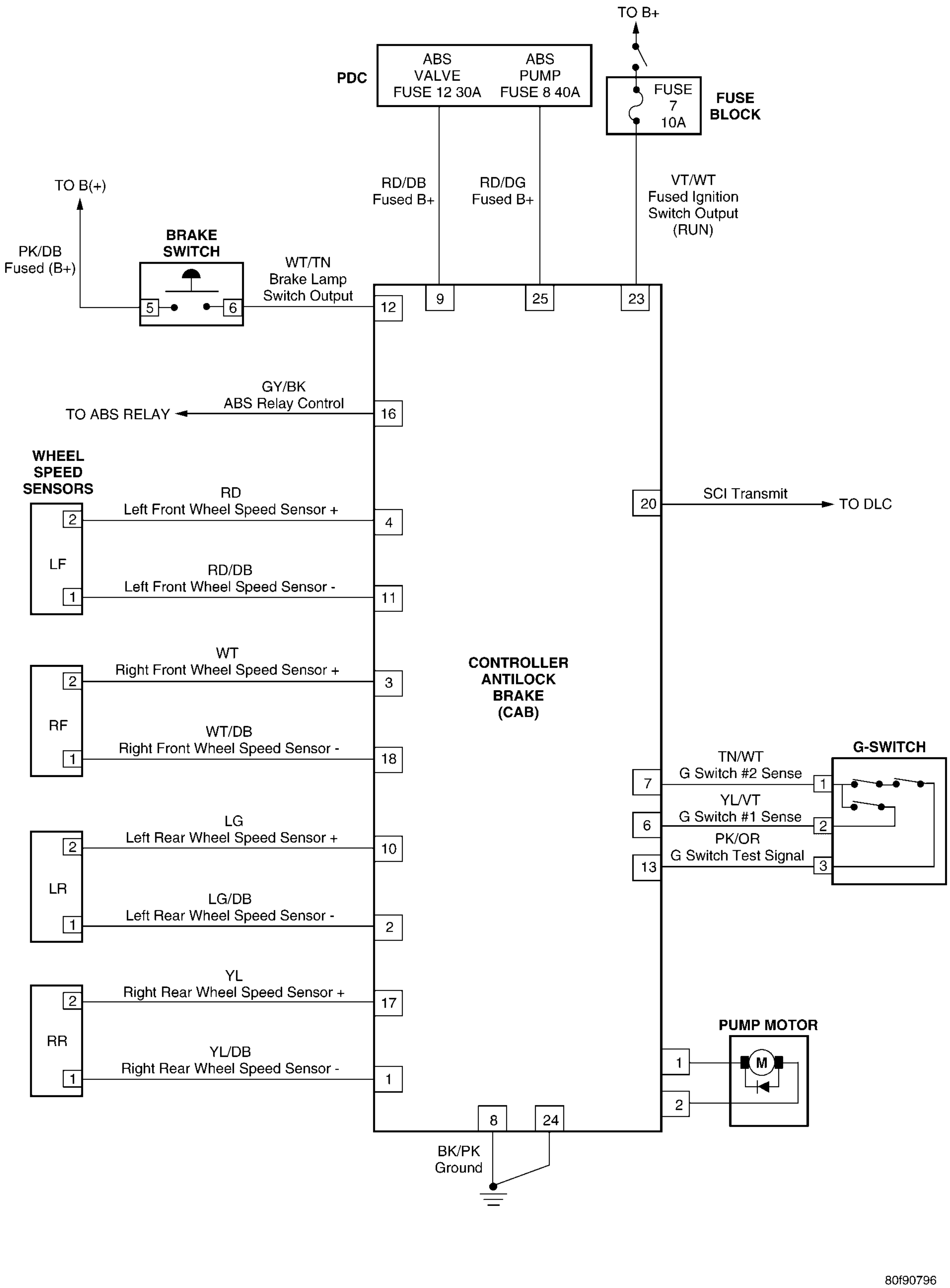
VEHICLE SPEED SENSOR - BLACK 3 WAY

CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	5V SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL

NOTES

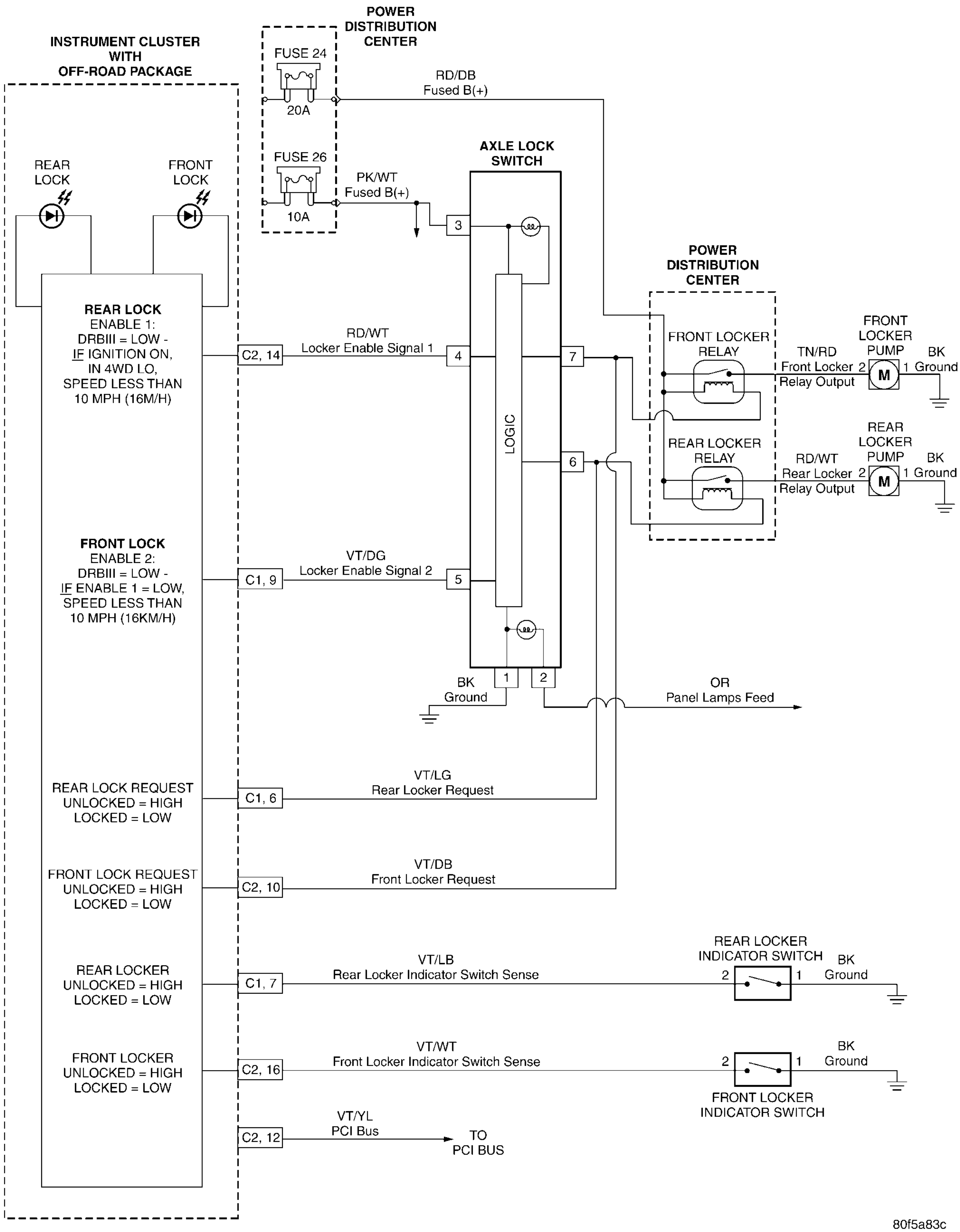
10.0 SCHEMATIC DIAGRAMS

10.1 TEVES MARK 20I CONTROLLER ANTILOCK BRAKE - ABS



SCHEMATIC DIAGRAMS

10.2 AXLE LOCK



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NOTES

1.0 INTRODUCTION

The procedures contained in this manual include all of the specifications, instructions, and graphics needed to diagnose 42RLE Electronic Automatic Transmission (EATX) problems. The diagnostics in this manual are based on the failure condition or symptom being present at the time of diagnosis.

When repairs are required, refer to the appropriate volume of the service manual for the proper removal and repair procedure.

Diagnostic procedures change every year. New diagnostic systems may be added and/or carryover systems may be enhanced. READ THIS MANUAL BEFORE TRYING TO DIAGNOSE A VEHICLE TROUBLE CODE. It is recommended that you review the entire manual to become familiar with all new and changed diagnostic procedures.

This book reflects many suggested changes from readers of past issues. After using this book, if you have any comments or recommendations, please fill out the form at the back of the book and mail it back to us.

1.1 SYSTEM COVERAGE

This diagnostic procedures manual covers all TJ equipped with a 42RLE Transmission.

1.2 SIX-STEP TROUBLESHOOTING PROCEDURE

Diagnosis of the 42RLE electronic Transmission is done in six basic steps:

- verification of complaint
- verification of any related symptoms
- symptom analysis
- problem isolation
- repair of isolated problem
- verification of proper operation

2.0 IDENTIFICATION OF SYSTEM

Visual identification of vehicles equipped with a 4 speed transmission, the Solenoid/Pressure Switch Assembly is located on the passenger side, The Transmission Range Sensor, Input Speed Sensor and Output Speed Sensor are located on the drivers side of the transmission. Refer to the Service Information for transmission ID tag descriptions.

3.0 SYSTEM DESCRIPTION AND FUNCTIONAL OPERATION

3.1 GENERAL DESCRIPTION

The 42RLE electronic Transmission is a conventional Transmission in that it uses hydraulically applied clutches to shift a planetary gear train. However, the electronic control system replaces many of the mechanical and hydraulic components used in conventional transmission valve bodies.

3.2 FUNCTIONAL OPERATION

The 42RLE/AE electronic Transmission has a fully adaptive control system. The system performs it's functions based on continuous real-time sensor feedback information. The control system automatically adapts to changes in engine performance and friction element variations to provide consistent shift quality. The control system ensures that clutch operation during upshifting and downshifting is more responsive without increased harshness.

The Transmission Control Module (TCM) continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a diagnostic trouble code. Some of these codes cause the Transmission to go into Limp-in or default mode. While in this mode, electrical power is taken away from the Transmission via the TCM, de-energizing the transmission control relay, and taking power from the solenoid pack. When this happens, the only Transmission mechanical functions are:

Park and Neutral
Reverse
Second Gear

No upshifts or downshifts are possible. The position of the manual valve alone allows the three ranges that are available. Although vehicle performance is seriously degraded while in this mode, it allows the owner to drive the vehicle in for service.

Once the DRBIII® is in the EATX portion of the diagnostic program, it constantly monitors the TCM to see if the system is in Limp-in mode. If the Transmission is in Limp-in mode, the DRBIII® will flash the red LED.

3.2.1 AUTOSTICK FEATURE (IF APPLICABLE)

This feature allows the driver to manually shift the Transmission when the shift lever is pulled into the AutoStick position. When in AutoStick mode, the instrument cluster displays the current gear.

3.2.2 TRANSMISSION OPERATION AND SHIFT SCHEDULING AT VARIOUS OIL TEMPERATURES

The transmission covered in this manual has unique shift schedules depending on the temperature of the transmission oil. The shift schedule is modified to extend the life of the transmission while operating under extreme conditions.

The oil temperature is measured with a Temperature Sensor on the 42RLE/AE transmission. The Temperature Sensor is an integral component of the Transmission Range Sensor (TRS). If the Temperature Sensor is faulty, the transmission will default to a calculated oil temperature. Oil temperature will then be calculated through a complex heat transfer equation using engine coolant temperature, battery/ambient temperature, and engine off time from the Body Control Module (BCM). These inputs are received from the PCI bus periodically and used to initialize the oil temperature at start up. Once the engine is started, the TCM updates the transmission oil temperature based on torque converter slip speed, vehicle speed, gear, and engine coolant temperature to determine an estimated oil temperature during vehicle operation. Vehicles using calculated oil temperature track oil temperature reasonably accurate during normal operation. However, if a transmission is overfilled, a transmission oil cooler becomes restricted, or if a customer drives aggressively in low gear, the calculated oil temperature will be inaccurate. Consequently the shift schedule selected may be inappropriate for the current conditions. The key highlights of the various shift schedules are as follows:

Extreme Cold: Oil temperature at start up below 26.6°C (-16°F)

> Goes to Cold schedule above -24°C (-12°F) oil temperature

> Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts)

Cold: Oil temperature at start up above -24°C (-12°F) and below 2.2°C (36°F)

> Goes to Warm schedule above 4.4°C (40°F) oil temperature

> Delayed 2-3 upshift approximately 35-50 Km/h (22 - 31 MPH)

> Delayed 3-4 upshift 72-85 Km/h (45-53 MPH)

> Early 4-3 coastdown shift approximately 48 Km/h (30 MPH)

> Early 3-2 coastdown shift approximately 27 Km/h (17 MPH)

> High speed 4-2, 3-2, 2-1 kickdown shifts are prevented

> No EMCC

Warm: Oil temperature at start up above 2.2°C (36°F) and below 27°C (80°F)

> Goes to a Hot schedule above 27°C (80°F) oil temperature

> Normal operation (upshifts, kickdowns, and coastdowns)

> No EMCC

Hot: Oil temperature at start up above 27°C (80°F)

> Goes to a Overheat schedule above 115°C (240°F) oil temperature

> Normal operation (upshifts, kickdowns, and coastdowns)

> Full EMCC, No PEMCC except to engage FEMCC, except at closed throttle at speeds above 113-133 Km/h (70 - 83 MPH)

Overheat: Oil temperature above 115°C (240°F) or engine coolant temperature above 118°C (244°F)

> Goes to a Hot below 110°C (230°F) oil temperature or a Super Overheat above 115°C (240°F) oil temperature

> Delayed 2-3 upshift 40-51 Km/h (25-32 MPH)

> Delayed 3-4 upshift 66-77 Km/h (41-48 MPH)

> 3rd gear FEMCC from 48-77 Km/h (30-48 MPH)

> 3rd gear PEMCC from 43-50 Km/h (27-31 MPH)

Super Overheat: Oil temperature above 127°C (260°F)

> Goes back to a Overheat below 115°C (240°F) oil temperature

> All a Overheat shift schedules features apply

> 2nd gear PEMCC above 35 Km/h (22 MPH)

> Above 35 Km/h (22 MPH) the torque converter will not unlock unless the throttle is closed (i.e. at 80 Km/h (50 MPH) a 4th FEMCC to 3rd FEMCC shift will be made during a part throttle kickdown or a 4th FEMCC to 2nd PEMCC shift will be made at wide open throttle) or if a wide open throttle 2nd PEMCC to 1 kickdown is made.

Causes for operation in the wrong temperature shift schedule:

Extreme Cold or Cold shift schedule at start up:

> Temperature Sensor circuit.

> Overheat or Super Overheat shift schedule after extended operation:

> Operation in city traffic or stop and go traffic

> Engine idle speed too high

> Aggressive driving in low gear

> Trailer towing in OD gear position (use 3 position (or A/S 3rd) if frequent shifting occurs)

> Cooling system failure causing engine to operate over 110°C (230°F)

> Engine coolant temperature stays low too long - If engine coolant temperature drops below 65°C (150°F), the transmission will disengage EMCC. Extended operation with the EMCC disengaged will cause the transmission to overheat.

> Brake switch issue will cause the EMCC to disengage. Extended operation with the EMCC disengaged will cause the transmission to overheat.

> Transmission fluid overfilled

> Transmission cooler or cooler lines restricted

> Transmission Temperature Sensor circuit

3.3 DIAGNOSTIC TROUBLE CODES

Diagnostic trouble codes (DTC's) are codes stored by the Transmission Control Module (TCM) that help us diagnose Transmission problems. They are viewed using the DRBIII® scan tool.

Always begin by performing a visual inspection of the wiring, connectors, cooler lines and the transmission. Any obvious wiring problems or leaks should be repaired prior to performing any diagnostic test procedures. Some engine driveability problems can be misinterpreted as a transmission problem. Ensure that the engine is running properly and that no PCM DTC's are present that could cause a transmission complaint.

If there is a communication bus problem, trouble codes will not be accessible until the problem is fixed. The DRBIII® will display an appropriate message. The following is a possible list of causes for a bus problem:

– open or short to ground/battery in PCI bus circuit.

– internal failure of any module or component on the bus

Each diagnostic trouble code is diagnosed by following a specific testing sequence. The diagnostic test procedures contain step-by-step instructions for determining the cause of a transmission diagnostic trouble code. Possible sources of the code are checked and eliminated one by one. It is not necessary to perform all of the tests in this book to diagnose an individual code. These tests are based on the problem being present at the time that the test is run.

All testing should be done with a fully charged battery.

If the TCM records a DTC that will adversely affect vehicle emissions, it will request (via the communication bus) that the PCM illuminate the Malfunction Indicator Lamp (MIL). Although these DTC's will be stored in the TCM immediately as a 1 trip failure, it may take up to five minutes of accumulated trouble confirmation to set the DTC and illuminate the MIL. Three consecutive successful OBDII (EURO STAGE III OBD) trips or clearing the DTC's with a diagnostic tool (DRBIII® or equivalent) is required to extinguish the MIL. When the TCM requests that the PCM illuminate the MIL, the PCM sets a DTC P0700 ($89) to alert the technician that there are DTC's in the TCM. This must also be erased in the PCM in order to extinguish the MIL.

3.3.1 HARD CODE

Any Diagnostic Trouble Code (DTC) that is set whenever the system or component is monitored is a HARD code. This means that the problem is there every time the TCM checks that system or component. Some codes will set immediately at start up and others will require a road test under specific conditions. It must be determined if a code is repeatable (Hard) or intermittent before attempting diagnosis.

3.3.2 ONE TRIP FAILURES

A One Trip Failure, when read from the TCM, is a hard OBDII (EURO STAGE III OBD) code that has not matured for the full 5 minutes. This applies to codes that will only set after 5 minutes of substituted gear operation.

3.3.3 INTERMITTENT CODE

A diagnostic trouble code that is not there every time the TCM checks the circuit or function is an a intermittent code. Some intermittent codes, such as codes P1684(12), P0891(14), P0888(15), P0725(18), P1694(19), P0871(21), P0846(22), P1724(24), P0706(28), P0120(29), P0750(41), P0755(42), P0760(43), P0765(44), P1793(48), P0715(56), P0720(57), P1794(58), P0951(70), P1799(74), P0884(76), P1687(77), and P1652(78) are caused by wiring or connector problems. However intermittent codes 50 - 54 are usually caused by intermittent hydraulic seal leakage in the clutch and/or accumulator circuits. Problems that come and go like this are the most difficult to diagnose, they must be looked for under the specific conditions that cause them.

3.3.4 STARTS SINCE SET COUNTER

For the most recent code, the Starts Since Set counter counts the number of times the vehicle has started since it was last set. The counter will count up to 255 starts. Note that this code only applies to the last or most recent code set.

When there are no diagnostic trouble codes stored in memory, the DRBIII® will display NO DTC's PRESENT and the reset counter will show "STARTS SINCE CLEAR = XXX

The number of starts helps determine if the diagnostic trouble code is hard or intermittent.

– If the count is less than 3, the code is usually a hard code.
– If the count is greater than 3, it is considered an intermittent code. This means that the engine has been started most of the time without the code recurring.

3.3.5 TROUBLE CODE ERASURE

A Diagnostic trouble code will be cleared from TCM memory if it has not reset for 40 warm-up cycles.

A warm-up cycle is defined as sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 71°C (160°F).

The Malfunction Indicator Lamp (MIL) will turn off after 3 good trips or when the DTC's are cleared from the TCM.

3.3.6 EATX DTC EVENT DATA

EATX DTC EVENT DATA can be used as a diagnostic aid when experiencing Electronic Transmissions with intermittent problems. When a Diagnostic Trouble Code (DTC) is set, the vehicles EATX inputs are stored in the controller memory and are retrievable with the DRBIII®. This information can be helpful when a DTC can not be duplicated.

The EATX DTC EVENT DATA is located in the DRBIII®, under the Transmission system menu, in the sub-screen Miscellaneous. It is a good practice to document the EATX DTC EVENT DATA before beginning any diagnostic or service procedure.

A thorough understanding of how the transmission works is beneficial in order to interpret the data correctly. These skills are necessary in order to avoid an incorrect diagnosis.

A MASTERTECH video and reference book was produced in January 2002 that explains many of the features of the EATX DTC EVENT DATA with several examples on how to interpret the information and suggested training material to help understand all the specifics.

EATX DTC EVENT DATA can only be erased by:

1. Disconnecting the battery.
2. Performing a DRBIII® QUICK LEARN procedure.
3. Reprogramming the EATX controller.

Erasing Transmission DTCs does not clear the EATX DTC EVENT DATA.

3.3.7 LIST OF DIAGNOSTIC TROUBLE CODES (DETAILED DESCRIPTIONS FOLLOW LIST)

The TCM may report any of the following DTC's.

DTC	P-Code	Name of Code	Limp-in	MIL
11	P0613	Internal TCM	Yes	Yes
12	P1684	Battery was disconnected	No	No
13	P0613	Internal TCM	Yes	Yes
14	P0891	Transmission Relay always on	Yes	Yes
15	P0888	Relay output always off	Yes	Yes
16	P0605	Internal TCM	Yes	Yes
17	P0604	Internal TCM	Yes	Yes
18	P0725	Engine speed sensor circuit	Yes	Yes
19	P1694	Bus communication with engine module	No	No
20	P0890	Switched battery	Yes	Yes
21	P0871	OD pressure switch sense circuit	Yes	Yes-1
22	P0846	2/4 pressure switch sense circuit	Yes	Yes
24	P0841	LR pressure switch sense circuit	Yes	Yes
28	P0706	Check shifter signal	No	No
29	P0124	Throttle Position Sensor/APPS intermittent	No	Yes-3
2A	P0122	Throttle Position Sensor /APPS low	No	Yes-3
2B	P0123	Throttle Position Sensor /APPS high	No	Yes-3
31	P0870	OD hydraulic pressure test failure	Yes	Yes
32	P0845	2/4 hydraulic pressure test failure	Yes	Yes
33	P0992	2-4/OD hydraulic pressure test failure	Yes	Yes
35	P0944	Loss of prime	No	No

The TCM may report any of the following DTC's.				
DTC	**P-Code**	**Name of Code**	**Limp-in**	**MIL**
36	P1790	Fault immediately after shift	No	No
37	P1775	Solenoid switch valve latched in TCC position	No	Yes
38	P0740	Torque converter clutch control circuit	No	Yes
41	P0750	LR Solenoid circuit	Yes	Yes
42	P0755	2/4 Solenoid circuit	Yes	Yes
43	P0760	OD Solenoid circuit	Yes	Yes
44	P0765	UD Solenoid circuit	Yes	Yes
45	P0613	Internal TCM	No	No
47	P1776	Solenoid switch valve latched in LR position	Yes	Yes
48	P1793	TRD link communication error	No	Yes-4
50	P0736	Gear ratio error in reverse	Yes	Yes
51	P0731	Gear ratio error in 1st	Yes	Yes
52	P0732	Gear ratio error in 2nd	Yes	Yes
53	P0733	Gear ratio error in 3rd	Yes	Yes
54	P0734	Gear ratio error in 4th	Yes	Yes
56	P0715	Input speed sensor error	Yes	Yes
57	P0720	Output speed sensor error	Yes	Yes
58	P1794	Speed sensor ground error	Yes	Yes
71	P1797	Manual shift overheat	No	No
73	P0897	Worn out/burnt Transmission fluid	No	No
75	P0218	High temperature operation activated	No	No
7A	P0711	Transmission temperature sensor performance	No	No
7B	P0712	Transmission temperature sensor low	No	No
7C	P0713	Transmission temperature sensor high	No	No
7D	P0714	Transmission temperature sensor intermittent	No	No
76	P0884	Power up at speed	No	No
77	P1687	No communication with the MIC	No	No
78	P1652	Serial communication link malfunction	No	No-2
79	P0562	Low battery voltage	Yes	Yes

Notes:
P1xxx DTC's will set the MIL only after 10 seconds of vehicle operation.
1 - The Mil will be lit only if DTC P0706 is also present
2 - The MIL will be lit by the engine controller
3 - The MIL will be lit only if the engine controller is not calibrated for throttle substitution.
4 - The MIL will be lit for engines that limit throttle after a TRD problem.
Yes (underlined) indicates that this DTC can take up to five minutes of problem identification before illuminating the MIL.

3.3.8 DTC DESCRIPTIONS

Name of code: P0613 (11, 13, or 45) - Internal Controller
When monitored: Whenever the key is in the Run or Run/Start position.
Set condition: This code is set whenever Transmission Control Module (TCM) senses an internal error.
Theory of operation: The TCM is constantly monitoring it's internal processor. If an internal problem is detected, this DTC will be set. This DTC can also be set by a bad ground to the TCM and/or Trans Control Relay.
Transmission Effects: The MIL will illuminate (this DTC can take up to five minutes of problem identification before illuminating the MIL) and the transmission system will default to the Immediate Shutdown routine.
Possible causes:

> TCM ground circuit.

> Relay ground circuit.

> TCM

Name of code: P1684(12) - Battery was Disconnected (Informational code Only)
When monitored: Whenever the key is in the Run/Start position.

Set condition: This code is set whenever the Transmission Control Module (TCM) is disconnected from battery power (B+) or ground. It will also be set during the DRBIII® Battery Disconnect procedure.
Theory of operation: A battery backed RAM (Random Access Memory) is used to maintain some learned values. When the battery B(+) is disconnected, the memory is lost. When the B(+) is restored, this memory loss is detected by the TCM. The code is set and the learned values are initialized to known constants or previously learned values from EEPROM (Electronic Erasable Programmable Read Only Memory). This results in the initialization of some parameters.
Transmission Effects: Loss of trouble code data. Immediate Limp-in mode if power is lost while operating the vehicle. Normal operation is resumed if the power is restored during the same key start.
Possible causes:

- > Battery voltage removed from TCM
- > TCM disconnected
- > Dead Battery
- > Low battery voltage during cranking
- > Battery Disconnect by DRBIII® or MDS
- > Bad TCM ground circuit.

Name of code: <u>P0891(14) - Transmission Relay Always On</u>
When monitored: Ignition key is turned from off position to run position and/or ignition key is turned from crank position to run position.
Set condition: This code is set if the Transmission Control Module (TCM) senses greater than 3 volts at the Trans Relay Output (switched battery) terminal of the TCM prior to the TCM energizing the relay.
Theory of operation: The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the TCM through pins 16 and 17. It is referred to as the Trans Relay Output circuit or switched battery.
Transmission Effects: The MIL will illuminate and the transmission system defaults to Logical Limp-in mode. Logical Limp-in mode results in the same modes of operation as Limp-in. Since the relay is stuck “on”, the TCM can not open the relay, and the TCM shifts to 2nd gear.
Possible causes:

- > Relay (welded contacts)
- > Short to battery in 12-volt supply and/or Transmission Control Relay Output circuit(s)
- > Short to voltage
- > TCM connector problems
- > TCM

Name of code: <u>P0888(15) - Relay Output Always Off</u>
When monitored: Continuously
Set condition: This code is set when less than 3 volts are present at the Trans Relay Output (switched battery) terminals at the Transmission Control Module (TCM) when the TCM is energizing the relay.
Theory of operation: The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the TCM through pins 16 and 17. It is referred to as the Trans Relay Output circuit or switched battery.

After a controller reset (ignition key turned to the run position or after cranking engine), the controller energizes the relay. Prior to this the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.
Transmission Effects: The MIL illuminates and the transmission system defaults to Limp-in mode.
Possible causes:

- > Relay failure (intermittent relay function caused by oxidized or contaminated relay contacts)
- > Short to ground or open circuit in the Transmission Control Relay circuit(s)
- > TCM connector problem
- > TCM

Name of code: <u>P0725(18) - Engine Speed Sensor Circuit</u>

<u>NOTE: This code is not a Transmission Input Speed Sensor DTC</u>

When monitored: Whenever the engine is running.
Set condition: This code is set when the engine speed sensed by the Transmission Control Module (TCM) is less than 390 RPM or greater than 8000 RPM for more that 2.0 seconds.
Theory of operation: The TCM uses either a EATX RPM signal (simulated Crank Sensor signal) or the TCM uses the Crank Position Sensor signal to calculate engine RPM depending on the engine application. The signal supplied by the PCM and uses a dedicated circuit is called the EATX RPM Signal circuit. The Crank Position Sensor signal is a spliced circuit from the engine Crank Position Sensor. Check the wiring schematics to determine

which (engine speed sensor circuit) is used in the vehicle. If the TCM interprets this signal to be out of range when the engine is running (as reported by the PCM over the bus) the code is set.
Transmission Effects: The MIL illuminates and the transmission system defaults to Limp-in mode.
Possible causes:

> Open or short in EATX RPM Signal circuit.
> Open or short in Crank Position Sensor Signal circuit.
> Open or short in Crank Position Sensor ground circuit.
> TCM and/or PCM connector problems
> TCM
> PCM

Name of code: P1694(19) - Bus Communication with Engine Module
When monitored: Continuously with key on.
Set condition: If no PCI bus messages are received from the Powertrain Control Module (PCM) for 10 seconds. Theory of operation: The TCM communicates with the PCM using the PCI bus. It relies on certain information to function properly. The TCM continuously monitors the PCI bus to check for messages broadcast from the PCM.
Transmission Effects: Delayed 3-4 shifts. No EMCC and early 3-4 shifts for a few minutes after engine is started.
Possible causes:

> Open or shorted PCI bus circuit
> TCM
> PCM

Name of code: P0890(20) - Switched Battery
When monitored: Ignition key is turned from off position to run position and/or ignition key is turned from crank position to run position.
Set condition: This code is set if the Transmission Control Module (TCM) senses voltage on any of the pressure switch inputs prior to the TCM energizing the relay.
Theory of operation: The transmission control relay is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is off, no power is supplied to the solenoid pack and the transmission is in Limp-in mode. The relay output is fed back to the TCM through pins 16 and 17. It is referred to as the Trans Relay Output circuit or a switched battery.

Immediately after a controller reset (ignition key turned to the run position or after cranking engine), the TCM verifies that the relay contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the Solenoid Pack pressure switches is checked. There should be no voltage on the pressure switches at this time. The TCM will then activate the relay.
Transmission Effects: The MIL illuminates and the transmission system defaults to Limp-in mode.
Possible causes:

> Short to battery on one or more pressure switch sense circuits
> TCM connector problems
> TCM

Name of code: P0871(21) - OD Pressure Switch Sense Circuit
When monitored: Whenever the engine is running.
Set condition: This code is set if the OD pressure switch is open or closed at the wrong time in a given gear (see chart below).
Theory of operation: The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD clutch circuits. The pressure switches are continuously monitored for the correct states in each gear as shown below.

PRESSURE SWITCH STATES

SWITCHES	R	N	1ST	2ND	3RD	4TH
L/R	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
2/4	OPEN	OPEN	OPEN	CLOSED	OPEN	CLOSED
O/D	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

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Transmission Effects: Normal operation will be experienced if no other codes are present. TCM will ignore the code. Limp-in condition will only occur if code P0871(21) is present with a code P0706(28).
Possible causes:

> If code P0944(35) is present, ignore code P0871(21) and perform code P0944 diagnostic procedures
> OD pressure switch sense circuit open or shorted to ground between TCM and solenoid pack
> OD pressure switch sense circuit shorted to battery
> Solenoid pack
> Loose valve body bolts
> Plugged filter - internal transmission or torque converter failure
> TCM

Name of code: P0846(22) - 2/4 Pressure Switch Sense Circuit

When monitored: Whenever the engine is running.

Set condition: This code is set if the 2/4 pressure switch is open or closed at the wrong time in a given gear (see chart below).

Theory of operation: The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear as shown below.

PRESSURE SWITCH STATES

SWITCHES	R	N	1ST	2ND	3RD	4TH
L/R	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
2/4	OPEN	OPEN	OPEN	CLOSED	OPEN	CLOSED
O/D	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

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Transmission Effects: If the 2/4 pressure switch is identified as closed in P or N, the code will immediately be set and normal operation will be allowed for that given key start. If the problem is identified for 3 successive key starts, the transmission will go into Limp-in mode.

If the 2/4 pressure switch is identified as being closed in 1st or 3rd gear and was not identified as being closed in P or N, then 2nd gear or 4th gear will be substituted for 1st or 3rd gear depending on throttle angle and vehicle speed. A short period of time after the gear substitution, the transmission will return to normal operating mode. If the transmission is shifted back into 1st or 3rd gear through normal operation, and the 2/4 pressure switch remains closed, 2nd or 4th gear will be substituted briefly and then resume normal operation. If four gear substitutions occur in a given key start, the transmission will go into Limp-in mode.

If the 2/4 pressure switch is open (indicating no 2/4 clutch pressure) in 2nd or 4th gear, the TCM sets code P0846(22) and continues with normal operation. The transmission will only go into Limp-in mode if a code P0706(28) is also present. If no 2/4 clutch pressure is present a gear ratio code P0732(52) or P0734(54) will be set and cause the limp-in condition.

Possible causes:

> If code P0944(35) is present, ignore code P0846(22) and perform code P0944 diagnostic procedures

> 2/4 pressure switch sense circuit open or shorted to ground between TCM and solenoid pack

> 2/4 pressure switch sense circuit shorted to battery

> Solenoid pack

> Transmission overheated - Excessive regulator valve leakage in valve body causing high line pressure which results in 2/4 solenoid blow-off in 1st or 3rd gear. May require new valve body if it happens only when hot.

> Loose valve body bolts

> Plugged filter - internal transmission or torque converter failure

> TCM

Name of code: P0841(24) - LR Pressure Switch Sense Circuit

When monitored: Whenever the engine is running.

Set condition: This code is set if the LR pressure switch is either open or closed at the wrong time in a given gear.

Theory of operation: The Transmission system uses three pressure switches to monitor the fluid pressure in the LR, 2/4, and OD elements. The pressure switches are continuously monitored for the correct states in each gear as shown below.

PRESSURE SWITCH STATES

SWITCHES	R	N	1ST	2ND	3RD	4TH
L/R	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
2/4	OPEN	OPEN	OPEN	CLOSED	OPEN	CLOSED
O/D	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

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Transmission Effects: If a set condition is identified, 1st gear and torque converter lock-up (EMCC) will be inhibited. The vehicle will launch in 2nd gear and shift normally through the gears without allowing EMCC. If during the same key start, the set condition is no longer valid, the transmission will return to normal operation (1st and EMCC available). Limp-in will not occur unless code P0841(24) is accompanied by a code P0706(28) and the MIL will illuminate after 5 minutes of substituted operation.

Possible causes:

> If code P0944(35) is present, ignore code P0841(24) and perform code P0944(35) diagnostic procedures

> LR pressure switch sense circuit open or shorted to ground between TCM and solenoid pack

> LR pressure switch sense circuit shorted to battery

- > Solenoid pack
- > Valve body - solenoid switch valve stuck in LU position. May be accompanied by a code P1775(37)
- > Loose valve body bolts
- > Plugged filter - internal transmission or torque converter failure
- > TCM

Name of code: <u>P0706(28) - Check Shifter Signal</u>
When Monitored: Continuously with the key on.
Set Condition: 3 occurrences in one key start of an invalid PRNDL code which lasts for more than 0.1 second.
Theory of Operation: The C1 through C4 (T1, T3, T41, and T42) sense circuits communicate the shift lever position to the TCM. Each circuit is terminated at the transmission with a switch. Each switch can be either open or closed, depending on the shift lever position. The TCM can decode this information and determine the shift lever position. Each shift lever position has a certain combination of switches which will be open and closed, this is called a PRNDL code. There are 4 switches, therefore: there are many possible combinations of open and closed switches (codes). However, there are only 9 valid codes (8 for AutoStick), one for each gear position and three recognized between gear codes. The remainder of the codes should never occur, these are called invalid codes. The following chart shows the normal switch states for each shift lever position.

TRS	Park	T1	Rev	T2	N	T2	OD	T3	3/AS	T3	L
T1 (C4)	OP	OP	OP	CL	CL	CL	CL	CL	OP	CL	CL
T3 (C3)	CL	CL	OP	OP	OP	OP	OP	CL	CL	CL	CL
T41 (C1)	CL	OP	OP	OP	CL	OP	OP	OP	OP	OP	OP
T42 (C2)	CL	CL	CL	CL	CL	CL	OP	OP	OP	OP	CL

The following are DRBIII® reported Shift Lever Error Codes (chart)

SHIFT LEVER ERROR CODES REPORTED BY THE DRBIII®

ERROR CODE	SWITCH STUCK	POSITION
1	T1/C4 STUCK	OPEN
2	T1/C4 STUCK	CLOSED
3	T3/C3 STUCK	OPEN
4	T3/C3 STUCK	CLOSED
5	T42/C2 STUCK	OPEN
6	T24/C2 STUCK	CLOSED
7	T41/C1 STUCK	OPEN
8	T41/C1 STUCK	CLOSED

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Transmission Effects and possible causes:
Scenario 1) - All PRNDL lights stay illuminated indefinitely in Park following a Key start.

- > Wrong Part Number TCM for application
- > TRS connector not plugged in
- > C1 through C4 (T1, T3, T41, or T42) circuits are open, shorted to ground, or shorted to 12 volts.
- > PCI bus failure (Open or shorted resulting in no communication to BCM or Cluster)
- > TRS
- > TCM
- > BCM

Scenario 2) - "P" is indicated following a key start but all PRNDL lights illuminate in "N" following a shift from "R" to "N". If PRNDL lights illuminate in "N" and shifter is moved directly into "3" or "L" position without pausing in "OD", then the "OD" position shift schedule and electronic display will indicate "OD" until the shifter is shifted into the "OD" position and held for at least 3 seconds.

- > Worn Manual Lever (Rooster Comb). Check for heavy wearing by TRS switch contacts
- > Intermittent C1 through C4 (T1, T3, T41 or T42) circuits. Check for corrosion, terminal push-outs or spread terminals at 60-way and/or TRS switch 10-way connector
- > TRS
- > TCM
- > BCM

Scenario 3) - If an invalid code happens while operating in the "3" or "L" position, the "3" or "L" shift schedule and electronic display will be frozen (regardless of whether "OD", "3" or "L" is selected). The display will be frozen until the shifter is moved to the "N" position (all PRNDL lights will illuminate) and then back to the "OD" position. The "N" and "OD" position must be held for at least 3 seconds in each position to resume the normal "OD" shift schedule and electronic display.

- > Intermittent C1 through C4 (T1, T3, T41 or T42) circuits. Check for corrosion, terminal push-outs or spread terminals at 60-way and/or TRS connector
- > TRS
- > TCM
- > BCM

These same symptoms may occur without the code P0706(28) getting set. It is possible that the invalid code that was sensed by the TCM only occurred once or twice during the given ignition key start and/or did not last for longer than 0.1 second.

Name of code: P0124(29) - Throttle Position Sensor/APPS Intermittent
Name of code: P0122(2A) - Throttle Position Sensor /APPS Low
Name of code: P0123(2B) - Throttle Position Sensor /APPS High
When monitored: Whenever the key is on or the engine is running. Engine speed > 500 rpm
Set condition:
P0124 - Throttle angle change > 5° in 7 milliseconds the Fault set time milliseconds 0.448 seconds
P0122 - Throttle angle < 6° the Fault Set Time: 0.448 seconds
P0123 - Throttle angle > 120.6° the Fault Set Time: 0.448 seconds
Theory of operation: The transmission controller receives the throttle position signal and its ground from the Throttle Position Sensor (TPS). The TPS has a 5 volt pull up supplied by the engine controller. The throttle signal is checked for out-of-range as well as intermittent operation (excessive signal changes). The engine controller transmits the throttle value via the Bus. Most engine controllers can synthesize the throttle value if the throttle position sensor signal is lost. If a throttle error is detected by the transmission controller and the throttle value is available via the Bus, the Bus throttle value will be used and normal operation will continue, however a throttle fault code will be set. If a throttle error is detected and the throttle value is not available via the Bus, normal operation will be discontinued, a throttle fault code will be set, and the MIL will be turned on after 5 min. of substituted operation.
Transmission Effects:
- If throttle value is available via the Bus -No effect.
- If throttle value is not available via the Bus
  A default throttle value is used.
  Torque converter lock-up inhibited.
  4th gear inhibited.
  Limited shift schedule.
  MIL on after 5 min. of substituted operation.

Possible causes:
> Open or shorted TPS signal and/or ground circuits
> TCM connector problems
> TPS or TPS connector (Check PCM DTC's)
> PCM
> TCM

Name of code: P0870(31) - OD Hydraulic Pressure Test Failure
P0845(32) - 2/4 Hydraulic Pressure Test Failure
P0992(33) - 2-4/OD Hydraulic Pressure Test Failure
When monitored: In 1st, 2nd, or 3rd gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.
Set condition: Immediately after a shift into 1st, 2nd, or 3rd gear, with engine speed above 1000 RPM, the TCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate pressure switch closes. If the pressure switch does not close it is tested again. If the switch does not close the second time, the appropriate code is set.
Theory of operation: The Transmission Control Module (TCM) tests the OD and 2/4 pressure switches when they are off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 3rd gear). The test verifies that the switches are operational. The TCM verifies that the switch closes when the corresponding element is applied. If a switch fails to close, it is retested, If it fails the second test, the code is set.
Transmission Effects: The MIL illuminates and the transmission system defaults to Limp-in mode.
Possible causes:
> Pressure switch sense circuit shorted to battery between TCM and solenoid pack.
> Low line pressure
> Solenoid Pack

PRESSURE SWITCH STATES

SWITCHES	R	N	1ST	2ND	3RD	4TH
L/R	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
2/4	OPEN	OPEN	OPEN	CLOSED	OPEN	CLOSED
O/D	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

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Name of code: Name of code: P0944(35) - Loss Of Prime
When monitored: If the transmission is slipping in any forward gear and the pressure switches are not indicating pressure, a loss of prime test is run.
Set condition: If the transmission begins to slip in any forward gear, and the pressure switch or switches that should be closed for a given gear are open, a loss of prime test begins. All available elements (in 1st gear LR, 2/4 and OD, in 2nd, 3rd, and 4th gear 2/4 and OD) are turned on by the Transmission Control Module (TCM) to see if pump prime exists. The code is set if none of the pressure switches respond. The TCM will continue to run the loss of prime test until pump pressure returns.

Theory of operation: The loss of prime test is used to prevent transmission faults, which can be caused by a lack of pump prime.
Transmission Effects: Vehicle will not move or transmission slips. Normal operation will continue if pump prime returns.
Possible causes:

> Low transmission fluid level

> PRNDL indicates a valid OD code in the hydraulic reverse position

> Transmission fluid filter clogged or damaged

> Transmission fluid filter improperly installed (Bolts loose or O-ring missing)

> Oil pump - If a customer has a problem when the transmission is cold. Where someone shifts to reverse, reverse is engaged, and then shifts to OD and does not get OD (gets a neutral condition), and then can not get reverse or OD for 3-20 seconds, replace the oil pump. High side clearance in the oil pump will set a code 35. The pump will prime upon start-up, but as the torque converter purges air (drain down) the air will leak across the inner rotor into the pump suction port and cause a loss of prime right after the shift into OD. After 3 - 20 seconds, pump prime will return and normal operation will continue. The pump should be replaced only after all other possible causes above have been checked and verified.

Name of code: <u>P1790(36) - Fault Immediately After Shift</u>
When monitored: After a gear ratio error is stored.
Set condition: This code is set if the associated gear ratio code is stored within 1.3 seconds after a shift.
Theory of operation: This code will only be stored along with a 50 series code. If this code is set, it indicates the problem is mechanical in nature. When this code exists, diagnosing the transmission should be based on the associated gear ratio code and primarily mechanical causes should be considered.
Transmission Effects: None
Possible causes:

> Mechanical causes as listed under associated gear ratio code.

Name of code: <u>P1775(37) - Solenoid Switch Valve Latched in TCC Position</u>
When monitored: During an attempted shift into 1st gear.
Set condition: This code is set if three unsuccessful attempts are made to get into 1st gear in one given key start.
Theory of operation: The solenoid switch valve (SSV) controls the direction of the transmission fluid when the LR/TCC solenoid is energized. The SSV will be in the downshifted position in 1st gear, thus directing the fluid to the LR clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC).

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The LR pressure switch is monitored to confirm SSV movement. If movement is not confirmed (the LR pressure switch does not close), 2nd gear is substituted for 1st.
Transmission Effects: Transmission will have no 1st gear (2nd gear will be substituted), and no EMCC operation and the MIL will illuminate after 5 minutes of substituted operation
Possible causes:

> PRNDL indicates a valid OD code in the hydraulic reverse position

> Valve body - Solenoid valve stuck in TCC position

> High idle speed

> Solenoid malfunction - LR pressure switch will not close

> LR Pressure Switch Sense circuit shorted to battery

Name of code: <u>P0740(38) - Torque Converter Clutch Control Circuit</u>
When monitored: During Electronically Modulated Converter Clutch (EMCC)
Set condition:
a) The transmission must be in EMCC, with the input speed greater than 1750 RPM. The TCC/LR solenoid must achieve it's maximum duty cycle and still not be able to pull the engine speed within 60 RPM of input speed.
b) If the transmission is in FEMCC and the engine can slip the TCC by more than 100 RPM (Engine speed - Input speed) for 10 seconds.

The code will be set if one of these event happens three times at a throttle angle less than 30 degrees.
Theory of operation: When in 2nd, 3rd, or 4th gear, the torque converter clutch (TCC) can be locked when certain conditions are met. The TCC piston is electronically modulated by increasing the duty cycle of the LR/TCC solenoid until the torque converter slip difference (difference between engine and turbine speed) is within 60 RPM. Then the LR/TCC solenoid is fully energized (FEMCC / 100% duty cycle). Torque converter slip is monitored in FEMCC to ensure adequate clutch capacity.

Transmission Effects: EMCC will still be available after code is set. MIL will illuminate after 5 minutes of accumulated slip in FEMCC. The transmission will attempt normal operation (not in Limp-in) even after the MIL is illuminated.
Possible causes:

> Worn pump bushing and/or failed torque converter - both should be replaced during a rebuild with code P0740(38) present

> Solenoid pack.

Name of code: P0750(41) - LR Solenoid Circuit
P0755(42) - 2/4 Solenoid Circuit
P0760(43) - OD Solenoid Circuit
P0765(44) - UD Solenoid Circuit
When monitored: Ignition key is turned from off position to run position and/or ignition key is turned from crank position to run position, then every 10 seconds thereafter, or when a gear ratio or pressure switch error DTC is detected.
Set condition: All four solenoids are tested for continuity continuously immediately upon start up and during vehicle operation. For solenoids that are currently energized, power is momentarily interrupted, then reenergized. For solenoids that are not currently energized, the solenoid is momentarily energized, then deenergized. Under both situations, if an inductive spike is not sensed by the Transmission Control Module (TCM) during the continuity check, it is retested twice. If it fails the test the third time, the appropriate code is set.

SOLENOID APPLICATION CHART

GEAR	UD	OD	REV	2/4	LR
PARK					X
REVERSE			X		X
NEUTRAL					X
1ST	X				X
2ND	X			X	
3RD	X	X			
4TH		X		X	

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Theory of operation: Four solenoids are used to control the friction elements (clutches). The continuity of the solenoids circuits are periodically tested. Each solenoid is turned on or off depending on it's current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a gear ratio or pressure switch error occurs. In this case, one failure will result in the appropriate code being set.
Transmission Effects: The MIL will illuminate and the transmission goes into neutral if code is set above 35 Km/h (22 MPH), Limp-in mode when vehicle speed is below 35 Km/h (22 MPH).
Possible causes:

> Open or shorted solenoid circuit(s) between TCM and solenoid pack.

> Open ground circuit.

> TCM connector problems.

> Solenoid pack connector problem.

> Solenoid Pack.

> TCM

Name of code: P1776(47) - Solenoid Switch Valve Latched in LR Position
When monitored: Continuously when doing partial or full EMCC (PEMCC or FEMCC)
Set condition: If the transmission senses the LR pressure switch closing while performing PEMCC or FEMCC. This code will be set after two unsuccessful attempts to perform PEMCC or FEMCC.
Theory of operation: The solenoid switch valve (SSV) controls the direction of the transmission fluid when the LR/TCC solenoid is energized. SSV will be in the downshifted position in 1st gear, thus directing the fluid to the LR clutch circuits. In 2nd, 3rd, and 4th, the SSV will be in the upshifted position and directs the fluid into the torque converter clutch (TCC).

When doing PEMCC or FEMCC, the LR pressure switch should indicate no pressure if the SSV is in the TCC position. If the LR pressure switch indicates pressure while in PEMCC or FEMCC, EMCC operation is aborted and inhibited to avoid inadvertent application of the LR clutch. Partial EMCC will be attempted if the LR pressure switch does not indicate pressure. A second detection of LR pressure results in setting the code.
Transmission Effects: At speeds above 72 Km/h (45 MPH), EMCC is inhibited. Once speed falls below 72 Km/h (45 MPH), the transmission will go into Limp-in mode and the MIL will illuminate after 5 minutes of substituted operation.
Possible causes:

> Valve body - Solenoid valve stuck in LR position

> Intermittent short to ground or open circuit in LR Pressure Switch Sense circuit (with code 24 only)

> Solenoid pack (with code P0841(24) only)

> TCM (with code P0841(24) only)

Name of code: P1793(48) - TRD Link Communication Error

NOTE: The MIL will be lit for some engines that limit throttle after a TRD failure

When monitored: Whenever the engine is running

Set condition: This code is set when the TCM sends multiple torque reduction messages to the PCM and the TCM does not receive a response from the PCM.

Theory of operation: During high torque shifts the TCM will send a message requesting that the PCM reduce engine power until the shift is completed. This message is sent from the TCM to the Powertrain Control Module across the Torque Management Request Sense Circuit. The PCM will acknowledge the TCM request by sending a message across the PCI bus within a specific amount of time. The TRD Link communication is also tested periodically for operation whenever the engine is running and the vehicle is not moving with zero degrees throttle.

Transmission Effects: Maximum throttle angle used by TCM will be 54 degrees. As a result a customer my complain about loss of performance or of short shifting when driving aggressively.

Possible causes:

> Sticky Throttle Position Sensor (TPS)

> Wiring or Connector problems in the Torque Management Request Sense Circuit

> PCM

> TCM

Name of code: P0736(50) - Gear Ratio Error in Reverse
P0731(51) - Gear Ratio Error in 1st
P0732(52) - Gear Ratio Error in 2nd
P0733(53) - Gear Ratio Error in 3rd
P0734(54) - Gear Ratio Error in 4th
P0715(56) - Input Speed Sensor Error
P0720(57) - Output Speed Sensor Error
P1794(58) - Speed Sensor Ground Error

When monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set condition: This code is set if the gear ratio is not correct for a period of time.

- Codes 50 through 54 sets if the ratio of the input RPM (Nt) to the output RPM (No) does not match the given gear ratio.
- Code 56 sets if there is an excessive change in input RPM in any gear
- Code 57 sets if there is an excessive change in output RPM in any gear
- Code 58 sets after a TCM reset in neutral and Nt/No equals a ratio of input to output of 2.50

A hard code sets within 3 seconds, an intermittent code sets within 15 seconds.

Theory of operation: The transmission system uses two speed sensors, one to measure input RPM and one to measure output RPM. These inputs are essential for proper transmission operation. Therefore, the integrity of this data is verified through the following checks:

1) When in gear, if the gear ratio does not compare to a known gear ratio, the corresponding in-gear trouble code is set (codes 50 through 54).

2) An excessive change in input or output speeds indicating signal intermittent will result in codes 56 and/or 57 being set.

3) After a TCM reset in neutral, observing erratic output and input speed sensor signals indicates a loss of the common speed sensors ground. This sets a code 58.

Transmission Effects: The transmission will not go into Limp-in mode until three gear ratio error events occur in a given key start also the MIL will illuminate after 5 minutes of substituted operation. This allows for intermittent problems to correct themselves without opening the relay. However, if a gear ratio error develops, a code is always set, but if the condition corrects itself the transmission will continue without requiring the ignition key to be cycled on and off. Many different events could occur given the range of failures possible for codes 50 through 58. The following are a few examples:

- Codes 51, 52, 53, 54, 56, and 57 at speeds above 72 Km/h (45 MPH) - The appropriate code is set, EMCC is aborted and current gear is maintained. If while still traveling above 72 Km/h (45 MPH), the gear ratio becomes valid again, EMCC will reengage and normal operation will resume. If the gear ratio becomes intermittent and recovers three times in a given key start, the current gear will be maintained and EMCC inhibited, then the transmission will go into Limp-in mode if throttle is applied below 72 Km/h (45 MPH) or at 35 Km/h (22 MPH) with closed throttle.
- Codes 51, 52, 53, 54, 56, and 57 at speeds between 35 and 72 Km/h (22 and 45 MPH) - If one of these codes is set between 35 and 72 Km/h (22 and 45 MPH), the current gear will be maintained until the gear ratio problem corrects itself. If throttle is applied, the trans will go to 2nd gear. If this happens and the gear ratio problem goes away, normal operation will resume. If three gear ratio problems are identified in a given key start, the current gear will be frozen until throttle is applied.

The transmission will then go into Limp-in mode with throttle applied at speeds between 35 and 72 Km/h (22 and 45 MPH)

– Codes 51, 52, 53, 54, 56, and 57 at speeds below 35 Km/h (22 MPH) - If a gear ratio problem is identified below 35 Km/h (22 MPH), the transmission will immediately substitute second gear for the current gear. If the gear ratio problem goes away, normal operation will resume. If three gear ratio problems are identified in a given key start, the transmission will go into Limp-in mode.

Possible causes:

Code P0736(50) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) is also set, follow diagnostic procedure for code P0944(35) first

> Valve body - #1 ball check or LR switch valve sticking - may also set code P0731(51)

> Speed sensor or associated wiring - may also set codes P0731(51), P0715(56), or P0720(57)

> Failed or slipping LR clutch - may also set code P0731(51)
- LR seal leakage (Intermittent no drive or reverse)
- Sticky LR accumulator seals (Intermittent no drive or reverse)

> Failed reverse clutch (hard code)
- OD/Rev lip seal leakage
- Worn reaction shaft support seal rings
- Snap ring out of position

Code P0731(51) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) is also set, follow diagnostic procedure for code P0944(35) first

> Valve body - #1 ball check or LR switch valve sticking - may also set code P0736(56) or have no Reverse

> Speed sensor or associated wiring - may also set codes P0736(50), P0715(56), or P0720(57)

> Failed or intermittent slipping UD clutch - may also set P0732(52), or P0733(53)
- UD seal leakage (intermittent)
- Worn input clutch hub bushing (hard code at heavy throttle)
- Sticky UD accumulator seals (intermittent)
- Worn reaction shaft support seal rings (hard code at heavy throttle)
- Solenoid pack (UD pressure in 4th gear)

> Failed or slipping LR clutch - may also set code P0736(56) or have no Reverse
- LR seal leakage (Intermittent)
- Sticky LR accumulator seals (Intermittent)

Code P0732(52) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) is also set, follow diagnostic procedure for code P0944(35) first

> Failed or slipping 2/4 clutch - may also set code P0734(54)
- 2/4 seal leakage (intermittent)
- Sticky accumulator seals (intermittent)

> Failed or intermittent slipping UD clutch - may also set code P0731(51) and/or P0733(53)
- UD seal leakage (intermittent)
- Worn input clutch hub bushing (hard code at heavy throttle)
- Sticky UD accumulator seals (intermittent)
- Worn reaction shaft support seal rings (hard code at heavy throttle)
- Solenoid pack (UD pressure in 4th gear)

Code P0733(53) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) is also set, follow diagnostic procedure for code P0944(35) first

> Failed or slipping OD clutch - may also set code P0734(54)
- OD and Reverse inner and outer lip seal leakage (usually hard code)
- Sticky OD accumulator seals (intermittent)
- Worn reaction shaft support seal rings (hard code at heavy throttle)
- Broken OD/UD tapered snap ring - (hard code at heavy throttle)

> Failed or intermittent slipping UD clutch - may also set code P0731(51) and/or P0732(52)
- UD seal leakage (intermittent)
- Worn input clutch hub bushing (hard code at heavy throttle)
- Sticky UD accumulator seals (intermittent)
- Worn reaction shaft support seal rings (hard code at heavy throttle)
- Solenoid pack (UD pressure in 4th gear)

Code P0734(54) - Excludes geartrain failures which should be obvious upon disassembly

> If code P0944(35) is also set, follow diagnostic procedure for code P0944(35) first

> Failed or slipping OD clutch - may also set code P0733(53)
- OD and Reverse inner and outer lip seal leakage (usually hard code)
- Sticky OD accumulator seals (intermittent)
- Worn reaction shaft support seal rings (hard code at heavy throttle)

– Broken OD/UD tapered snap ring - (hard code at heavy throttle)

> Failed or slipping 2/4 clutch - may also set code P0732(52)

– 2/4 seal leakage (intermittent)

– Sticky accumulator seals (intermittent)

Codes P0715(56) and P0720(57)

> Failed input or output speed sensor (intermittent or hard code)

> Shorted or open wiring between TCM and speed sensor(s) (intermittent)

> Connector problems at 60 TCM connector and/or speed sensor connector

Code P1794(58)

> Open or shorted speed sensor ground (speed sensor ground is different from chassis ground)

> Open or shorted Temperature Sensor wiring to TRS

> TRS - Will also set code P1799(74)

> TCM

Name of code: P1797(71)- Manual Shift Overheat
When monitored: Whenever the engine is running.
Set condition:
1) If the engine temperature exceeds 124 C (255°F) while operating in AutoStick mode.
2) If the transmission temperature exceeds 135°C (275°F) while in AutoStick mode
Theory of operation: Transmission and engine temperatures are monitored during vehicle operation. If conditions occur causing the engine or transmission to overheat, the AutoStick mode will be canceled, and a code will be set.
Transmission Effects: The 3 position shift schedule that is used in non-AutoStick applications is substituted while operating in the AutoStick gear selector position. No Limp-in mode occurs.
Possible causes:

> Engine overheat - refer to service information for diagnosis and repair

> Transmission Overheat

– Restricted transmission cooling system

– Transmission fluid overfilled

– Radiator fan not functioning properly

– Extended driving in low gear

NOTE: Strenuous driving conditions may cause the vehicle to overheat. If the driver operates in or initiates AutoStick with an overheated vehicle, the code will be set.

Name of code: P0897(73) - Worn Out/Burnt Transmission Fluid
When monitored: At every Fully Electronically Modulated Converter Clutch (FEMCC) to Partial Electronically Modulated Converter Clutch (PEMCC) transition miles when A/C compressor clutch is being cycled.
Set condition: The code will be set if vehicle shudder is detected 20 times when the A/C clutch is cycled.
Theory of operation: While in 3rd or 4th gear FEMCC and just before the A/C clutch engages, the Powertrain Control Module (PCM) requests the Transmission Control Module (TCM) to momentarily establish PEMCC operation. If vehicle shudder is detected during the FEMCC to PEMCC transition, a counter is incremented. If the count reaches 20, the trouble code is set. The driver may then notice harsh bumps when the A/C clutch is being cycled, but vehicle shudder will be eliminated. After 35 OBDII (EURO STAGE III OBD) warm-up starts or if the code is cleared, PEMCC will be reactivated to see if shudder is still present. If one shudder event occurs, the code will be reset. Clearing the code and running battery disconnect with the DRBIII® is the only way to reset the shudder counter from 20 back to zero.
Transmission Effects: This code does not cause the transmission to go into Limp-in mode. However, once the code is set, FEMCC to PEMCC operation before the A/C clutch engagement will be disabled for 35 OBDII (EURO STAGE III OBD) warm up starts.
Possible causes:

> Degraded transmission fluid

> Wheels severely out of alignment

> Internal torque converter problem

Name of code: P0218(75) - High Temperature Operation Activated.
When monitored: Whenever the engine is running.
Set condition: Immediately once the Overheat Shift Schedule is activated.
Theory of operation: If the transmission oil temperature rises above 115°C (240°F), the overheat shift schedule is activated refer to Transmission Operation as a function of Transmission Oil Temperature and the code is set. The DTC is an information code only and is being set to aid the technician in determining root cause of a customer driveability issue. The code is also intended to alert the technician to determine if a cooling system malfunction has occurred or if an additional transmission air to oil cooler should be added to the vehicle if the customer regularly drives in a manner that overheats the transmission. Extended operation above 115°C (240°F) will reduce the durability of the transmission and should be avoided. Correcting the cooling system malfunction

or installing an additional transmission oil cooler will improve transmission durability especially for customers who operate in city/construction stop and go traffic, tow trailers regularly, drive aggressively in low gear or drive regularly in mountainous areas.

Transmission effects: Information only code. - Overheat shift schedule was activated, no Limp-in condition occurs. 2nd gear partial EMCC above 40 Km/h (25 MPH), 3rd gear EMCC from 45-69 Km/h (28-43 MPH), delayed 3-4 upshift at 69 Km/h (43 MPH), early 4-3 coastdown at 66 Km/h (41 MPH), EMCC operation under all conditions above 40 Km/h (25 MPH) except at closed throttle or 1st gear.

Possible causes:

- Transmission Overfilled with Oil
- Engine cooling fan failure
- Engine thermostat stuck closed
- Radiator corroded or packed with dirt
- Transmission Oil Cooler Plugged
- Customer driving pattern requires additional transmission cooling

Name of code: P0884(76) - Power Up at Speed

When monitored: When TCM (transmission control module) initially powers-up.

Set condition: If the TCM powers up while in the "Drive" position and the vehicle is going above 32 Km/h (20 MPH), the code is set.

Theory of Operation: If a vehicle loses power to the TCM, the vehicle will go to the 2nd gear mode since there is no power available to control the transmission solenoids. However if power is restored, the TCM will power-up and normal operation will be restored. This DTC identifies that power to the TCM was restored when the gear selector was in a "Drive" position while the vehicle was moving at speeds above 32 Km/h (20 MPH). If someone shifts to Neutral and cycles the ignition key and quickly shifts to "Drive" while moving before the TCM comes out of its START ROUTINE, the DTC can be set. Therefore it is critical that this DTC diagnosis repair procedure should only be used if the vehicle is experiencing intermittent 2nd gear operation and subsequently a return to normal operation during normal driving.

Transmission Effects: No Limp-in condition. The DTC is for information only when trying to diagnosis intermittent 2nd gear operation and subsequently a return to normal operation.

Possible causes:

- No Problem if vehicle is started in "neutral" at speeds above 32 Km/h (20 MPH) and shifted quickly to "Drive" before TCM comes out of the START ROUTINE.

FOR INTERMITTENT 2ND GEAR OPERATION AND THEN A SUBSEQUENT RETURN TO NORMAL OPERATION WITHOUT CYCLING THE IGNITION KEY

- Intermittent Direct Battery connection between TCM (60-way pin 56) and battery.
- Intermittent Fused Ignition Switch Output between TCM (60-way pin 11) and ignition switch.
- Intermittent Ground to TCM (60 way pins 53 and 57).

Name of code: P1687(77) - No Communication with the MIC

When monitored: Continuously with key on.

Set condition: If no PCI bus messages are received from the Mechanical Instrument Cluster (MIC) for 25 seconds.

Theory of operation: The TCM communicates with the MIC using the PCI bus. It relies on certain information to function properly. The TCM continuously monitors the PCI bus to check for messages broadcast from the PCM.

Transmission effects: Possible improper TCM AutoStick configuration.

Possible causes:

> Open or shorted PCI bus circuit from MIC

> MIC

> TCM (If other communications codes are stored in the TCM only)

Name of code: P1652(78) - Serial Communication Link Malfunction

When monitored: Continuously with key on.

Set condition: If no PCI bus messages are received by the Transmission Control Module (TCM) for 10 seconds.

Theory of operation: The TCM communicates with the other modules in the vehicle using the PCI bus. It relies on certain information to function properly. The TCM continuously monitors the PCI bus to check for messages broadcast from the certain modules.

Transmission Effects: Possible improper TCM AutoStick configuration and delayed 3-4 shifts. No EMCC and early 3-4 shifts for a few minutes after engine is started.

Possible causes:

> Open or shorted PCI bus circuit from BCM

> TCM

Name of code: P0562(79) Low Battery Voltage

When monitored: Continuously with engine running and Transmission Relay energized.

Set condition: If the voltage sensed at the Transmission Control Relay Output circuit (pins 16 and 17 at TCM) for 15 seconds.

Theory of operation: The Transmission system requires sufficient battery voltage in order to energize the transmission solenoids. The TCM continuously monitors the voltage available to the solenoids.

Transmission effects: At speeds above 72 Km/h (45 MPH) the transmission system will default to neutral. Below 72 Km/h (45 MPH) the transmission system will default to Limp-in mode and the MIL will illuminate after 5 minutes of substituted operation. Manual gear selection of Park, Reverse, Neutral and Second will be available.

Possible causes:

> Charging system problem

> Poor/High resistance connection between TCM and Battery/Alternator

> TCM pin 16 and 17 high resistance or poor connection

> TCM ground pins 53 and 57 high resistance or poor connection

> High resistance in Transmission Control Relay contacts

> TCM

Name of code: P0711(7A) - Transmission temperature sensor performance

When monitored: Every 7 milliseconds with the engine running and no loss of prime DTC set.

Set condition: A temperature reading of 80°F is not reached in the specified period of time

Theory of operation: The temperature sensor (thermistor) is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter lock-up, and when and if some diagnostics are run. A failed temperature sensor could affect the OBD II diagnostics, therefore when a fault is detected in the temperature sensor circuit, transmission temperature will be based on a calculated temperature value.

Transmission Effects: When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible causes:

> Temperature sensor

> Temperature sensor wiring circuit.

> Internal controller

Name of code: P0712(7B) - Transmission temperature sensor low

When monitored: Every 7 milliseconds with the engine running and no loss of prime DTC set.

Set condition: Sensor output voltage less than 0.078v.

Theory of operation: The temperature sensor (thermistor) is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter lock-up, and when and if some diagnostics are run. A failed temperature sensor could affect the OBD II diagnostics, therefore when a fault is detected in the temperature sensor circuit, transmission temperature will be based on a calculated temperature value.

Transmission effects: When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible causes:

> Temperature sensor

> Temperature sensor wiring circuit.

> Internal controller

Name of code: P0713(7C) - Transmission temperature sensor high

When monitored: Every 7 milliseconds with the engine running and no loss of prime DTC set.

Set condition: Sensor output voltage greater than 4.94v.

Theory of operation: The temperature sensor (thermistor) is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter lock-up, and when and if some diagnostics are run. A failed temperature sensor could affect the OBD II diagnostics, therefore when a fault is detected in the temperature sensor circuit, transmission temperature will be based on a calculated temperature value.

Transmission effects: When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible causes:

> Temperature sensor

> Temperature sensor wiring circuit.

> Internal controller

Name of code: P0714(7D) - Transmission temperature sensor intermittent

When monitored: Every 7 milliseconds with the engine running and no loss of prime DTC set.

Set condition: Temperature reading change greater than maximum change allowed per loop.

Theory of operation: The temperature sensor (thermistor) is used to sense the temperature of the transmission fluid. Transmission fluid temperature can affect shift quality, torque converter lock-up, and when and if some diagnostics are run. A failed temperature sensor could affect the OBD II diagnostics, therefore when a fault is detected in the temperature sensor circuit, transmission temperature will be based on a calculated temperature value.

Transmission effects: When the fault is set, calculated temperature is substituted for measured temperature, however the fault code is stored only after three consecutive occurrences of the fault.

Possible causes:

> Temperature sensor

> Temperature sensor wiring circuit.

> Internal controller

3.3.9 QUICK LEARN

The Quick Learn function customizes adaptive parameters of the TCM to the transmission characteristics of a vehicle. This gives the customer improved “as received” shift quality compared to the initial parameters stored in the TCM.

Notes about Quick Learn Features

The nature of the Quick Learn function requires that certain features must be taken into consideration.

> Quick Learn should generally not be used as a repair procedure unless directed by a repair or diagnostic procedure. If the transmission system is exhibiting a problem that you think is caused by an invalid CVI, you should try to relearn the value by performing the appropriate driving maneuvers. In most cases, if quick learn makes a vehicle shift better, the vehicle will return with the same problem.

> Before performing Quick Learn, it is imperative that the vehicle be shifted into OD with the engine running and the oil level set to the correct level. This step will purge air from the clutch circuits to prevent erroneous clutch volume values which could cause poor initial shift quality.

> If an unused TCM is installed on a vehicle with a HOT engine, Quick Learn will cause the TCM to report a cold calculated oil temperature. This requires monitoring the calculated oil temperature using the DRBIII®. If the temperature is below 15°C (60°F), the transmission must be run at idle or driven in gear until it goes above 15°C (60°F). If the temperature is above 93°C (200°F), the transmission must cool to below 93°C (200°F).

> First gear is engaged in overdrive after Quick Learn is completed. Place the vehicle in park after performing Quick Learn.

The Quick Learn function should be performed:

– Upon installation of a new service TCM
– After replacement or rebuild of internal transmission components or the torque converter
– If one or more of the clutch volumes indexes (CVI’S) contain skewed readings because of abnormal conditions.

To perform the Quick Learn procedure, the following conditions must be met.

– It is imperative that the vehicle be shifted into OD with the engine running and the oil level set to the correct level. This step will purge the air in the clutch circuits to prevent erroneous clutch volume values, which could cause poor initial shift quality.
– The brakes must be applied.
– The engine must be idling.
– The throttle angle (TP sensor) must be less than 3 degrees.
– The shift lever position must stay in neutral until prompted to shift into OD.
– The shift lever must stay in OD after the “Shift to Overdrive” prompt until the DRBIII® indicates the procedure is complete.
– The oil temperature must be between 15°C (60°F) and 93°C (200°F).

NOTE: The above conditions must be maintained during the procedure to keep the procedure from being aborted.

The Quick Learn procedure is performed with the DRBIII® by selecting “Transmission” system then “Miscellaneous” functions, then “Quick Learn”. Follow the procedure instructions displayed on the DRBIII®.

3.3.10 CLUTCH VOLUMES

The LR clutch volume is updated when doing a 2-1 or 3-1 coast down shift. The transmission temperature must be between 21-49°C (70-120°F). The clutch volume should be between 35 and 83.

The 2/4 clutch volume is updated when doing a 1-2 shift. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 20 and 77.

The OD clutch volume is updated when doing a 2-3 shift. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 40 and 150.

The UD clutch volume is updated when doing a 4-3 or 4-2 shift. The transmission temperature must be above 43°C (110°F). The clutch volume should be between 24 and 70.

3.3.11 ELECTRONIC PINION FACTOR (IF APPLICABLE)

Using the following steps, the pinion factor can be checked and/or reset using the DRBIII®:

1. Select Transmission system, then Miscellaneous functions, then Pinion Factor. The DRBIII® will display the current tire size.
2. If the tire size is incorrect, press the Enter key and then select the correct size.
3. Press the Page Back key to exit the reset procedure.

Notes About Electronic Pinion Factor Features
The nature of the electronic pinion factor requires that certain features must be taken into consideration.

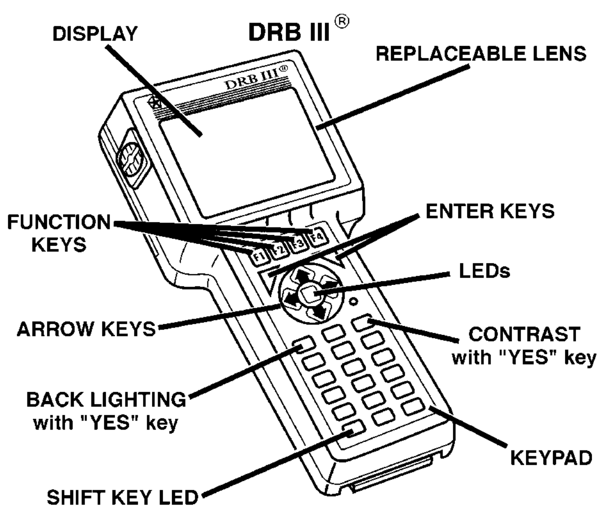
> If no pinion factor is stored in an installed TCM, the vehicle speedometer will not operate, engine speed will be limited to 2300 RPM, and catalyst damage may occur.

> Selecting a wrong tire size will cause the speedometer to be inaccurate and will also cause any speed related features to operate improperly.

NOTE: After replacing the TCM, you must reprogram pinion factor

3.4 USING THE DRBIII®

Refer to the DRBIII® users guide for instructions and assistance with reading trouble codes, erasing trouble codes, and other DRBIII® functions.



3.5 DRBIII® ERROR MESSAGES

Under normal operation, the DRBIII® will display one of only two error messages:

– User-Requested WARM Boot
– User-Requested COLD Boot

If the DRBIII® should display any other error message, record the entire display and call the S.T.A.R.. Center.

3.5.1 DRBIII® DOES NOT POWER UP (BLANK SCREEN)

If the LED's do not light or no sound is emitted at start up, check for loose cable connections or a bad cable. Check the vehicle battery voltage. A minimum of 11 volts is required to adequately power the DRBIII®.

If all connections are proper between the DRBIII® and the vehicle or other devices, and the vehicle battery is fully charged, an inoperative DRBIII® may be the result of faulty cable or vehicle wiring. For a blank screen, refer to the appropriate Body Diagnostic manual.

3.5.2 DISPLAY IS NOT VISIBLE

Low temperatures will affect the visibility of the display. Adjust the contrast to compensate for this condition.

3.6 TRANSMISSION SIMULATOR (MILLER TOOL # 8333) AND ELECTRONIC TRANSMISSION ADAPTER KIT (MILLER TOOL #8333-1A)

NOTE: Remove the starter Relay when using the transmission simulator

- **Failure to remove the Starter Relay can cause a PCM - No Response condition.**
- **The removal of the Starter Relay will also prevent the engine from starting in gear.**
- **The Transmission Simulator will not accurately diagnose intermittent faults.**

The transmission simulator, simply put, is an electronic device that simulates the electronic functions of any EATX or NGC controlled transmission. The Simulators basic function is to aid the technician in determining if an internal transmission problem exists or if the problem resides in the vehicle wiring or control module. It is only useful for electrical problems. It will not aid in the diagnosis of a failed mechanical component, but it can tell you that the control module and wiring are working properly and that the problem is internal.

The ignition switch should be in the lock position before attempting to install the simulator. Follow all instructions included with the simulator. If the feedback from the simulator is in doubt, you can verify it's operation by installing it on a known good vehicle. A "known good vehicle" would be defined as a vehicle that does not set any DTC's and drives and shifts as expected.

One important point to remember is that the Simulator receives it's power from the Trans Relay Output circuit. If the transmission system is in Limp-in (Relay open), the simulator will not operate. This is not really an indication of a problem, but an additional symptom. If the simulator does not power up ("P" led lit), this is an indication that the problem is still present with the simulator hooked up. This indicates that the problem is in the wiring or control module and not the transmission.

Miller Tool # 8333-1A consists of the adapter cables and overlay necessary to adapt the simulator to TE/AE/LE/RLE transmissions.

4.0 DISCLAIMERS, SAFETY, AND WARNINGS

4.1 DISCLAIMERS

All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

4.2 SAFETY

4.2.1 TECHNICIAN SAFETY INFORMATION

WARNING: ENGINES PRODUCE CARBON MONOXIDE THAT IS ODORLESS, CAUSES SLOWER REACTION TIME, AND CAN LEAD TO SERIOUS INJURY. WHEN THE ENGINE IS OPERATING KEEP SERVICE AREAS WELL VENTILATED OR ATTACH THE VEHICLE EXHAUST SYSTEM TO THE SHOP EXHAUST REMOVAL SYSTEM.

Set the parking brake and block the wheels before testing or repairing the vehicle. If is especially important to block the wheels on front-wheel drive vehicles: the parking brake does not hold the drive wheels.

Some operations in this manual require that hydraulic tubes, hoses, and fittings, disconnected for inspection or testing purposes. These systems, when fully charged, contain fluid at high pressure.

Before disconnecting any hydraulic tubes, hoses, and fittings, be sure that the system is fully depressurized.

When servicing a vehicle, always wear eye protection, and remove any metal jewelry such as watchbands or bracelets that might make an inadvertent electrical contact.

When diagnosing a Transmission system problem, it is important to follow approved procedures where applicable. These procedures can be found in the service information. Following these procedures is very important to the safety of individuals performing diagnostic tests.

4.2.2 VEHICLE PREPARATION FOR TESTING

Make sure the vehicle being tested has a fully charged battery. If it does not, false diagnostic DTC's or error messages may occur. It is extremely important that accurate shift lever position data is available to the TCM. The accuracy of any DTC found in memory is doubtful unless the Shift Lever Test, performed on the DRBIII® Scan Tool, passes without failure.

4.2.3 SERVICING SUB-ASSEMBLIES

Some components of the Transmission system are intended to be serviced in assembly only. Attempting to remove or repair certain system subcomponents may result in personal injury and/or improper system operation. Only those components with approved repair and installation procedures in the service information should be serviced.

4.2.4 DRBIII® SAFETY INFORMATION

WARNING: EXCEEDING THE LIMITS OF THE DRBIII® MULTIMETER IS DANGEROUS. IT CAN EXPOSE YOU TO SERIOUS OR POSSIBLY FATAL INJURY. CAREFULLY READ AND UNDERSTAND THE CAUTIONS AND THE SPECIFICATION LIMITS.

- Follow the vehicle manufacturer's service specifications at all times.
- Do not use the DRBIII® if it has been damaged.
- Do not use the test leads if the insulation is damaged or if metal is exposed.
- To avoid electrical shock, do not touch the test leads, tips or the circuit being tested.
- Choose the proper range and function for the measurement. Do not try voltage or current measurements that may exceed the rated capacity.
- Do not exceed the limits shown in the table.

FUNCTION	INPUT LIMIT
Volts	0 - 500 volts peak AC 0 - 500 volts DC
Ohms (resistance)*	0 - 1.12 megohms
Frequency Measured Frequency Generated	0 - 10 kHz
Temperature	-58 - 1100°F -50 - 600°C

*Ohms cannot be measured if voltage is present. Ohms can be measured only in a non-powered circuit.

- Voltage between any terminal and ground must not exceed 500v DC or 500v peak AC.
- Use caution when measured voltage above 25v DC or 25v AC.
- The circuit being tested must be protected by a 10A fuse or circuit breaker.
- Use the low current shunt to measure circuits up to 10A. Use the high current clamp to measure circuits exceeding 10A.
- When testing for the presence of voltage or current, make sure the meter is functioning correctly. Take a reading of a known voltage or current before accepting a zero reading.
- When measuring current, connect the meter in series with the load.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the meter function, keep the DRBIII® away from spark plug or coil wires to avoid measuring error from outside interference.

4.3 WARNINGS

4.3.1 VEHICLE DAMAGE WARNINGS

Before disconnecting any control module, make sure the ignition is “lock” position. Failure to do so could damage the module.

When testing voltage or continuity at any control module, use the terminal side (not the wire end) of the connector. Do not probe a wire through the insulation: this will damage the wire and eventually cause the wire to fail because of corrosion.

Be careful when performing electrical tests so as to prevent accidental shorting of terminals. Such mistakes can damage fuses or components. Also, a second DTC could be set, making diagnosis of the original problem more difficult.

When replacing a blown fuse, it is important to use only a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical system overload. If a properly rated fuse continues to blow, it indicates a problem in the circuit that must be corrected.

4.3.2 ROAD TESTING A COMPLAINT VEHICLE

Some complaints will require a test drive as part of the repair verification procedure. The purpose of the test drive is to try to duplicate the diagnostic DTC or symptom condition.

CAUTION: Before road testing a vehicle, be sure that all components are reassembled. During the test drive, do not try to read the DRBIII® screen while in motion. Do not hang the DRBIII® from the rear view mirror or operate it yourself. Have an assistant available to operate the DRBIII®.

Road testing is an essential step in the diagnostic process that must not be overlooked. Along with the diagnostic information obtained from the DRBIII® Scan Tool and the original customer concern, the road test helps verify the problem was current and any repairs performed, fixed the vehicle correctly. Always operate and observe the vehicle under actual driving conditions.

Just as important as the road test is, there are preliminary inspections that should be performed prior to the road test. Always check the fluid level and condition before taking the vehicle on a road test. Determine if an incorrect fluid type is being used, improper fluid will result in erratic transmission operation. Some of the conditions of incorrect fluid level are as follows:

- Delayed engagement
- Poor shifting or erratic shifting
- Excessive noise
- Overheating

The next step is to verify that the shifter is correctly adjusted. If the shifter is incorrectly adjusted, a number of complaints can result.

The TCM monitors the Shift Lever Position (SLP) Sensor continuously. If the shifter is incorrectly adjusted, the TCM will sense a shift lever position that is not correct for the gear chosen by the driver. This may cause a DTC to be set.

The following complaints may also be the result of an incorrectly adjusted or worn shifter:

- Delayed clutch engagement
- Erratic shifts
- Vehicle will drive in neutral
- Engine will not crank in park or neutral
- Shifter will be able to be moved without the key in the ignition
- Not able to remove the ignition key in park
- Parking pawl will not engage properly

The shifter should also be adjusted when replacing the Transmission, repairing the valve body, or when repairing any component between the shift lever and the Transmission.

Some questions to ask yourself when performing the road test are as follows:

- Is the complaint or concern what you think the problem is, based on the drivers description of the problem?

- Is the Transmission operating normally, or is there a real problem?
- When does the problem occur?
- Is the problem only in one gear range?
- What temperature does the problem occur?
- Does the vehicle have to sit over night for the problem to occur?
- Does the transmission go into Limp-in mode?

4.3.3 ELECTRONIC PINION FACTOR WARNINGS (IF APPLICABLE)

The pinion factor must be set when replacing the TCM.

NOTE: The pinion factor is a fixed number and cannot be changed or updated in some vehicle applications. If the pinion factor is not set or incorrectly set, any speed related functions will not operate correctly i.e. speedometer, speed control, rolling door locks, other control modules will be affected that depend on speed information.

4.3.4 BULLETINS AND RECALLS

Always perform all Safety Recalls and Technical Service Bulletins that are applicable to the problem.

5.0 REQUIRED TOOLS AND EQUIPMENT

- > DRBIII® (diagnostic read-out box) − Must be at latest release level.
- > Transmission Simulator (Miller # 8333)
- > Electronic Transmission Adapter Kit (Miller # 8333-1A)
- > Jumper wires
- > Test Light (minimum of 25 ohms of resistance)
- > Ohmmeter
- > Voltmeter
- > Pressure gauge (0-300 PSI)

6.0 GLOSSARY OF TERMS

6.1 ACRONYMS

BCM	-Body Control Module
CKT	-Circuit
CVI	-Clutch Volume Index
DLC	-Data Link Connector
DRBIII®	-Diagnostic Readout Box
DTC	-Diagnostic Trouble Code
EATX	-Electronic Automatic Transmission
EMCC	-Electronically Modulated Converter Clutch
FCM	-Front Control Module (part of the IPM system)
IOD	-Ignition off-draw
IPM	-Intelligent Power Module
IRT	-Intelligent Recovery Timer
ISS	-Input Speed Sensor
LED	-Light Emitting Diode
LR	-Low/reverse Clutch or Pressure Switch
LU	-Lockup
MIC	-Mechanical Instrument Cluster
MIL	-Malfunction Indicator Lamp
OBDII	-On Board Diagnostics
OD	-Overdrive Clutch or Pressure Switch
OSS	-Output Speed Sensor
PCM	-Powertrain Control Module
PEMCC	-Partial Electronically Modulated Converter Clutch
PLU	-Partial Lockup
REV	-Reverse Clutch
SLPK	-Solenoid Pack
SSV	-Solenoid Switch Valve
SW	-Switch
TCC	-Torque Converter Clutch
TCM	-Transmission Control Module
TP	-Throttle Position
TRD	-Torque Reduction
TRS	-Transmission Range Sensor
UD	-Underdrive Clutch
2/4	-2nd and 4th gear Clutch or Pressure Switch

6.2 DEFINITIONS

OBDII (EURO STAGE III OBD) Trip - A vehicle start and drive cycle such that all once per trip diagnostic monitors have run.

Key Start - A vehicle start and run cycle of at least 20 seconds.

Warm-up Cycle - A vehicle start and run cycle such that the engine coolant must rise to at least 71°C (160°F) and must rise by at least 4.4°C (40°F) from initial start up. To count as a warm-up cycle, no DTC may occur during the cycle.

7.0

DIAGNOSTIC INFORMATION AND PROCEDURES

Symptom:
*NO RESPONSE FROM TRANSMISSION CONTROL MODULE

POSSIBLE CAUSES
NO RESPONSE FROM TRANSMISSION CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN/ST) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT (START) CIRCUIT SHORT
FUSED B(+) CIRCUIT OPEN
GROUND CIRCUIT(S) OPEN
OPEN PCI BUS CIRCUIT
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. **Note: As soon as one or more module communicates with the DRB, answer the question.** With the DRB, attempt to communicate with the Airbag Control Module (ACM). With the DRB, attempt to communicate with the Instrument Cluster. Was the DRB able to I/D or establish communications with either of the modules? Yes → Go To 2 No → Refer to the Body Communication category and perform the symptom PCI Bus Communication Failure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
2	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Run/St) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 3 No → Repair the Fused Ignition Switch Output (Run/St) circuit for an open. Refer to the wiring diagrams location in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the starter relay from the PDC. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output (Start) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Observe the test light while momentarily turning the ignition switch to the Start position. Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused Ignition Switch Output (Start) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. With a voltmeter in the millivolt scale, measure the voltage of the Fused Ignition Switch Output (Start) circuit. **NOTE: A no response condition can exist if voltage is present on this circuit with the ignition switch in any position except for the Start position.** **NOTE: Voltage up to .080 millivolts can cause this condition.** **NOTE: Check for after market components that could cause this condition.** Perform this step with the Ignition Switch in every position except for the Start position. Is any voltage present? Yes → Repair the Fused Ignition Switch Output (Start) circuit for a short to voltage. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5 **Note: Reinstall the original Starter Relay.**	All
5	Turn the ignition off. Disconnect the TCM harness connector. Using a 12-volt test light connected to ground, check the Fused B(+) circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Fused B(+) circuit for an open. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

*NO RESPONSE FROM TRANSMISSION CONTROL MODULE — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Using a 12-volt test light connected to 12-volts, check each ground circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly at all the ground circuits? Yes → Go To 7 No → Repair the Ground circuit(s) for an open. Check the main ground connection to engine block and/or chassis. Refer to the wiring diagrams located in the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	**Note: Ensure there is PCI Bus communication with other modules on the vehicle before proceeding. If not, refer to the symptom list from the menu and repair as necessary.** Disconnect the TCM harness connector. Use Scope input cable CH7058, Cable to Probe adapter CH7062, and the red and black test probes. Connect the scope input cable to the channel one connector on the DRB. Attach the red and black leads and the cable to probe adapter to the scope input cable. With the DRBIII® select Pep Module Tools. Select lab scope. Select Live Data. Select 12 volt square wave. Press F2 for Scope. Press F2 and use the down arrow to set voltage range to 20 volts. Set Probe to x10. Press F2 again when complete. Connect the Black lead to the chassis ground. Connect the Red lead to the PCI Bus circuit in the TCM connector. Turn the ignition on. Observe the voltage display on the DRB Lab Scope. Does the voltage pulse from 0 to approximately 7.5 volts? Yes → Go To 8 No → Repair the PCI Bus circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
8	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module in accordance with the service information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0122-THROTTLE POSITION SENSOR/APPS LOW

When Monitored and Set Condition:

P0122-THROTTLE POSITION SENSOR/APPS LOW

When Monitored: Continuously with the ignition on and engine running.

Set Condition: This DTC will set if the monitored TPS voltage drops below .078 volts for the period of 0.48 seconds.

POSSIBLE CAUSES
ENGINE TPS DTC'S PRESENT
TPS SIGNAL CIRCUIT HIGH RESISTANCE
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check Engine DTC's. Are there any Engine TPS related DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0122-THROTTLE POSITION SENSOR/APPS LOW — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII® in Transmission Sensors, read the TPS voltage. Is the TPS voltage below 0.5 volts? Yes → Go To 4 No → Go To 6	All
4	Ignition on, engine not running. With the DRBIII® in Transmission Sensors, record the TPS voltage. While back probing the TCM harness connector, measure the voltage of the TPS Signal circuit. Compare the voltage readings between the DRBIII® and the reading from the digital multi meter. Are the voltages within 0.1 volt of each other? Yes → Repair the TPS signal circuit between the TCM harness connector and the splice for high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Pay particular attention to the point where the TPS signal and sensor ground circuits splice off from the engine circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0123-THROTTLE POSITION SENSOR/APPS HIGH

When Monitored and Set Condition:

P0123-THROTTLE POSITION SENSOR/APPS HIGH

When Monitored: Continuously with the ignition on and engine running.

Set Condition: This DTC will set if the monitored TPS voltage rises above 4.94 volts for the period of 0.48 seconds.

POSSIBLE CAUSES
ENGINE TPS DTC'S PRESENT
SENSOR GROUND CIRCUIT OPEN TO TCM
TPS SIGNAL CIRCUIT OPEN TO TCM
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check Engine DTC's. Are there any Engine TPS related DTCs present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0123-THROTTLE POSITION SENSOR/APPS HIGH — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII® in Transmission Sensors, read the TPS voltage. Is the TPS voltage above 4.5 volts? Yes → Go To 4 No → Go To 7	All
4	Turn the ignition off to the lock position. Disconnect the TPS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TPS Signal Circuit from the TCM harness connector to the TPS harness connector. Is the resistance below 5.0 ohms? Yes → Go To 5 No → Repair the TPS Signal circuit between the TCM harness connector and the splice for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TPS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Sensor Ground circuit between the TPS harness connector and the Transmission Control Module harness connector. Is the resistance below 5.0 ohms? Yes → Go To 6 No → Repair the Sensor Ground circuit between the TCM harness connector and the splice for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Pay particular attention to the point where the TPS signal and sensor ground circuits splice off from the engine circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0124- THROTTLE POSITION SENSOR/APPS INTERMITTENT

When Monitored and Set Condition:

P0124- THROTTLE POSITION SENSOR/APPS INTERMITTENT

When Monitored: Continuously with the ignition on and engine running.

Set Condition: This DTC will set with a throttle angle between 6° and 120.6° with a 5° or higher change under 7.0 milliseconds.

POSSIBLE CAUSES
ENGINE TPS DTC'S PRESENT
THROTTLE POSITION SENSOR
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check Engine DTC's. Are any Engine TPS related DTC's present? Yes → Refer to the Powertrain category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0124- THROTTLE POSITION SENSOR/APPS INTERMITTENT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition On, Engine Not Running. With the DRBIII®, under Transmission Sensors, monitor the TPS voltage in the following step. Slowly open and close the throttle while checking for erratic voltage changes. Did the TPS voltage change smooth and consistent? Yes → Go To 4 No → Replace the Throttle Position Sensor per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0218-HIGH TEMPERATURE OPERATION ACTIVATED

When Monitored and Set Condition:

P0218-HIGH TEMPERATURE OPERATION ACTIVATED

When Monitored: Whenever the engine is running.

Set Condition: Immediately when the Overheat shift schedule is activated 116 C (240 F) Transmission oil temp.

POSSIBLE CAUSES
ENGINE COOLING SYSTEM MALFUNCTION
TRANSMISSION OIL COOLER PLUGGED
HIGH TEMPERATURE OPERATIONS ACTIVATED

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0218-HIGH TEMPERATURE OPERATION ACTIVATED — Continued

TEST	ACTION	APPLICABILITY
2	This DTC is an informational DTC designed to aid the Technician in diagnosing shift quality complaints. This DTC indicates that the Transmission has been operating in the ″Overheat″ shift schedule which may generate a customer complaint. The customer driving patterns may indicate the need for an additional Transmission Oil Cooler. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair the cause of the Transmission Overheating per the Service Information. If indicated install an additional Transmission Oil Cooler. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Perform Engine Cooling System diagnostics per the Service Information Is the Engine Cooling System functioning properly? Yes → Go To 4 No → Repair the cause of the Engine Overheating. Refer to the Service Information for additional repair information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	If there are no possible causes remaining, view repair. Repair Flush or replace the Transmission Oil cooler as necessary per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0562-LOW BATTERY VOLTAGE

When Monitored and Set Condition:

P0562-LOW BATTERY VOLTAGE

When Monitored: With the engine running and the TCM has closed the Transmission Control Relay.

Set Condition: If battery voltage at TCM Transmission Control Relay Output Sense circuit is less than 10.0 volts for 15 seconds. *This DTC generally indicates a gradually falling battery voltage or resistive connections to the TCM.

POSSIBLE CAUSES
RELATED CHARGING SYSTEM DTCS
INTERMITTENT WIRING AND CONNECTORS
FUSED B+ CIRCUIT OPEN OR HIGH RESISTANCE
GROUND CIRCUIT OPEN OR HIGH RESISTANCE
TRANS CONTROL RELAY OUTPUT TO TCM OPEN OR HIGH RESISTANCE
TRANSMISSION CONTROL RELAY OPEN OR HIGH RESISTANCE
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0562-LOW BATTERY VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read the PCM DTC's. Are there any Charging System related DTC's stored in the PCM? Yes → Refer to the Charging System category and repair any PCM Charging System DTC's first. NOTE: After repairing the PCM charging system DTC's, perform the Transmission Verification test to verify the transmission was not damaged. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	**NOTE: Generator, battery, and charging system must be fully functional before performing this test.** With the DRBIII®, read Transmission DTC's. With the DRBIII®, Check the STARTS SINCE SET counter for P0562. **Note: This counter only applies to the last DTC set.** Is the Starts Since Set counter for P0562 set at 0? Yes → Go To 4 No → Go To 9	All
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Using a 12-volt test light connected to 12-volts, check the ground circuits in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly for all the ground circuits? Yes → Go To 5 No → Repair the Ground circuit(s) for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 6 No → Repair the Fused B+ circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0562-LOW BATTERY VOLTAGE — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, check both Transmission Control Relay Output circuits in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 7 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	Turn the ignition off to the lock position. Install a substitute Relay in place of the Transmission Control Relay. Start the engine. Using a voltmeter, measure the battery voltage. With the DRBIII®, monitor the Transmission Switched Battery Voltage. Compare the DRBIII® Transmission Switched Battery voltage to the actual battery voltage. Is the DRBIII® voltage within 2.0 volts of the battery voltage? Yes → Replace the Transmission Control Relay. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
9	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0604-INTERNAL TCM

When Monitored and Set Condition:

P0604-INTERNAL TCM

When Monitored:

Set Condition: The TCM is reporting internal errors and must be replaced.

POSSIBLE CAUSES
TCM - INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0605-INTERNAL TCM

When Monitored and Set Condition:

P0605-INTERNAL TCM

When Monitored:

Set Condition: The TCM is reporting internal errors and must be replaced.

POSSIBLE CAUSES
TCM - INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0613-INTERNAL TCM

When Monitored and Set Condition:

P0613-INTERNAL TCM

When Monitored:

Set Condition: The TCM is reporting internal errors and must be replaced.

POSSIBLE CAUSES
TCM - INTERNAL ERROR

TEST	ACTION	APPLICABILITY
1	**NOTE: Make sure this DTC is set in the TCM before making repair.** Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0706-CHECK SHIFTER SIGNAL

When Monitored and Set Condition:

P0706-CHECK SHIFTER SIGNAL

When Monitored: Continuously with the ignition key on.

Set Condition: 3 occurrences in one key start of an invalid PRNDL code which lasts for more than 0.1 second.

POSSIBLE CAUSES
CONDITION P0706 PRESENT
TRS T1 SENSE CIRCUIT OPEN
TRS T3 SENSE CIRCUIT OPEN
TRS T41 SENSE CIRCUIT OPEN
TRS T42 SENSE CIRCUIT OPEN
TRS T1 SENSE CIRCUIT SHORT TO GROUND
TRS T3 SENSE CIRCUIT SHORT TO GROUND
TRS T41 SENSE CIRCUIT SHORT TO GROUND
TRS T42 SENSE CIRCUIT SHORT TO GROUND
TRS T1 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T3 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T41 SENSE CIRCUIT SHORT TO VOLTAGE
TRS T42 SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION RANGE SENSOR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Using the DRBIII®, perform the Shift Lever Position Test. Select the test outcome from the following: Test passes Go To 3 Test fails with DTC Go To 4 Test fails without DTC Adjust the shift linkage per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
3	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the DRBIII®, perform the Shift Lever Position Test. When the DRBIII ® instructs you to put the Gear Selector in a particular position, you must do so using the Transmission Simulator. The LED for the gear position in question must be illuminated prior to hitting ″enter″ on the DRBIII®. Did the test pass? Yes → Go To 5 No → Go To 6 **NOTE: Disconnect the Transmission Simulator and reconnect all the harness connectors.**	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Range Sensor per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Ignition on, engine not running. With the DRBIII® in Inputs/Outputs, read the TRS Sense circuits C1 thru C4. Move the shift lever thru all gear positions, pausing momentarily in each gear position. Watch for one of the circuits to not change state. Pick the one that did not change state. TRS T1 sense (C4) Go To 7 TRS T3 sense (C3) Go To 10 TRS T41 sense (C1) Go To 13 TRS T42 sense (C2) Go To 16	All
7	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T1 Sense circuit from the TCM harness connector to the TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T1 Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
8	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T1 circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T1 Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the TRS T1 Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the TRS T1 Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 19	All
10	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T3 Sense circuit from the TCM harness connector to the TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T3 Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 11	All
11	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T3 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T3 Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 12	All

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
12	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PCM. Ignition on, engine not running. Measure the voltage of the TRS T3 Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the TRS T3 Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 19	All
13	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T41 Sense circuit from the TCM connector to the TRS connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T41 Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 14	All
14	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T41 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T41 Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 15	All
15	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the TRS T41 Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the TRS T41 Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 19	All

P0706-CHECK SHIFTER SIGNAL — Continued

TEST	ACTION	APPLICABILITY
16	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the TRS T42 Sense circuit from the TCM harness connector to the TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the TRS T42 Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 17	All
17	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the TRS T42 Sense circuit in the TCM harness connector. Is the resistance below 5.0 ohms? Yes → Repair the TRS T42 Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 18	All
18	Turn the ignition off to the lock position. Disconnect the TRS harness connector. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the TRS T42 Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the TRS T42 Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 19	All
19	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE

When Monitored and Set Condition:

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE

When Monitored: Continuously with the ignition on and engine running.

Set Condition: This DTC will set when the desired transmission temperature does not reach a normal operating temperature within a given time frame. Time is variable due to ambient temperature. Approximate times are starting temperature to warm up time: (-40° F / -40° C - 35 min) (-20° F / -28° C - 25 min) (20° F / -6.6° C - 20 min) (60° F / 15.5 ° C - 10 min)

POSSIBLE CAUSES
RELATED DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check Transmission DTC's. Are there any other Transmission Temperature Sensor related DTCs present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0711. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 7	All
4	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove Starter Relay can cause a Transmission - No Response condition.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Input/Output switch to OFF. With the DRBIII®, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator. Compare the DRBIII® readings with the numbers listed on the Transmission Simulator. Do the readings on the Transmission Simulator match the DRBIII® readings ± 0.2 volts? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0711-TRANSMISSION TEMPERATURE SENSOR PERFORMANCE — Continued

TEST	ACTION	APPLICABILITY
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0712-TRANSMISSION TEMPERATURE SENSOR LOW

When Monitored and Set Condition:

P0712-TRANSMISSION TEMPERATURE SENSOR LOW

When Monitored: Continuously with the ignition on and engine running.

Set Condition: The DTC will set when the monitored Temperature Sensor voltage drops below 0.078 volts for the period of 0.45 seconds.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO GROUND
TRANSMISSION TEMPERATURE SENSOR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check Transmission DTC's. Are there any Speed Sensor DTCs present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0712-TRANSMISSION TEMPERATURE SENSOR LOW — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0712. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 8	All
4	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove Starter Relay can cause a Transmission - No Response condition.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Input/Output switch to OFF. With the DRBIII®, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator. Compare the DRBIII® readings with the numbers listed on the Transmission Simulator. Do the readings on the Transmission Simulator match the DRBIII® readings ± 0.2 volts? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector.. Disconnect the Transmission Solenoid/TRS Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Transmission Temperature Sensor Signal circuit. Is the resistance below 5.0 ohms? Yes → Repair the Transmission Temperature Sensor Signal circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0712-TRANSMISSION TEMPERATURE SENSOR LOW — Continued

TEST	ACTION	APPLICABILITY
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0713-TRANSMISSION TEMPERATURE SENSOR HIGH

When Monitored and Set Condition:

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH

When Monitored: Continuously with the ignition on and engine running.

Set Condition: The DTC will set when the monitored Temperature Sensor voltage rises above 4.94 volts for the period of 0.45 seconds.

POSSIBLE CAUSES
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT OPEN
TRANSMISSION TEMPERATURE SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION TEMPERATURE SENSOR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, Check the STARTS SINCE SET counter for P0713. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 3 No → Go To 8	All

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove Starter Relay can cause a Transmission - No Response condition.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Input/Output switch to OFF. With the DRBIII®, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator. Compare the DRBIII® readings with the numbers listed on the Transmission Simulator. Do the readings on the Transmission Simulator match the DRBIII® readings ± 0.2 volts? Yes → Go To 4 No → Go To 5	All
4	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector.. Disconnect the Transmission Solenoid /TRS Assembly harness connector **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Transmission Temperature Sensor Signal circuit from the TCM harness connector to the Transmission Solenoid/TRS Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Transmission Temperature Sensor Signal circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Transmission Temperature Sensor Signal circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Transmission Temperature Sensor Signal circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0713-TRANSMISSION TEMPERATURE SENSOR HIGH — Continued

TEST	ACTION	APPLICABILITY
7	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT

When Monitored and Set Condition:

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT

When Monitored: Continuously with the ignition on and engine running.

Set Condition: The DTC will set when the monitored Temperature Sensor voltage fluctuates or changes abruptly within a predetermined period of time.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
TRANSMISSION TEMPERATURE SENSOR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check Transmission DTC's. Are there any Speed Sensor and/or other Temperature Sensor DTCs present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0714-TRANSMISSION TEMPERATURE SENSOR INTERMITTENT — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0714. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 7	All
4	Turn the ignition off to the lock position. Remove the Starter Relay. **NOTE: Failure to remove Starter Relay can cause a Transmission - No Response condition.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, turn the Input/Output switch to OFF. With the DRBIII®, monitor the TRANS TEMP VOLTS while turning the Thermistor Voltage switch to all three positions on the Transmission Simulator. Compare the DRBIII® readings with the numbers listed on the Transmission Simulator. Do the readings on the Transmission Simulator match a non-fluctuating DRBIII® reading ± 0.2 volts? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/TRS Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0715-INPUT SPEED SENSOR ERROR

When Monitored and Set Condition:

P0715-INPUT SPEED SENSOR ERROR

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If there is an excessive change in input RPM in any gear.

POSSIBLE CAUSES
INPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
SPEED SENSOR GROUND CIRCUIT OPEN
INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
INPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
INPUT SPEED SENSOR ERROR
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine in park. With the DRBIII®, read the Input RPM. Is the Input RPM reading below 400 RPM? Yes → Go To 3 No → Go To 11	All
3	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the Transmission Simulator, set the ″Input/Output Speed″ switch to ″ON″ and the rotary switch to the ″3000/1250″ position. With the DRBIII®, monitor the Input and Output RPM. Does the Input RPM read 3000 RPM and the Output RPM read 1250 RPM +/- 50 RPM? Yes → Go To 4 No → Go To 5 **NOTE: Disconnect the Transmission Simulator and reconnect all harness connectors.**	All
4	If there are no possible causes remaining, view repair. Repair Replace the Input Speed Sensor per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Input Speed Sensor Signal circuit from the TCM harness connector to the Input Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Input Speed Sensor Signal circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Input Speed Sensor signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Input Speed Sensor Signal circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the Input Speed Sensor harness connector. Disconnect the TCM harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the Input Speed Sensor Signal circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Input Speed Sensor Signal circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Input Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Input Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the TRS harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit in the TCM harness connector. Is the voltage above 0.5 volts? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0715-INPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0720-OUTPUT SPEED SENSOR ERROR

When Monitored and Set Condition:

P0720-OUTPUT SPEED SENSOR ERROR

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: If there is an excessive change in output RPM in any gear.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
OUTPUT SPEED SENSOR SIGNAL CIRCUIT OPEN
SPEED SENSOR GROUND CIRCUIT OPEN
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND
OUTPUT SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE
SPEED SENSOR GROUND CIRCUIT SHORT TO VOLTAGE
OUTPUT SPEED SENSOR ERROR
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
2	Start the engine in park. Raise the drive wheels off of the ground. **WARNING: PROPERLY SUPPORT THE VEHICLE.** Place transmission in drive, release foot from brake. **WARNING: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** **Note: The drive wheels must be turning at this point.** With the DRBIII®, read the Output RPM Is the Output RPM below 100 RPM? Yes → Go To 3 No → Go To 11	All
3	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the Transmission Simulator, set the "Input/Output Speed" switch to "ON" and the rotary switch to the "3000/1250" position. With the DRBIII®, read the Input RPM and Output RPM. Does the Input RPM read 3000 and the Output RPM read 1250 ± 50 RPM? Yes → Go To 4 No → Go To 5	All
4	If there are no possible causes remaining, view repair. Repair Replace the Output Speed Sensor per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Output Speed Sensor Signal circuit from the TCM harness connector to the Output Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Output Speed Sensor Signal circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Output Speed Sensor Signal circuit. Is the resistance Below 5.0 ohms? Yes → Repair the Output Speed Sensor Signal circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Simulator. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) and Transmission Control Relay Output circuits in the Transmission Control Relay connector (In PDC). Ignition on, engine not running. Measure the voltage of the Output Speed Sensor Signal circuit in the TCM connector. Is the voltage above 3.0 volts? Yes → Repair Output Speed Sensor Signal circuit short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Output Speed Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Output Speed Sensor harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Speed Sensor Ground circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the TRS harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B(+) and Transmission Control Relay Output circuits in the Transmission Control Relay connector (In PDC). Ignition on, engine not running. Measure the voltage of the Speed Sensor Ground circuit in the TCM connector. Is the voltage above 3.0 volts? Yes → Repair the Speed Sensor Ground circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All

P0720-OUTPUT SPEED SENSOR ERROR — Continued

TEST	ACTION	APPLICABILITY
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0725-ENGINE SPEED SENSOR CIRCUIT

When Monitored and Set Condition:

P0725-ENGINE SPEED SENSOR CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: Engine RPM less than 390 or greater than 8000 for more than 2 seconds while the engine is running.

POSSIBLE CAUSES
INTERMITTENT WIRING & CONNECTORS CONDITIONS
EATX RPM SIGNAL CIRCUIT OPEN
EATX RPM SIGNAL CIRCUIT SHORTED TO GROUND
EATX RPM SIGNAL CIRCUIT SHORTED TO VOLTAGE
TRANSMISSION CONTROL MODULE
POWERTRAIN CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0725-ENGINE SPEED SENSOR CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: This code is not a Transmission Input Speed Sensor DTC** With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter set at 0? Yes → Go To 3 No → Go To 8	All
3	Turn ignition off to the lock position. Disconnect the Powertrain Control Module (PCM) harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the EATX RPM signal circuit between the TCM connector and the PCM connector. Is the resistance above 5.0 ohms? Yes → Repair the open EATX RPM Signal circuit. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn ignition off to the lock position. Disconnect the Powertrain Control Module (PCM) harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the EATX RPM Signal circuit and ground. Is the resistance below 5.0 ohms? Yes → Repair the EATX RPM Signal circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn ignition off to the lock position. Disconnect the PCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the EATX RPM Signal circuit in the PCM connector. Is the voltage above 10.0 volts? Yes → Repair the EATX RPM Signal circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the PCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the EATX RPM Signal circuit. Is the voltage between 4.5 and 5.5 volts? Yes → Replace and program the Powertrain Control Module per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0725-ENGINE SPEED SENSOR CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
8	The conditions necessary to set the DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. Check the power and ground circuits of the Transmission Control Module. Check the vehicles battery condition. Were any problems found? Yes → Repair wiring and/or connectors as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0731-GEAR RATIO ERROR IN 1ST

When Monitored and Set Condition:

P0731-GEAR RATIO ERROR IN 1ST

When Monitored: The Transmission Gear Ratio is monitored continuously while the Transmission is in gear.

Set Condition: If the ratio of the input RPM to the output RPM does not match the current Gear Ratio.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
INTERNAL TRANSMISSION

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, read Transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, or P1794 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0731-GEAR RATIO ERROR IN 1ST — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, perform the 1st Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the Clutch Test pass, Input Speed remain at 0? Yes → Go To 4 No → Go To 5	All
4	The conditions to set this DTC are not present at this time. Check the gearshift linkage adjustment. Gear ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the clutch test and still sets gear ratio DTC('s), check the Speed Sensors for proper operation. **NOTE: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission per the Service Information. Check all components related to the Underdrive and L/R clutches. Inspect the Oil Pump per the Service Information and repair or replace as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0732-GEAR RATIO ERROR IN 2ND

When Monitored and Set Condition:

P0732-GEAR RATIO ERROR IN 2ND

When Monitored: The Transmission Gear Ratio is monitored continuously while the Transmission is in Gear.

Set Condition: If the ratio of the input RPM to the output RPM does not match the current Gear Ratio.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
RELATED PRESSURE SWITCH DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION - INTERNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0732-GEAR RATIO ERROR IN 2ND — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, or P1794 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, perform the 2nd Gear Clutch Test. Follow the instructions on the DRBIII®. Increase the Throttle Angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the Clutch Test pass, Input Speed remain at 0? Yes → Go To 4 No → Go To 5	All
4	The conditions to set this DTC are not present at this time. Check the gearshift linkage adjustment. Gear ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the clutch test and still sets Gear Ratio DTC(s), check the Speed Sensors for proper operation. **NOTE: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	With the DRBIII®, read Transmission DTC's. Is the DTC P0845 and/or P0846 present also? Yes → Replace the Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P0732-GEAR RATIO ERROR IN 2ND — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. Check all of the components related to the Underdrive and 2/4 clutches. Inspect the Oil Pump per the Service Information and repair or replace as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0733-GEAR RATIO ERROR IN 3RD

When Monitored and Set Condition:

P0733-GEAR RATIO ERROR IN 3RD

When Monitored: The Transmission Gear Ratio is monitored continuously while the Transmission is in Gear.

Set Condition: If the ratio of the input RPM to the output RPM does not match the current Gear Ratio.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
TRANSMISSION SOLENOID PRESSURE SWITCH ASSEMBLY
INTERNAL TRANSMISSION
INTERMITTENT GEAR RATIO ERRORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0733-GEAR RATIO ERROR IN 3RD — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, or P1794 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, perform the 3rd gear clutch test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the Clutch Test pass, Input Speed remain at 0? Yes → Go To 4 No → Go To 5	All
4	The conditions to set this DTC are not present at this time. Check the gearshift linkage adjustment. Gear ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the clutch test and still sets Rear Ratio DTC(s), check the Speed Sensors for proper operation. **NOTE: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	With the DRBIII®, read Transmission DTC's. Is the DTC P0870 and/or P0871 present also? Yes → Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P0733-GEAR RATIO ERROR IN 3RD — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Repair internal transmission per the Service Information. Check all of the components related to the Underdrive and Overdrive clutches. Inspect the Oil Pump per the Service Information and repair or replace as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0734-GEAR RATIO ERROR IN 4TH

When Monitored and Set Condition:

P0734-GEAR RATIO ERROR IN 4TH

When Monitored: The Transmission Gear Ratio is monitored continuously while the Transmission is in Gear.

Set Condition: If the ratio of the input RPM to the output RPM does not match the current Gear Ratio.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
RELATED PRESSURE SWITCH DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION - INTERNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0734-GEAR RATIO ERROR IN 4TH — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission Control Module DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, or P1794 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, perform the 4th gear clutch test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the transmission.** Did the Clutch Test pass, Input Speed remain at 0? Yes → Go To 4 No → Go To 5	All
4	The conditions to set this DTC are not present at this time. Check the gearshift linkage adjustment. Gear Ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the clutch test and still sets Gear Ratio DTC(s), check the Speed Sensors for proper operation. **NOTE: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Check the Speed Sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	With the DRBIII®, read Transmission DTC's. Is the DTC P0845 and/or P0846 present also? Yes → Replace the Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P0734-GEAR RATIO ERROR IN 4TH — Continued

TEST	ACTION	APPLICABILITY
6	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. Check all of the components related to the Overdrive and 2/4 clutches. Inspect the Oil Pump per the Service Information and repair or replace as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0736-GEAR RATIO ERROR IN REVERSE

When Monitored and Set Condition:

P0736-GEAR RATIO ERROR IN REVERSE

When Monitored: The Transmission Gear Ratio is monitored continuously while the Transmission is in Gear.

Set Condition: If the ratio of the input RPM to the output RPM does not match the current Gear Ratio.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERMITTENT GEAR RATIO ERRORS
TRANSMISSION - INTERNAL

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, read Transmission DTC's If any of these DTC's are present, perform their respective tests first. Are the DTC's P0944, P0715, P0720, P1794, or present also? Yes → Refer to the Transmission category and perform the appropriate symptom. If any of these DTC's are present, they will cause a gear ratio error. Perform the test for Loss of Prime first if it is present. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0736-GEAR RATIO ERROR IN REVERSE — Continued

TEST	ACTION	APPLICABILITY
3	With the DRBIII®, perform the Reverse gear clutch test. Follow the instructions on the DRBIII®. Increase the throttle angle, TPS Degree, to 30° for no more than a few seconds. **CAUTION: Do not overheat the Transmission.** Did the Clutch Test pass, Input Speed remain at 0? Yes → Go To 4 No → Go To 5	All
4	The conditions to set this DTC are not present at this time. Check the gearshift linkage adjustment. Gear Ratio DTC's can be set by problems in the Input and Output Speed Sensor circuits. If the vehicle passes the clutch test and still sets Gear Ratio DTC(s), check the Speed Sensors for proper operation. **NOTE: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Check the speed sensor wiring and connectors for good connection, then perform a wiggle test using the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1A. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem. Check all of the components related to the Reverse and L/R clutches. Inspect the Oil Pump per the Service Information and repair or replace as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT

When Monitored and Set Condition:

P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT

When Monitored: During Electronically Modulated Converter Clutch (EMCC) Operation.

Set Condition: A) Transmission must be in EMCC, with input speed > than 1750 RPM. TCC/L-R sol achieves the maximum duty cycle & can't pull engine RPM within 60 RPM of input speed. B) Transmissions is in FEMCC & engine slips TCC > than 100 RPM for 10 seconds.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
INTERNAL TRANSMISSION
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTC's Is the DTC P0750 and/or P0841 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All

P0740-TORQUE CONVERTER CLUTCH CONTROL CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
3	Ignition on, engine not running. With the DRBIII®, record and erase Transmission DTCs. Drive the vehicle until it is fully warmed up to at least 43° C or 110° F. Perform the following steps 3 times. With the DRBIII®, monitor TPS degree. Drive the vehicle to the speed of 83 Km/h or 50 MPH and allow 4th gear to engage for at least 10 seconds. Close the throttle, then tip back in until the throttle angle, TPS degrees, is between 25 and 29 degrees. **NOTE: If you go over 30 TPS degrees, you must back off of the throttle and retry.** Did the TCC engage during any of the attempts? Yes → Go To 4 No → Go To 5	All
4	The conditions necessary to set the DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wires while checking for shorts and open circuits. This DTC can also be set under extreme temperature conditions, this is usually caused by an internal problem. Verify if the problem is only experienced under extreme hot or cold conditions. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	If there are no possible causes remaining, view repair. Repair Perform the Hydraulic Pressure test in the Service Information. Repair the internal transmission components and torque convertor per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0750-LR SOLENOID CIRCUIT

When Monitored and Set Condition:

P0750-LR SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. The solenoids will also be tested immediately after a Gear Ratio or Pressure Switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if a test is run in response to a Gear Ratio or Pressure Switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R SOLENOID CONTROL CIRCUIT OPEN
L/R SOLENOID CONTROL CIRCUIT SHORT TO GROUND
L/R SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
L/R SOLENOID
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	Ignition on, engine not running. With the DRBIII®, read Transmission DTC's Are there any Transmission Control Relay DTC's present? Yes → Refer to symptom list and perform the appropriate symptom for Transmission Control Relay related DTC's. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0750. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0750 set at 0? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the DRBIII®, actuate the L/R Solenoid. With the Transmission Simulator, monitor the L/R Solenoid LED. Did the L/R Solenoid LED on the Transmission Simulator blink on and off during actuation? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Measure the resistance of the L/R Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Measure the resistance between ground and the L/R Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Solenoid Control circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the L/R Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the L/R Solenoid Control circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0750-LR SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0755-2/4 SOLENOID CIRCUIT

When Monitored and Set Condition:

P0755-2/4 SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a Gear Ratio or Pressure Switch error is detected.

Set Condition: Three consecutive Solenoid continuity test failures, or one failure if test is run in response to a Gear Ratio or Pressure Switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2/4 SOLENOID CONTROL CIRCUIT OPEN
2/4 SOLENOID CONTROL CIRCUIT SHORT TO GROUND
2/4 SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
2/4 SOLENOID
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0755-2/4 SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission Control Module DTC's Are there any Transmission Control Relay DTC's present?. Yes → Refer to symptom list and perform the appropriate symptom for Transmission Control Relay related DTC's. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0755 set at 0? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the DRBIII®, actuate the 2/4 Solenoid. With the Transmission Simulator, monitor the 2/4 Solenoid LED. Did the 2/4 Solenoid LED on the Transmission Simulator blink on and off during actuation? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2/4 Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2/4 Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0755-2/4 SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2/4 Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2/4 Solenoid Control circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the 2/4 Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the 2/4 Solenoid Control circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0755-2/4 SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0760-OD SOLENOID CIRCUIT

When Monitored and Set Condition:

P0760-OD SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a Gear Ratio or Pressure Switch error is detected.

Set Condition: Three consecutive solenoid continuity test failures, or one failure if test is run in response to a Gear Ratio or Pressure Switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
OD SOLENOID CONTROL CIRCUIT OPEN
OD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
OD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
OD SOLENOID
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission Control Module DTC's Are there any Transmission Control Relay DTC's present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter for P0760. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0760 set at 0? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the Transmission Simulator, monitor the OD Solenoid LED. With the DRBIII®, actuate the OD Solenoid. Did the OD Solenoid LED on the Transmission Simulator blink on and off during actuation? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the OD Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the OD Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the OD Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the OD Solenoid Control circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Measure the voltage of the OD Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the OD Solenoid Control circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0760-OD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0765-UD SOLENOID CIRCUIT

When Monitored and Set Condition:

P0765-UD SOLENOID CIRCUIT

When Monitored: Initially at power-up, then every 10 seconds thereafter. They will also be tested immediately after a Gear Ratio or Pressure Switch error is detected.

Set Condition: Three consecutive Solenoid continuity test failures, or one failure if test is run in response to a Gear Ratio or Pressure Switch error.

POSSIBLE CAUSES
RELATED RELAY DTC'S PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
UD SOLENOID CONTROL CIRCUIT OPEN
UD SOLENOID CONTROL CIRCUIT SHORT TO GROUND
UD SOLENOID CONTROL CIRCUIT SHORT TO VOLTAGE
UD SOLENOID
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission Control Module DTC's Are there any Transmission Control Relay DTC's present? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0765 set at 0? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. With the DRBIII®, actuate the UD Solenoid. With the Transmission Simulator, monitor the UD Solenoid LED. Did the UD Solenoid LED on the Transmission Simulator blink on and off? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the UD Solenoid Control circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the UD Solenoid Control circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the UD Solenoid Control circuit. Is the resistance below 5.0 ohms? Yes → Repair the UD Solenoid Control circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. Connect a jumper wire between the Fused B+ circuits and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. **Note: Check connectors - Clean/repair as necessary.** Measure the voltage of the UD Solenoid Control circuit. Is the voltage above 0.5 volt? Yes → Repair the UD Solenoid Control circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0765-UD SOLENOID CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0841-LR PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0841-LR PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate DTC is set if one of the Pressure Switches are open or closed at the wrong time in a given gear .

POSSIBLE CAUSES
LOSS OF PRIME DTC P0944 PRESENT
TRANSMISSION CONTROL RELAY DTCS PRESENT
TCM AND WIRING
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other Transmission DTC's. Is the DTC P0944 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read Transmission DTC's Are there any Transmission Control Relay DTC's present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0841. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 11	All
5	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. On the Transmission Simulator select L/R on the Pressure Switch selector switch. With the DRBIII®, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the Pressure Switch state change from OPEN to CLOSED when the test button was pressed? Yes → Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the L/R Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the L/R Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Pressure Switch circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/Pressure Switch Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0841-LR PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0845-2/4 HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0845-2/4 HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed > 1000 RPM, the TCM momentarily turns on element pressure to the clutch ckts that don't have pressure to identify the correct pressure sw closes. If the pressure sw does not close 2 times the code sets.

POSSIBLE CAUSES
LOSS OF PRIME P0944 PRESENT
RELATED DTC'S PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN
2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

P0845-2/4 HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other Transmission DTCs. Is the DTC P0944 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read Transmission DTC's. Is the DTC P0732, P0734 and/or P0846 present also? Yes → Repair internal transmission as necessary. Refer to the Service Information for the proper repair procedure for components related to the OD clutch. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0845. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 12	All

P0845-2/4 HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, select ″2/4″ on the Pressure Switch rotary switch. With the DRBIII®, monitor the 2/4 Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Wiggle the wiring leading to the TCM while pressing the button. Did the 2-4 Pressure Switch state change to closed and remain closed while wiggling the wires? Yes → Go To 6 No → Go To 7	All
6	If there are no possible causes remaining, view repair. Repair Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If there are no problems found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2/4 Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2/4 Pressure Switch Sense circuit or an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2/4 Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2/4 Pressure Switch Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All

P0845-2/4 HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2/4 Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the 2/4 Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector in the PDC. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 11 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
11	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0846-2/4 PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0846-2/4 PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate DTC is set if one of the Pressure Switches are open or closed at the wrong time in a given gear .

POSSIBLE CAUSES
TRANSMISSION RELAY DTC'S PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
2/4 PRESSURE SWITCH SENSE CIRCUIT OPEN
2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
2/4 PRESSURE SWITCH
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0846-2/4 PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTC's Are there any Transmission Control Relay DTC's present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less for P0846? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. With the Transmission Simulator, select 2/4 on the Pressure Switch selector switch. With the DRBIII®, monitor the 2/4 Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the Pressure Switch state change from OPEN to CLOSED when the test button was pressed? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the 2/4 Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the 2/4 Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0846-2/4 PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the 2/4 Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the 2/4 Pressure Switch Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2/4 Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the 2/4 Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0846-2/4 PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0870-OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0870-OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed > 1000 RPM, the TCM momentarily turns on element pressure to the clutch ckts that don't have pressure to identify the correct pressure sw closes. If the pressure sw does not close 2 times the code sets

POSSIBLE CAUSES
LOSS OF PRIME DTC P0944 PRESENT
RELATED DTC'S PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
OD PRESSURE SWITCH SENSE CIRCUIT OPEN
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
OD PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERNAL TRANSMISSION
TRANSMISSION CONTROL MODULE

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, check for other Transmission DTCs. Is the DTC P0944 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, read Transmission DTC's. Is the DTC P0733 and/or P0871 present also? Yes → Replace the Transmission or Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	With the DRBIII®, Check the STARTS SINCE SET counter for P0870. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 5 No → Go To 12	All

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **NOTE: Check connectors - Clean/repair as necessary.** With the Transmission Simulator, select ″OD″ on the Pressure Switch rotary switch. With the DRBIII®, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Wiggle the wires leading to the TCM while pressing the test button. Did the O/D Pressure Switch state change to closed and remain closed while wiggling the wires? Yes → Go To 6 No → Go To 7	All
6	If there are no possible causes remaining, view repair. Repair Disassemble and inspect the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in the Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the OD Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the O/D Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the OD Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the OD Pressure Switch Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All

P0870-OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the OD Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair OD Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 10	All
10	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 11 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
11	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
12	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0871-OD PRESSURE SWITCH SENSE CIRCUIT

When Monitored and Set Condition:

P0871-OD PRESSURE SWITCH SENSE CIRCUIT

When Monitored: Whenever the engine is running.

Set Condition: The appropriate DTC is set if one of the Pressure Switches are open or closed at the wrong time in a given gear.

POSSIBLE CAUSES
TRANSMISSION CONTROL RELAY DTCS PRESENT
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
O/D PRESSURE SWITCH SENSE CIRCUIT OPEN
O/D PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
O/D PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
O/D PRESSURE SWITCH
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC’s. Check and repair all engine DTC’s prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC’s. Record all DTC’s and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC’s, check and record all CVI’s. Most DTC’s set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB’s related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTC's Are there any Transmission Control Relay DTC's present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less for P0871? Yes → Go To 4 No → Go To 11	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. On the Transmission Simulator, select OD on the Pressure Switch selector switch. With the DRBIII®, monitor the OD Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the Pressure Switch state change from OPEN to CLOSED when the test button was pressed? Yes → Go To 5 No → Go To 6	All
5	If there are no possible causes remaining, view repair. Repair Replace Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the O/D Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the O/D Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the O/D Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the O/D Pressure Switch circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the O/D Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the O/D Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 9	All
9	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0871-OD PRESSURE SWITCH SENSE CIRCUIT — Continued

TEST	ACTION	APPLICABILITY
11	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0884-POWER UP AT SPEED

When Monitored and Set Condition:

P0884-POWER UP AT SPEED

When Monitored: When Transmission Control Module powers up.

Set Condition: This DTC will set if the TCM powers up and senses the vehicle in a valid forward gear (no PRNDL DTCs) with a output speed above 800 RPM (approximately 32Km/h or 20 MPH).

POSSIBLE CAUSES
POWER UP AT SPEED

TEST	ACTION	APPLICABILITY
1	This DTC is set when the TCM is initialized while the vehicle is moving down the road in a valid forward gear. Check all of the Fused B+, Fused Ignition Switch Output, and Ground circuits to the TCM for an intermittent open or short to ground. Were there any problems found? Yes → Repair wiring and/or connectors as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 2	All
2	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Test Complete.	All

Symptom:
P0888-RELAY OUTPUT ALWAYS OFF

When Monitored and Set Condition:

P0888-RELAY OUTPUT ALWAYS OFF

When Monitored: Continuously

Set Condition: This code is set when less than 3 volts are present at the transmission control relay output circuits at the Transmission Control Module when the TCM is energizing the relay.

POSSIBLE CAUSES
FUSED B+ CIRCUIT OPEN
TRANSMISSION CONTROL RELAY GROUND CIRCUIT OPEN
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, Check the STARTS SINCE SET counter for P0888. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter set at 0? Yes → Go To 3 No → Go To 5	All

P0888-RELAY OUTPUT ALWAYS OFF — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the Transmission Control Relay connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused B+ circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Using a 12-volt test light connected to 12-volts, check the Transmission Control Relay Ground circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Test Complete. No → Repair the Transmission Control Relay Ground circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0890-SWITCHED BATTERY

When Monitored and Set Condition:

P0890-SWITCHED BATTERY

When Monitored: Ignition key is turned from the OFF position to RUN position and/or ignition key is turned from the CRANK position to RUN position.

Set Condition: This DTC is set if the Transmission Control Module senses voltage on any of the Pressure Switch Inputs prior to the TCM energizing the Transmission Control Relay.

POSSIBLE CAUSES
2/4 PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	With the DRBIII®, Check the STARTS SINCE SET counter for P0890. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P0890 set at 0? Yes → Go To 3 No → Go To 5	All

P0890-SWITCHED BATTERY — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the 2/4 Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the 2/4 Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0891-TRANSMISSION RELAY ALWAYS ON

When Monitored and Set Condition:

P0891-TRANSMISSION RELAY ALWAYS ON

When Monitored: When the ignition is turned from the OFF position to the RUN position and/or the ignition is turned from the CRANK position to RUN position.

Set Condition: This DTC is set if the Transmission Control Module senses greater than 3.0 volts at the Transmission Control Relay Output terminal of the TCM prior to the TCM energizing the Transmission Control Relay.

POSSIBLE CAUSES
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL RELAY STUCK CLOSED
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT SHORT TO VOLTAGE
TRANSMISSION RELAY CONTROL CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0891-TRANSMISSION RELAY ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check the STARTS SINCE SET counter for P0891. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter set to 0? Yes → Go To 3 No → Go To 7	All
3	Turn the ignition off to the lock position. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between the Fused B+ circuit and the Transmission Control Relay Output Circuit in the Transmission Control Relay. Is the resistance above 5.0 ohms? Yes → Go To 4 No → Replace the Transmission Control Relay. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Transmission Control Relay Output circuit in the Solenoid/Pressure Switch Assembly harness connector. Is the voltage above 0.5 volt? Yes → Repair the Transmission Control Relay Output circuit for a short to voltage Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Remove the Transmission Control Relay from the PDC. Ignition on, engine not running. **Note: Check connectors - Clean/repair as necessary.** Measure the voltage of the Transmission Relay Control circuit in the PDC connector. Is the voltage above 0.5 volt? Yes → Repair Transmission Relay Control Circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P0891-TRANSMISSION RELAY ALWAYS ON — Continued

TEST	ACTION	APPLICABILITY
7	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0897-WORN OUT/BURNT TRANSAXLE FLUID

When Monitored and Set Condition:

P0897-WORN OUT/BURNT TRANSAXLE FLUID

When Monitored: With each transition from full Torque Convertor to partial Torque Convertor engagement for A/C bump prevention.

Set Condition: When vehicle shudder is detected during partial engagement (PEMCC).

POSSIBLE CAUSES
WORN OUT/ BURNT TRANSMISSION FLUID

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0897-WORN OUT/BURNT TRANSAXLE FLUID — Continued

TEST	ACTION	APPLICABILITY
2	Turn the ignition off. Remove the Transmission Oil Pan and Oil Filter per the Service Information. Install a new Transmission Oil Filter per Service Information. Reinstall Transmission Oil Pan, and refill with new Transmission Fluid per the Service Information. **Note: The Transmission Cooler must be flushed before prodceeding.** Start the engine, check and adjust the Transmission Fluid Level per Service Information. Allow the engine to idle for 10 minutes, in Park. Flush the Transmission Oil Cooler per the Service Information. Turn the ignition off. Drain and refill the Transmission Fluid. Flush the Transmission Oil Cooler again. Start the engine, check and adjust the Transmission Fluid Level per Service Information. With the DRBIII®, perform a Battery Disconnect. **Note: This must be done to re enable EMCC during an A/C Clutch engagement.** The vehicle may exhibit intermittent shudder during the first few hundred miles. **Note: The oil will gradually penetrate the TCC friction material and the shudder should disappear.** Erase the DTC and return the vehicle to the customer. Did the Code reset or does the vehicle still shudder after a few thousand miles? Yes → Replace the Torque Convertor per the Service Information. Note: After replacing the Torque Convertor, use the DRBIII to perform the TCC Break In procedure. This will prevent a possible shudder condition. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P0944-LOSS OF PRIME

When Monitored and Set Condition:

P0944-LOSS OF PRIME

When Monitored: If the transmission is slipping in any forward gear and the pressure switches are not indicating pressure, a loss of prime test is run.

Set Condition: If the Trans. begins to slip in a forward gear & the press. switch(s) that should be closed are open a loss of prime test begins. Available elements are turned on by the TCM to see if pump prime exists.The code sets if no pressure switches respond.

POSSIBLE CAUSES
SHIFT LEVER POSITION
PLUGGED TRANSMISSION OIL FILTER
TRANSMISSION OIL PUMP
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0944-LOSS OF PRIME — Continued

TEST	ACTION	APPLICABILITY
2	Place the gear selector in park. Start the engine. **NOTE: The TRANS TEMP DEG must be at least 43° C or 110° F before performing the following steps.** The Transmission must be at operating temperature prior to checking pressure. A cold Transmission will give higher readings. Place the Transmission in Reverse. With the DRBIII®, observe the Transmission Pressure Switch states. Are any of the Pressure Switches closed? Yes → Go To 3 No → Go To 5	All
3	The conditions necessary to set this DTC are not present at this time. Test drive the vehicle. Allow the Transmission to shift through all gears and ranges. Did you experience a delayed engagement and/or a no drive condition? Yes → Go To 5 No → Go To 4	All
4	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	With the DRBIII®, perform a Shift Lever Position test. Follow the instructions on the DRBIII®. Did the Shift Lever Position Test pass? Yes → Go To 6 No → Refer to symptom list and perform test for DTC P0706. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	Remove and inspect the Transmission Oil Pan and Transmission Oil Filter per the Service Information. Does the Transmission Oil Pan contain excessive debris and/or is the Oil Filter plugged? Yes → Repair the cause of the plugged Transmission Oil Filter. Refer to the Service Information for the proper repair procedure. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P0944-LOSS OF PRIME — Continued

TEST	ACTION	APPLICABILITY
7	If there are no possible causes remaining, view repair. Repair Replace the Transmission Oil Pump per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P0992- 2-4/OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored and Set Condition:

P0992- 2-4/OD HYDRAULIC PRESSURE TEST FAILURE

When Monitored: In any forward gear with engine speed above 1000 RPM shortly after a shift and every minute thereafter.

Set Condition: After a shift into a forward gear, with engine speed > 1000 RPM, the TCM momentarily turns on element pressure to the clutch ckts that don't have pressure to identify the correct pressure sw closes. If the pressure sw does not close 2 times the code sets.

POSSIBLE CAUSES
CONDITION P0992 PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P0992- 2-4/OD HYDRAULIC PRESSURE TEST FAILURE — Continued

TEST	ACTION	APPLICABILITY
2	**NOTE: The vehicle must be driven to set this DTC, the transmission must be warm or hot with the Engine RPM above 1000 RPM.** This DTC is an indicator of a 2/4 and/or O/D Hydraulic Pressure Switch DTC's present. Perform the tests for P0870 and/or P0845 to determine which switch is failing. If there are no possible causes remaining, view repair. Repair Refer to the Transmission category and perform the appropriate symptom for P0870 and/or P0845. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P1652-SERIAL COMMUNICATION LINK MALFUNCTION

When Monitored and Set Condition:

P1652-SERIAL COMMUNICATION LINK MALFUNCTION

When Monitored: Continuously with engine running.

Set Condition: The DTC sets in approximately 20 seconds if no BUS messages are received by the TCM.

POSSIBLE CAUSES
NO COMMUNICATION WITH MIC
NO COMMUNICATION WITH PCM
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, erase TCM DTC's. **Note: Erase P0700 DTC in the PCM to turn the MIL light off after making transmission repairs.** Start the engine in park. Did the DTC reset after the engine was started? Yes → Go To 2 No → Go To 5	All
2	Ignition on, engine not running. With the DRBIII®, attempt communication with the MIC Can you communicate with the MIC? Yes → Go To 3 No → Refer to the Communication category for the related symptom(s). Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
3	Ignition on, engine not running. With the DRBIII®, select the following screens in order: ″BODY″ ″MIC″ ″MONITOR DISPLAY″ ″PCI BUS ENGINE INFO″. Does the DRBIII®, read ″NO RESPONSE″ from any of the listed PCM monitors? Yes → Refer to Communication Category for the related symptom(s). Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 4	All

P1652-SERIAL COMMUNICATION LINK MALFUNCTION — Continued

TEST	ACTION	APPLICABILITY
4	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1684-BATTERY WAS DISCONNECTED

When Monitored and Set Condition:

P1684-BATTERY WAS DISCONNECTED

When Monitored: Whenever the key is in the Run/Start position.

Set Condition: This code is set whenever Transmission Control Module (TCM) is disconnected from battery power B+ or ground. It will also be set during the DRBIII® Quick Battery Disconnect procedure.

POSSIBLE CAUSES
QUICK LEARN WAS PERFORMED
RECENT BATTERY DISCONNECTION
TCM WAS REPLACED OR DISCONNECTED
INTERMITTENT WIRING AND CONNECTORS
FUSED B+ CIRCUIT TO TCM OPEN
GROUND CIRCUIT OPEN

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1684-BATTERY WAS DISCONNECTED — Continued

TEST	ACTION	APPLICABILITY
2	Turn ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Measure the voltage of the Fused B+ circuit in the TCM harness connector. Is the voltage below 10.0 volts? Yes → Go To 3 No → Go To 5	All
3	Turn the ignition off to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused B+ circuit in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 4 No → Repair the Fused B+ circuit for an open or high resistance. If the fuse is open make sure to check for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
4	Turn ignition off to the lock position. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Using a 12-volt test light connected to 12-volts, check all the ground circuits in the TCM harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the light illuminate brightly at all the ground circuits? Yes → Test Complete. No → Repair the Ground circuit(s) as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
5	Has the battery been disconnected, lost it's charge, or been replaced recently? Yes → This is the cause of the DTC. Erase the DTC and return the vehicle to the customer. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Has the Quick Learn procedure been performed? Yes → This is the cause of the DTC. Erase the DTC and return the vehicle to the customer. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P1684-BATTERY WAS DISCONNECTED — Continued

TEST	ACTION	APPLICABILITY
7	Has the TCM been replaced or disconnected? Yes → Replacing or disconnecting the TCM will set this DTC. Erase the DTC and return the vehicle to the customer. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1687-NO COMMUNICATION WITH THE MIC

When Monitored and Set Condition:

P1687-NO COMMUNICATION WITH THE MIC

When Monitored: Continuously with engine running.

Set Condition: The code sets in approximately 25 seconds if no BUS messages are received from the MIC.

POSSIBLE CAUSES
OTHER BUS PROBLEMS PRESENT
INTERMITTENT WIRING AND CONNECTORS
MIC - NO COMMUNICATION
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, Check the STARTS SINCE SET counter for P1687. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter set at 0? Yes → Go To 2 No → Go To 5	All
2	With the DRBIII®, check all of the other modules on the vehicle for evidence of a vehicle bus problem. Bus related DTC's in other modules point to an overall vehicle bus problem. Other symptoms such as a customer complaint of intermittent operation of bus controlled features also indicate a bus problem. Does the PRNDL display indicate "No Bus" or is there any evidence of an overall vehicle bus problem? Yes → Refer to the Communications category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, clear all DTC's. Start the engine in park. With the DRBIII®, read the MIC DTC's. Can the DRBIII® communicate with the MIC? Yes → Go To 4 No → Refer to the Communication category and perform the appropriate symptom related to No Response to MIC. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P1687-NO COMMUNICATION WITH THE MIC — Continued

TEST	ACTION	APPLICABILITY
4	Ignition on, engine not running. With the DRBIII®, erase TCM DTC's. Start the engine in park. With the DRBIII®, read Transmission DTC's. Is the DTC, P1687- No Communication with the MIC, present? Yes → Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1694-BUS COMMUNICATION WITH ENGINE MODULE

When Monitored and Set Condition:

P1694-BUS COMMUNICATION WITH ENGINE MODULE

When Monitored: Continuously with ignition key on.

Set Condition: If no bus messages are received from the Powertrain Control Module for 10 seconds.

POSSIBLE CAUSES
NO COMMUNICATION WITH PCM
OTHER BUS PROBLEMS PRESENT
INTERMITTENT WIRING AND CONNECTORS
TRANSMISSION CONTROL MODULE

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, Check the STARTS SINCE SET counter for P1694. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter for P1694 set to 0? Yes → Go To 2 No → Go To 5	All
2	With the DRBIII®, check all of the other modules on the vehicle for evidence of a vehicle bus problem. Bus related DTC's in other modules point to an overall vehicle bus problem. Other symptoms such as a customer complaint of intermittent operation of bus controlled features also indicate a bus problem. Does the PRNDL display indicate "No Bus" or is there any evidence of an overall vehicle bus problem? Yes → Refer to the Communication category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	Ignition on, engine not running. With the DRBIII®, attempt to communicate with the Powertrain Control Module (PCM). Can the DRBIII® communicate with the PCM? Yes → Go To 4 No → Refer to the Communication category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P1694-BUS COMMUNICATION WITH ENGINE MODULE — Continued

TEST	ACTION	APPLICABILITY
4	Ignition on, engine not running. With the DRBIII®, erase TCM DTC's. Start the engine in park. With the DRBIII®, read Transmission DTC's. Did the DTC, P1694, return? Yes → Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION

When Monitored and Set Condition:

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION

When Monitored: During an attempted shift into 1st gear.

Set Condition: This DTC is set if three unsuccessful attempts are made to shift into 1st gear in one given ignition start.

POSSIBLE CAUSES
RELATED DTC P0841 PRESENT
L/R PRESSURE SWITCH
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other Transmission DTC's Is the DTC P0841 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter for P1775. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 10	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the FWD Adapter Cable kit, Miller tool #8333-1. Ignition on, engine not running. With the DRBIII®, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. With the Transmission Simulator, select the L/R on the Pressure Switch selector. While observing the LR pressure switch state with the DRBIII®, depress the Pressure Switch Test button. Did the L/R Pressure Switch state change from OPEN to CLOSED when the test button was pressed? Yes → Inspect the Solenoid Switch Valve in the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the L/R Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the L/R Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit. Is the voltage above 0.5 volt? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between Fused B+ circuit and the Transmission Control Relay Output circuit. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit in the Solenoid/Pressure Switch Assembly harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 9 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P1775-SOLENOID SWITCH VALVE LATCHED IN TCC POSITION — Continued

TEST	ACTION	APPLICABILITY
9	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
10	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Test drive the vehicle. Did you experience any 2nd gear launches or no TCC engagement? Yes → Inspect the Valve Body for signs of a stuck valve or other problem in the SSV area. If no problems are found, replace the Solenoid/Pressure Switch Assembly. If excessive debris is present in the Pan or Valve Body, repair cause of the debris as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION

When Monitored and Set Condition:

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION

When Monitored: Continuously when doing partial or full EMCC (PEMCC or FEMCC).

Set Condition: This DTC will set if the TCM senses the L/R Pressure Switch closing while performing PEMCC or FEMCC or after two unsuccessful attempts to perform PEMCC or FEMCC.

POSSIBLE CAUSES
RELATED DTC P0841 PRESENT
L/R PRESSURE SWITCH
TRANSMISSION CONTROL RELAY OUTPUT CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT OPEN
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO GROUND
L/R PRESSURE SWITCH SENSE CIRCUIT SHORT TO VOLTAGE
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, check for other Transmission DTCs Is the DTC P0841 present also? Yes → Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter for P1776. **NOTE: This counter only applies to the last DTC set.** Is the STARTS SINCE SET counter 2 or less? Yes → Go To 4 No → Go To 10	All
4	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the FWD Adapter Cable kit, Miller tool #8333-1. Ignition on, engine not running. On the Transmission Simulator select L/R on the Pressure Switch selector switch. With the DRBIII®, monitor the L/R Pressure Switch state while pressing the Pressure Switch Test button on the Transmission Simulator. Did the Pressure Switch state change from OPEN to CLOSED when the test button was pressed? Yes → Inspect the Solenoid Switch Valve in the Valve Body per the Service Information and repair or replace as necessary. If no problems are found in Valve Body, replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the L/R Pressure Switch Sense circuit from the TCM harness connector to the Transmission Solenoid/Pressure Switch Assembly harness connector. Is the resistance above 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the L/R Pressure Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair the L/R Pressure Switch Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay from the PDC. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Measure the voltage of the L/R Pressure Switch Sense circuit. Is the voltage above 0.5 volts? Yes → Repair the L/R Pressure Switch Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	Turn the ignition off to the lock position. Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector. Remove the Transmission Control Relay. **Note: Check connectors - Clean/repair as necessary.** Connect a jumper wire between the Fused B+ circuit and the Transmission Control Relay Output circuit in the Transmission Control Relay connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Transmission Control Relay Output circuit. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 9 No → Repair the Transmission Control Relay Output circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
9	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

P1776-SOLENOID SWITCH VALVE LATCHED IN LR POSITION — Continued

TEST	ACTION	APPLICABILITY
10	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Test drive the vehicle. Did you experience any 2nd gear launches or no TCC engagement? Yes → Inspect the Valve Body for signs of a stuck valve or other problem in the SSV area. If no problems are found, replace the Solenoid/ Pressure Switch Assembly. If excessive debris is present in the Pan or Valve Body, repair the cause of debris as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1790-FAULT IMMEDIATELY AFTER SHIFT

When Monitored and Set Condition:

P1790-FAULT IMMEDIATELY AFTER SHIFT

When Monitored: After a speed ratio error is stored.

Set Condition: This code is set if the associated speed ratio code is stored within 1.3 seconds after a shift.

POSSIBLE CAUSES
CONDITION P1790 PRESENT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	This DTC is set along with a gear ratio DTC. Perform the appropriate test for the Gear Ratio DTC stored. **NOTE: Check 1 trip failures if there are no Gear Ratio DTC's current.** If there are no possible causes remaining, view repair. Repair Refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All

Symptom:
P1793-TRD LINK COMMUNICATION ERROR

When Monitored and Set Condition:

P1793-TRD LINK COMMUNICATION ERROR

When Monitored: The transmission controller pulses the 12 volt TRD signal from the PCM to ground, during torque managed shifts with the throttle angle above 54 degrees. The TRD system is also tested whenever the vehicle is stopped and the engine speed is at idle.

Set Condition: This code is set when the Transmission Control Module (TCM) sends two subsequent torque reduction messages to the Powertrain Control Module (PCM) via the TRD link circuit and does not receive a confirmation from the PCM over the communication bus.

POSSIBLE CAUSES
RELATED DTC'S PRESENT
TORQUE MANAGEMENT REQUEST SENSE CIRCUIT OPEN
TORQUE MANAGEMENT REQUEST SENSE SHORT TO GROUND
TORQUE MANAGEMENT REQUEST SENSE CIRCUIT SHORT TO VOLTAGE
POWERTRAIN CONTROL MODULE
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1793-TRD LINK COMMUNICATION ERROR — Continued

TEST	ACTION	APPLICABILITY
2	With the DRBIII®, read Transmission DTC's. Are any of the following DTCs P1694, P0731, P0732, P0733, P0734, P0736 present also? Yes → If any of these codes are present, disregard the P1793 DTC and refer to the Transmission category and perform the appropriate symptom. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	With the DRBIII®, Check the STARTS SINCE SET counter. **Note: This counter only applies to the last DTC set.** Is the STARTS SINCE SET equal to 0? Yes → Go To 4 No → Go To 9	All
4	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Torque Management Request Sense circuit from the TCM harness connector to the PCM harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Torque Management Request Sense circuit for an open. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Turn the ignition off to the lock position. Disconnect the PCM harness connector. Disconnect the TCM harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Torque Management Request Sense circuit. Is the resistance below 5.0 ohms? Yes → Repair Torque Management Request Sense circuit for a short to ground. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 6	All
6	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Measure the voltage of the Torque Management Request Sense circuit. Is the voltage above 10.5 volts? Yes → Repair Torque Management Request Sense circuit for a short to voltage. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 7	All

P1793-TRD LINK COMMUNICATION ERROR — Continued

TEST	ACTION	APPLICABILITY
7	Turn the ignition off to the lock position. Disconnect the TCM harness connector. Ignition on, engine not running. Measure the voltage of the Torque Management Request Sense circuit in the TCM harness connector. Is the voltage above 7.0 volts? Yes → Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 8	All
8	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per the Service Information. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
9	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1794-SPEED SENSOR GROUND ERROR

When Monitored and Set Condition:

P1794-SPEED SENSOR GROUND ERROR

When Monitored: The transmission gear ratio is monitored continuously while the transmission is in gear.

Set Condition: After a TCM reset in neutral and Input/Output speed ratio equals a ratio of input to output of 2.5 to 1.

POSSIBLE CAUSES
SPEED SENSOR GROUND CIRCUIT OPEN
TRANSMISSION CONTROL MODULE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All
2	Start the engine in park. With the DRBIII®, observe the Input and Output Speed Sensor readings. Is the Output Speed Sensor reading twice the Input Speed Sensor reading? Yes → Go To 3 No → Go To 6	All

P1794-SPEED SENSOR GROUND ERROR — Continued

TEST	ACTION	APPLICABILITY
3	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the Electronic Transmission Adapter kit 8333-1. Ignition on, engine not running. Using the Transmission Simulator, set the selector switch to the 3000/1250 position. Turn the Input/Output switch to ON. With the DRBIII®, read the Input and Output Speed Sensor RPM. Does the Input Speed read 3000 RPM and the Output Speed read 1250 RPM within 50 RPM? Yes → Go To 5 No → Go To 4	All
4	Turn the ignition off to the lock position. Disconnect Input and Output Speed Sensor harness connectors. Disconnect the TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Speed Sensor Ground circuit from the TCM harness connector to the Input and Output Speed Sensor harness connectors. Is the resistance above 5.0 ohms on either Speed Sensor Ground circuit? Yes → Repair the Speed Sensor Ground circuit for an open or high resistance. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 5	All
5	Using the schematics as a guide, inspect the wiring and connectors. Repair as necessary. Pay particular attention to all power and ground circuits. If there are no possible causes remaining, view repair. Repair Replace the Transmission Control Module per the Service Information. WITH THE DRBIII® PERFORM QUICK LEARN. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1.	All
6	The conditions necessary to set this DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
P1797-MANUAL SHIFT OVERHEAT

When Monitored and Set Condition:

P1797-MANUAL SHIFT OVERHEAT

When Monitored: Whenever engine is running and transmission is in the AutoStick mode.

Set Condition: If the engine temperature exceeds 124° C or 255° F or the transmission temperature exceeds 135° C or 275° F while in AutoStick mode. Note: Aggressive driving or driving in low for extended periods of time in AutoStick® mode will set this DTC.

POSSIBLE CAUSES
MANUAL SHIFT OVERHEAT

TEST	ACTION	APPLICABILITY
1	**NOTE: Low fluid level can be the cause of many Transmission problems. If the fluid level is low, locate and repair the leak, then check and adjust the fluid level per the Service Information.** **NOTE: Always perform diagnostics with a fully charged battery to avoid false symptoms.** With the DRBIII®, read the engine DTC's. Check and repair all engine DTC's prior to performing Transmission Symptom Diagnostics. With the DRBIII®, read Transmission DTC's. Record all DTC's and 1 Trip Failures. **NOTE: Diagnose 1 Trip Failures as a fully matured DTC.** Using the wiring diagram/schematic as a guide, inspect the wiring and connectors. Repair as necessary. Perform the Shift Lever Position Test. If the test does not pass, refer to Symptom test for P0706 Check Shifter Signal. For Gear Ratio DTC's, check and record all CVI's. Most DTC's set on start up but some must be set by driving the vehicle such that all diagnostic monitors have run. **NOTE: Verify flash level of Transmission Control Module. Some problems are corrected by software upgrades to the Transmission Control Module.** **NOTE: Check for applicable TSB's related to the symptom.** Perform this procedure prior to Symptom diagnosis. Continue Go To 2	All

P1797-MANUAL SHIFT OVERHEAT — Continued

TEST	ACTION	APPLICABILITY
2	This is an informational DTC only. Check the Engine and Transmission Cooling Systems for proper operation. Check the Radiator Cooling Fan operation. Check the Transmission Cooling Fan operation if equipped. Check the Transmission Fluid Level. Make sure it is not overfilled. **NOTE: Aggressive driving or driving in low for extended periods of time in Autostick® mode will set this DTC.** With the DRBIII®, check the EATX EVENT DATA to help identify the conditions in which the DTC was set. Were there any problems found? Yes → Repair as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*BACKUP LAMPS COME ON WHILE SHIFTER IS NOT IN REVERSE POSITION

POSSIBLE CAUSES
BACKUP LAMPS ALWAYS ON
BACKUP LAMP SUPPLY CIRCUIT SHORT TO VOLTAGE
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Firmly apply brakes. Place the shift lever in the position which causes the Backup Lamps to come on other than Reverse. Do the Backup Lamps come on with the shift lever not in the Reverse position? Yes → Go To 2 No → Go To 4	All
2	Ignition on, engine not running. Place the Shift Lever in the position that causes the Backup Lamps to come on other than Reverse. Disconnect the TRS harness connector. **NOTE: This will cause a DTC P0706 and possibly other DTC's to be stored in the TCM. They must be erased before returning the vehicle to the customer.** Did the Backup Lamps go out when the TRS harness connector was disconnected? Yes → Replace the Transmission Range Sensor per the Service Information. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Go To 3	All
3	Turn the ignition off to the lock position. Disconnect the Transmission TRS harness connector. **NOTE: Check connectors - Clean/repair as necessary.** Ignition on, engine not running. Measure the voltage of the Back-up Lamp Supply circuit in the TCM harness connector. Is the voltage above 0.5 volt? Yes → Repair the Backup Lamp Supply circuit for a short to voltage. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Test Complete.	All

*BACKUP LAMPS COME ON WHILE SHIFTER IS NOT IN REVERSE POSITION — Continued

TEST	ACTION	APPLICABILITY
4	The condition is not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Test Complete.	All

Symptom:
*BACKUP LAMPS INOPERATIVE

POSSIBLE CAUSES
OPEN LEFT BACKUP LAMP BULB
OPEN RIGHT BACKUP LAMP BULB
BACKUP LAMP GROUND CIRCUIT OPEN
BACKUP LAMP SUPPLY CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
BACKUP LAMP SUPPLY CIRCUIT SHORT TO GROUND
TRANSMISSION RANGE SENSOR
INTERMITTENT WIRING AND CONNECTORS

TEST	ACTION	APPLICABILITY
1	Ignition on, engine not running. Place foot firmly on brake pedal. Place the shift lever in the reverse position. Do either of the Backup Lamps work? Yes → Go To 2 No → Go To 3	All
2	The condition is not present at this time. Using the schematics as a guide, inspect the wiring and connectors specific to this circuit. Wiggle the wiring while checking for shorts and open circuits. Were there any problems found? Yes → Repair as necessary. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Test Complete.	All
3	Remove the left Backup Lamp bulb. Measure the resistance of the Backup Lamp bulb. Is the resistance above 5.0 ohms? Yes → Replace the Backup Lamp bulb. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Go To 4	All
4	Remove the right Backup Lamp bulb. Measure the resistance of the Backup Lamp bulb. Is the resistance above 5.0 ohms? Yes → Replace the Backup Lamp bulb. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Go To 5	All

*BACKUP LAMPS INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
5	Turn the ignition off to the lock position. **CAUTION: Remove the Starter Relay. This will prevent the vehicle from being started in gear.** Install the Transmission Simulator, Miller tool #8333 and the FWD Adapter Cable kit, Miller tool #8333-1. Ignition on, engine not running. Press the "Reverse Light Test" button on the Transmission Simulator while observing the backup lamps. Do either of the back-up lamps come on? Yes → Go To 6 No → Go To 7	All
6	If there are no possible causes remaining, view repair. Repair Replace Transmission Range Sensor per the Service Information. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
7	Remove the Backup Lamp bulb. Using a 12-volt test light connected to 12-volts, check the Backup Lamp Ground circuit in the Backup Lamp socket. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 8 No → Repair the Backup Lamp Ground circuit for an open or high resistance. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
8	Turn the ignition off to the lock position. Remove the Backup Lamp bulb. Disconnect the Transmission TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the Backup Lamp Supply circuit from the Backup Lamp Socket to the TRS harness connector. Is the resistance above 5.0 ohms? Yes → Repair the Backup Lamp Supply circuit for an open. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Go To 9	All

*BACKUP LAMPS INOPERATIVE — Continued

TEST	ACTION	APPLICABILITY
9	Turn the ignition off to the lock position. Disconnect the Transmission TRS harness connector. Ignition on, engine not running. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit in the TRS harness connector. **NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.** Does the test light illuminate brightly? Yes → Go To 10 No → Repair the Fused Ignition Switch Output circuit for an open. If the fuse is open make sure to check for a short to ground. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
10	Turn ignition off to the lock position. Remove the Backup Lamp bulb. Disconnect the Transmission TRS harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the Backup Lamp Supply circuit. Is the resistance below 5.0 ohms? Yes → Repair Backup Lamp Supply circuit for a short to ground. Check the fuse and replace if necessary. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST. No → Test Complete.	All

Symptom:
*CHECKING PARK/NEUTRAL SWITCH OPERATION

POSSIBLE CAUSES
P/N POSITION SWITCH SENSE CIRCUIT OPEN
P/N POSITION SWITCH SENSE CIRCUIT SHORTED TO GROUND
TRANSMISSION RANGE SENSOR
PCM - P/N POSITION SWITCH

TEST	ACTION	APPLICABILITY
1	Turn the ignition on. With the DRBIII®, read the Park/Neutral Position Switch input state. While moving the gear selector through all gear positions, Park to 1 and back to Park, watch the DRBIII® display. Did the DRBIII® display show P/N and D/R in the correct gear positions? Yes → Test Complete. No → Go To 2	All
2	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Range Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance of the P/N Position Switch Sense circuit. Is the resistance below 5.0 ohms? Yes → Go To 3 No → Repair the P/N Position Switch Sense circuit for an open. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
3	Turn the ignition off. Disconnect the PCM harness connectors. Disconnect the Transmission Range Sensor harness connector. **Note: Check connectors - Clean/repair as necessary.** Measure the resistance between ground and the P/N Position Switch Sense circuit. Is the resistance above 100k ohms? Yes → Go To 4 No → Repair the P/N Position Switch Sense circuit for a short to ground. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All

*CHECKING PARK/NEUTRAL SWITCH OPERATION — Continued

TEST	ACTION	APPLICABILITY
4	Turn the ignition off. Disconnect the PCM harness connectors. Move the Gear selector through all gear positions, from Park to 1st and back. While moving the gear selector through each gear, measure the resistance between ground and the P/N Position Switch Sense circuit. Did the resistance change from above 10.0 ohms to below 10.0 ohms? Yes → Go To 5 No → Replace the Transmission Range Sensor. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
5	If there are no possible causes remaining, view repair. Repair Replace and program the Powertrain Control Module per the Service Information. Perform POWERTRAIN VERIFICATION TEST VER - 2.	All

Symptom:
*INCORRECT TRANSMISSION FLUID LEVEL

POSSIBLE CAUSES
INCORRECT FLUID LEVEL

TEST	ACTION	APPLICABILITY
1	The transmission must be above 70 degree F. prior to checking fluid level. Adjusting fluid level on a cold transmission will result in an overfilled transmission. Check the transmission fluid level per the service information. Is the fluid level OK? Yes → Test Complete. No → Adjust fluid level. Repair cause of incorrect fluid level. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All

Symptom:
*NO SPEEDOMETER OPERATION

POSSIBLE CAUSES
NO SPEEDOMETER OPERATION

TEST	ACTION	APPLICABILITY
1	With the DRBIII®, check the pinion factor setting in the TCM. Is the pinion factor missing or set incorrectly? Yes → One possible cause is the pinion factor is not set or is set incorrectly in the TCM. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*TRANSMISSION NOISY WITH NO DTC'S PRESENT

POSSIBLE CAUSES
INCORRECT FLUID LEVEL
INTERNAL TRANSMISSION PROBLEM - NOISY
INTERNAL TRANSMISSION PROBLEM - NOISY WHILE STANDING STILL

TEST	ACTION	APPLICABILITY
1	Check the Transmission Fluid Level per the Service Information. Is the fluid level OK? Yes → Go To 2 No → Adjust fluid level and repair cause of incorrect fluid level. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
2	Place vehicle on hoist. **WARNING: BE SURE TO KEEP HANDS AND FEET CLEAR OF ROTATING WHEELS.** Run vehicle on hoist under conditions necessary to duplicate the noise. **NOTE: It may be necessary to test drive the vehicle to duplicate the noise.** Using Chassis Ears or other suitable listening device, verify the source of the noise. Is the noise coming from the transmission? Yes → Go To 3 No → Test Complete.	All
3	With the shift lever in neutral, raise the engine speed and listen to the noise. **NOTE: THE RADIO MUST BE TURNED OFF. Alternator noise can come through the speakers and be misinterpreted as Transmission Pump Whine. This can happen even with the volume turned down.** Does the noise get louder or change pitch while the engine speed is changing? Yes → Go To 4 No → Go To 5	All
4	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem as necessary. Inspect all of the transmission components for signs of wear. If no problems found, replace the Transmission oil pump.. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All
5	If there are no possible causes remaining, view repair. Repair Repair internal transmission problem as necessary. Inspect all of the transmission components for signs of wear. Pay particular attention to bearings, pinion gears, etc. Repair or replace as necessary. Perform TRANSMISSION NO TROUBLE CODE VERIFICATION TEST.	All

Symptom:
*TRANSMISSION SHIFTS EARLY WITH NO DTC'S

POSSIBLE CAUSES
BUS PROBLEMS
CHECK FOR INTERMITTENT WIRING & CONNECTORS
COLD TRANSMISSION

TEST	ACTION	APPLICABILITY
1	Using the DRBIII®, check all other Modules for signs of a PCI bus problem such as bus related DTC's and/or communication problems. Check and diagnose all 1 trip failures as a hard code. Although it takes two occurences of a missed TRD link message to set the DTC P1793, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Do any of the other modules show signs of a bus problem? Yes → Repair the PCI bus problem. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 2	All
2	**NOTE: If the Transmission shifts too early when the Transmission is cold, this is a normal condition. The software is designed to protect the Transmission from high torque and/or high RPM shifts during cold operation.** Did the problem occur when the Transmission temperature was cold? Yes → This is a normal condition. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Go To 3	All
3	The conditions necessary to set the DTC are not present at this time. Using the schematics as a guide, inspect the wiring and connectors. Wiggle the wires while checking for shorts and open circuits. Although it takes two occurences of a missed TRD link message to set the DTC P1793, one missed message will cause the transmission to short shift until the next start up. If the vehicle has any indications of a bus problem, the bus must be repaired first Were any problems found? Yes → Repair wiring and/or connector as necessary. Perform 42RLE TRANSMISSION VERIFICATION TEST - VER 1. No → Test Complete.	All

Symptom:
*TRANSMISSION SIMULATOR 8333 WILL NOT POWER UP

TEST	ACTION	APPLICABILITY
1	**NOTE: If the Transmission Simulator Miller tool #8333 will not power up, this is a symptom of the Transmission Relay being open, such as Limp-in, and/or this also could be a indication of the Transmission Simulator not installed correctly on the vehicle.** **NOTE: Check the Simulator ground cable connection.** **NOTE: Check all Transmission Simulator harness connections.** Repair these symptoms before having the Transmission Simulator Miller Tool #8333 repaired. Continue Test Complete.	All

Verification Tests

42RLE TRANSMISSION VERIFICATION TEST - VER 1	APPLICABILITY
1. Connect the DRBIII® to the Data Link Connector (DLC). 2. Reconnect any disconnected components. 3. With the DRBIII®, erase all Transmission DTC's, also erase the PCM DTC's. **4. NOTE: Erase DTC P0700 in the PCM to turn the Malfunction Indicator Lamp (MIL) off after making Transmission repairs.** 5. With the DRBIII®, display Transmission Temperature. Start and run the engine until the Transmission Temperature is HOT - above 43° C or 110° F. 6. Check the Transmission Fluid and adjust if necessary. Refer to the Service information for the Fluid Fill procedure. **7. NOTE: If the Transmission Control Module or the Transmission has been repaired or replaced it is necessary to perform the DRBIII® Quick Learn Procedure and reset the "Pinion Factor"** 8. Road test the vehicle. With the DRBIII®, monitor the engine RPM. Make 15 to 20 1-2, 2-3, 3-4 upshifts. Perform these shifts from a standing start to 45 MPH with a constant throttle opening of 20 to 25 degrees. 9. Below 25 MPH, make 5 to 8 wide open throttle kickdowns to 1st gear. Allow at least 5 seconds each in 2nd and 3rd gear between each kickdown. 10. For a specific DTC, drive the vehicle to the Symptom's When Monitored/When Set conditions to verify the DTC repair. 11. If equipped with AutoStick®, up-shift and down-shift several times using the AutoStick® feature during the road test. **12. NOTE: Use the EATX OBDII Task Manager to run Good Trip time in each gear, this will confirm the repair and to ensure that the DTC has not re-matured.** 13. Check for Diagnostic Trouble Codes (DTC's) during the road test. If a DTC sets during the road test , return to the Symptom list and perform the appropriate Symptom. Were there any Diagnostic Trouble Codes (DTCs) set during the road test? Yes → Refer to the Symptom List for appropriate Symptom(s). No → Repair is complete.	All

Verification Tests — Continued

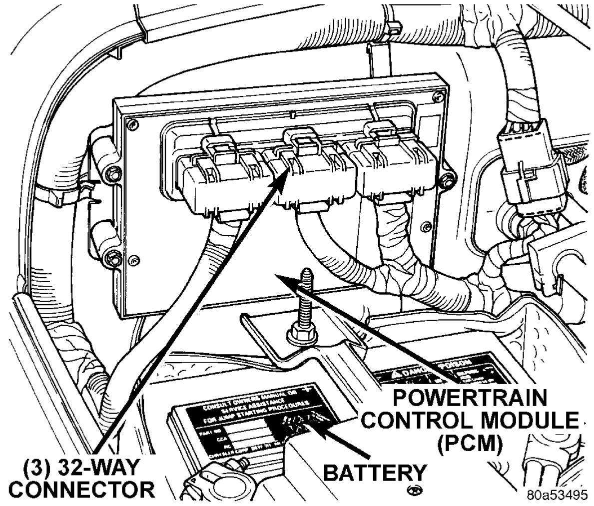
POWERTRAIN VERIFICATION TEST VER - 2	APPLICABILITY
1. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary. 2. If this verification procedure is being performed after a NO TROUBLE CODE repair, perform steps 3 and 4. 3. Check to see if the initial symptom still exists. If there are no trouble codes or the symptom no longer exists, the repair was successful and testing is complete. 4. If the initial or another symptom exists, the repair is not complete. Check all technical service bulletins or flash updates and return to Symptoms if necessary. 5. If this verification procedure is being performed after a DTC repair, perform steps 6 through 13. 6. Connect the DRBIII® to the data link connector. Using the DRBIII® erase any diagnostic trouble codes and reset all values. 7. If the PCM was not replaced, skip steps 8 through 10, then proceed with the verification. 8. If the PCM was replaced the correct VIN and mileage must be programmed or a DTC will set in the ABS and Air Bag modules. In addition, if the vehicle is equipped with Sentry Key Immobilizer System (SKIS), Secret Key data must be updated to enable start. 9. For ABS and Air Bag systems: Enter correct VIN and Mileage in PCM. Erase codes in ABS and Air Bag modules. 10. For SKIS theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, and Misc. Place SKIM in secured access mode by using the correct PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM. 11. Road test the vehicle. If the test is for an A/C DTC, ensure it is operating during the following test. 12. Drive the vehicle for at least 5 minutes at 64 Km/h (40 mph). Ensure the transmission shifts properly through all gears. At some point stop the vehicle and turn off the engine for at least 10 seconds. 13. With the DRBIII®, read DTCs. Are any DTCs or symptoms remaining? Yes → Check for any related Technical Service Bulletins and/or refer to the appropriate Symptom list (Diagnostic Procedure). No → Repair is complete.	All

TRANSMISSION NO TROUBLE CODE VERIFICATION TEST	APPLICABILITY
1. Inspect the vehicle to ensure that all engine and transmission components are properly installed and connected. Assemble and connect components as necessary. 2. Check if the initial symptom still exists. If the symptom still exists, return to the symptom list and perform the appropriate symptom. Make sure to check for any Technical Service Bulletins that my apply. 3. With the DRBIII®, erase any erroneous DTCs that may have been set due to a test procedure. Does the symptom still exist? Yes → Repair is not complete, refer to appropriate symptom. No → Repair is complete.	All

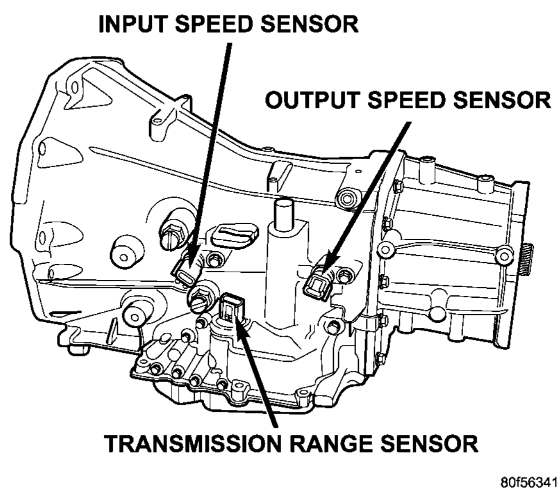
NOTES

8.0 COMPONENT LOCATIONS

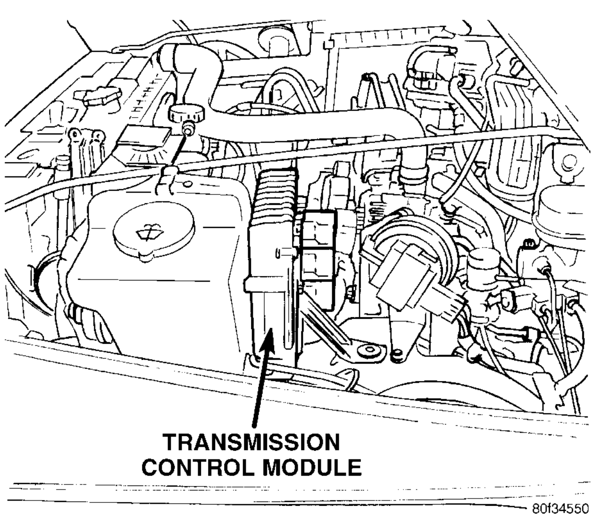
8.1 POWERTRAIN CONTROL MODULE



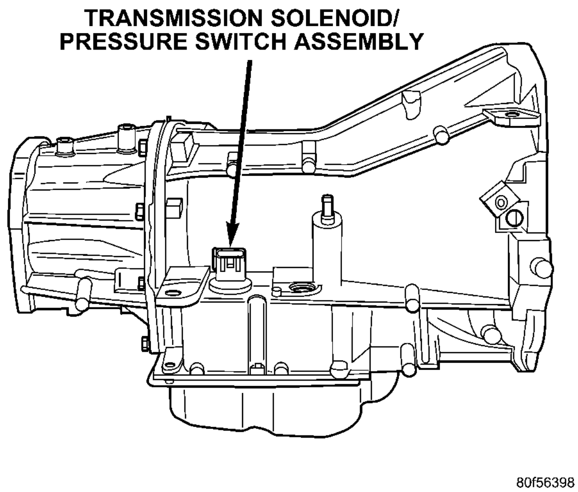
8.2 INPUT/OUTPUT SPEED SENSORS/TRS COMPONENT LOCATIONS



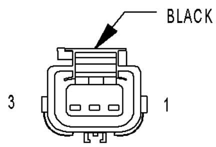
8.3 TRANSMISSION CONTROL MODULE



8.4 TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY



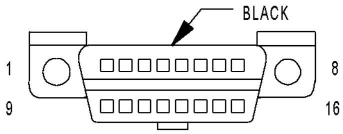
9.0 CONNECTOR PINOUTS



CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T)

CRANKSHAFT POSITION SENSOR (2.4L/4.0L A/T) - BLACK 3 WAY

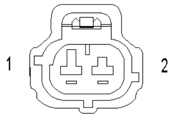
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK (2.4L)	CRANKSHAFT POSITION SENSOR SIGNAL
1	K7 20OR (4.0L)	5V SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
2	K4 18BK/LB (2.4L)	SENSOR GROUND 1
3	K7 18OR (2.4L)	5V SUPPLY
3	K24 18GY/BK (4.0L)	CRANKSHAFT POSITION SENSOR SIGNAL



DATA LINK CONNECTOR

DATA LINK CONNECTOR - BLACK 16 WAY

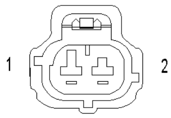
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	-	-
4	Z2 20BK/LG	GROUND
5	Z12 20BK/TN	GROUND
6	D32 20LG/WT	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D23 20WT/BR	FLASH PROGRAM ENABLE
10	-	-
11	-	-
12	-	-
13	-	-
14	D20 20LG/PK	SCI RECEIVE
15	-	-
16	M1 20PK/WT	FUSED B(+)



INPUT SPEED SENSOR

INPUT SPEED SENSOR - 2 WAY

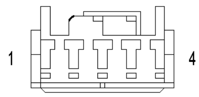
CAV	CIRCUIT	FUNCTION
1	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



OUTPUT SPEED SENSOR

OUTPUT SPEED SENSOR - 2 WAY

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND

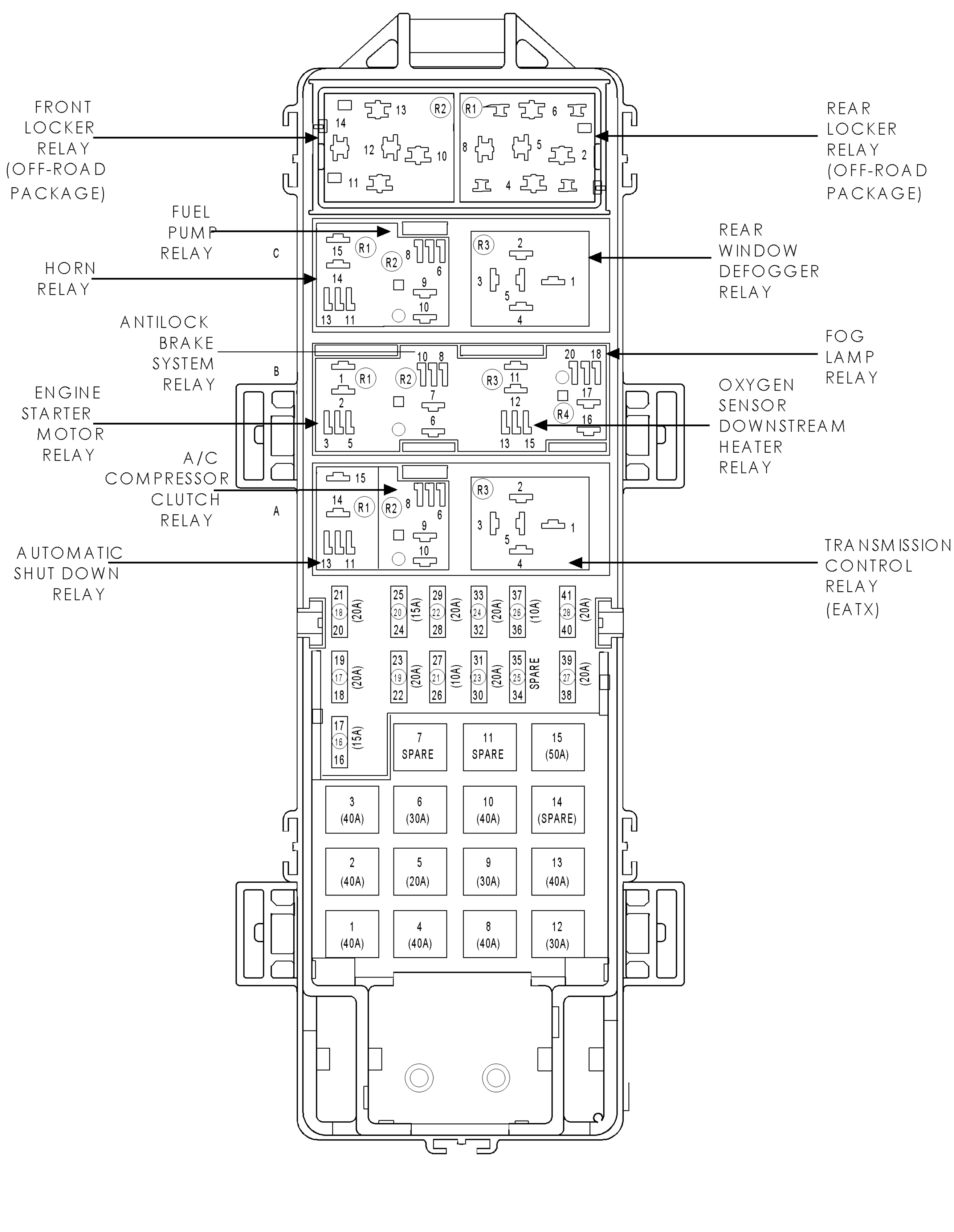


OVERDRIVE
OFF
SWITCH

OVERDRIVE OFF SWITCH - 4 WAY

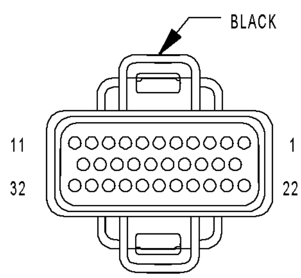
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
3	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
4	E2 20OR	PANEL LAMPS FEED

POWER DISTRIBUTION CENTER



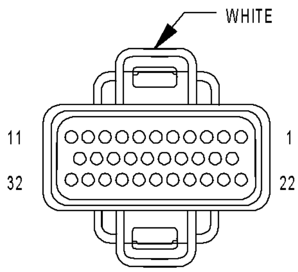
TRANSMISSION CONTROL RELAY (IN PDC)

CAV	CIRCUIT	FUNCTION
A1	A30 16RD/WT	FUSED B(+)
A1	A30 16RD/WT (OFF-ROAD PACKAGE)	FUSED B(+)
A2	K30 18PK	TRANSMISSION CONTROL RELAY CONTROL
A3	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
A4	Z1 18BK	GROUND
A5	-	-



POWERTRAIN CONTROL MODULE C1 - BLACK 32 WAY

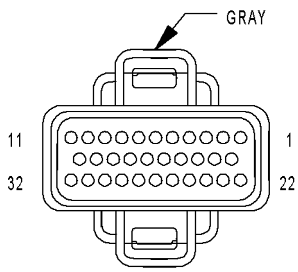
CAV	CIRCUIT	FUNCTION
1	K18 18RD/YL (4.0L)	IGNITION COIL NO. 3 DRIVER
2	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	-	-
4	K4 18BK/LB	SENSOR GROUND 1
5	-	-
6	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
7	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	-	-
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR (2.4L)	POWER STEERING PRESSURE SWITCH SENSE
13	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
14	-	-
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5V SUPPLY
18	K44 18TN/YL	CMP SIGNAL
19	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	-	-
22	A14 14RD/WT	FUSED B(+)
23	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
24	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL
26	K241 18LG/RD (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD	MAP SIGNAL
28	-	-
29	K341 18TN/WT (4.0L EXCEPT EXPORT/4.0L JAPAN LOW EMISSION VEHICLE)	OXYGEN SENSOR 2/2 SIGNAL
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE C2

POWERTRAIN CONTROL MODULE C2 - WHITE 32 WAY

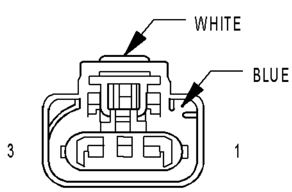
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY (4.0L)	FUEL INJECTOR NO. 5 DRIVER
7	-	-
8	-	-
9	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
10	K20 18DG	GENERATOR FIELD
11	-	-
12	K58 18BR/DB (4.0L)	FUEL INJECTOR NO. 6 DRIVER
13	-	-
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	-	-
18	-	-
19	C18 18DB (2.4L)	A/C PRESSURE SIGNAL
20	-	-
21	-	-
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SIGNAL
24	-	-
25	-	-
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	K6 18VT/WT	5V SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE C3

POWERTRAIN CONTROL MODULE C3 - GRAY 32 WAY

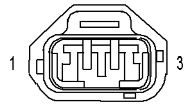
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR (A/C)	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	C24 18DB/PK (2.4L)	LOW SPEED RADIATOR FAN RELAY CONTROL
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD (SPEED CONTROL)	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD (SPEED CONTROL)	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	K99 18BR/OR	OXYGEN SENSOR 1/1 HEATER CONTROL
9	K512 18RD/YL (4.0L)	OXYGEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
10	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18YL/RD (SPEED CONTROL)	SPEED CONTROL ON/OFF SWITCH SENSE
12	A142 14DG/PK	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG (A/T)	TORQUE MANAGEMENT REQUEST SENSE
14	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE
15	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
16	K299 18BR/WT	OXYGEN SENSOR HEATER CONTROL
17	-	-
18	-	-
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	EVAP/PURGE SOLENOID CONTROL
21	C27 18DB (2.4L)	HIGH SPEED RADIATOR FAN RELAY CONTROL
22	C21 18DB/OR (A/C)	A/C SWITCH SENSE
23	C90 18LG (A/C)	A/C SELECT INPUT
24	K29 18WT/PK	BRAKE LAMP SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18DB/LG (4.0L)	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/WT	SCI RECEIVE
30	D25 18VT/YL	PCI BUS
31	-	-
32	V37 18RD/LB (SPEED CONTROL)	SPEED CONTROL SWITCH SIGNAL



THROTTLE POSITION SENSOR (2.4L)

THROTTLE POSITION SENSOR (2.4L) - WHITE/BLUE 3 WAY

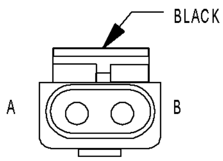
CAV	CIRCUIT	FUNCTION
1	K7 18OR	5 VOLT SUPPLY
2	K4 18BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO.1 SIGNAL



THROTTLE POSITION SENSOR (4.0L)

THROTTLE POSITION SENSOR (4.0L) - 3 WAY

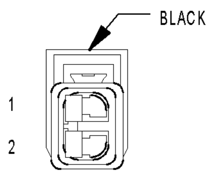
CAV	CIRCUIT	FUNCTION
1	K7 20OR	5-VOLT SUPPLY
2	K4 20BK/LB	SENSOR GROUND 1
3	K22 18OR/DB	THROTTLE POSITION SENSOR NO.1 SIGNAL



TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE)

TRANSFER CASE SWITCH (EXCEPT OFF-ROAD PACKAGE) - BLACK 2 WAY

CAV	CIRCUIT	FUNCTION
A	G107 20BK/RD	4WD INDICATOR
B	Z1 18BK	GROUND



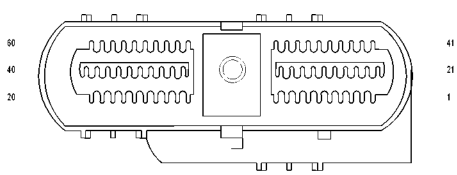
TRANSFER CASE SWITCH (OFF-ROAD PACKAGE)

TRANSFER CASE SWITCH (OFF-ROAD PACKAGE) - BLACK 2 WAY

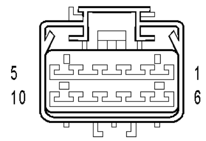
CAV	CIRCUIT	FUNCTION
1	K77 18BR/WT	TRANSFER CASE POSITION SENSOR INPUT
2	K4 18BK/LB	SENSOR GROUND 1

TRANSMISSION CONTROL MODULE - 60 WAY

CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	-	-
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 18PK	SCI TRANSMIT
8	T141 18YL/RD	FUSED IGNITION SWITCH OUTPUT (START)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F15 18DB/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK	TRANSMISSION CONTROL RELAY CONTROL
16	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T56 18DG/LB	OVERDRIVE OFF SWITCH INDICATOR
19	T19 16WT	2-4 SOLENOID CONTROL
20	T20 16LB	LOW/REVERSE SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	T411 18WT/PK	TRS T41 SENSE
42	T42 16VT/WT	TRS T42 SENSE
43	D25 18VT/YL	PCI BUS
44	-	-
45	-	-
46	D20 18LG	SCI RECEIVE
47	T47 18YL/BK	2-4 PRESSURE SWITCH SENSE
48	-	-
49	T6 18OR/WT	OVERDRIVE OFF SWITCH SENSE
50	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND 1
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z112 16BK	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A30 16RD/WT	FUSED B(+)
57	Z113 16BK/YL	GROUND
58	-	-
59	T59 16PK	UNDERDRIVE SOLENOID CONTROL
60	T60 16BR	OVERDRIVE SOLENOID CONTROL



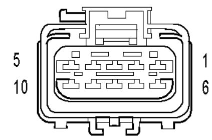
TRANSMISSION CONTROL MODULE



TRANSMISSION RANGE SENSOR

TRANSMISSION RANGE SENSOR - 10 WAY

CAV	CIRCUIT	FUNCTION
1	F20 20VT/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	T13 18DB/BK	SPEED SENSOR GROUND
4	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	T41 20BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE (T41)
6	L1 20VT/BK	BACK-UP LAMP FEED
7	T1 18LG/BK	TRS T1 SENSE
8	T3 18VT	TRS T3 SENSE
9	T42 16VT/WT	TRS T42 SENSE
10	T411 18WT/PK	TRS T41 SENSE



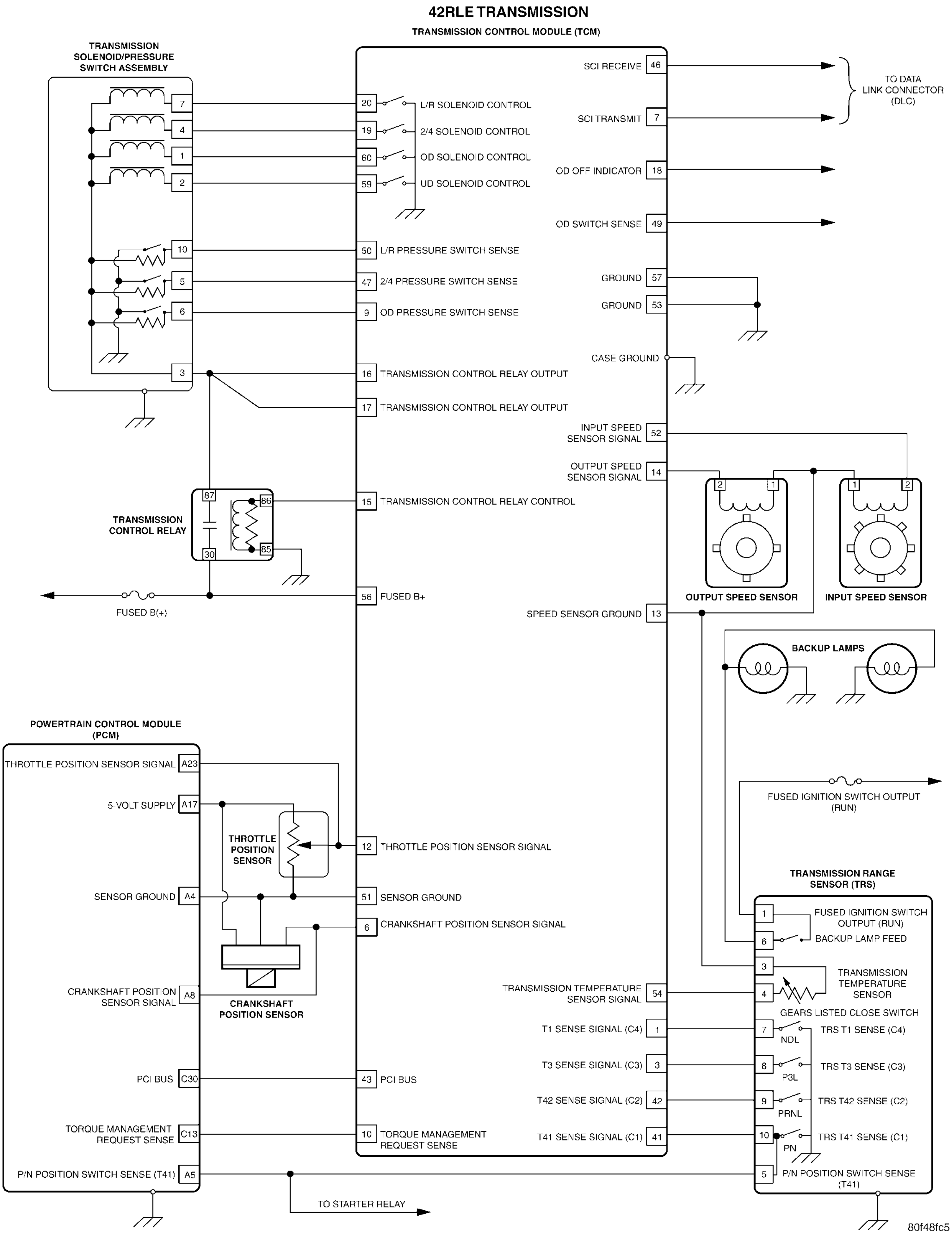
TRANSMISSION SOLENOID/ PRESSURE SWITCH ASSEMBLY

TRANSMISSION SOLENOID/PRESSURE SWITCH ASSEMBLY - 10 WAY

CAV	CIRCUIT	FUNCTION
1	T60 16BR	OVERDRIVE SOLENOID CONTROL
2	T59 16PK	UNDERDRIVE SOLENOID CONTROL
3	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT
4	T19 16WT	2-4 SOLENOID CONTROL
5	T47 18YL/BK	2-4 PRESSURE SWITCH SENSE
6	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
7	T20 16LB	LOW/REVERSE SOLENOID CONTROL
8	-	-
9	-	-
10	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE

NOTES

10.0 SCHEMATIC DIAGRAMS



S C H E M A T I C D I A G R A M S

NOTES

11.0 CHARTS AND GRAPHS

11.1 PRESSURE SWITCH STATES

PRESSURE SWITCH STATES

SWITCHES	R	N	1ST	2ND	3RD	4TH
L/R	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
2/4	OPEN	OPEN	OPEN	CLOSED	OPEN	CLOSED
O/D	OPEN	OPEN	OPEN	OPEN	CLOSED	CLOSED

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11.2 SOLENOID APPLICATION CHART

SOLENOID APPLICATION CHART

GEAR	UD	OD	REV	2/4	LR
PARK					X
REVERSE			X		X
NEUTRAL					X
1ST	X				X
2ND	X			X	
3RD	X	X			
4TH		X		X	

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11.3 SHIFT LEVER ERROR CODES

SHIFT LEVER ERROR CODES
REPORTED BY THE DRBIII®

ERROR CODE	SWITCH STUCK	POSITION
1	T1/C4 STUCK	OPEN
2	T1/C4 STUCK	CLOSED
3	T3/C3 STUCK	OPEN
4	T3/C3 STUCK	CLOSED
5	T42/C2 STUCK	OPEN
6	T24/C2 STUCK	CLOSED
7	T41/C1 STUCK	OPEN
8	T41/C1 STUCK	CLOSED

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11.4 TRANSMISSION TEMPERATURE SENSOR

TRANSMISSION TEMPERATURE SENSOR (DUAL RANGE)

START ENGINE. WITH DRB, MONITOR AND RECORD TRANSMISSION TEMPERATURE VOLTAGE.
COMPARE THE MEASURED TEMPERATURE AND VOLTAGE WITH THE GRAPH SHOWN BELOW.
THE MEASURED VALUE SHOULD FALL ON ONE OF THE LINES ON THE GRAPH.